Effects of Sintering Temperature on Crystallization and Fabrication of Porous Bioactive Glass Scaffolds for Bone Regeneration

In this work the sintering ability of borosilicate (S53B50), borophosphate (P40B10) and phosphate (Sr) bioactive glasses was investigated. The glass powders were crushed and sintered in air at a heating rate of 10 °C/min for 2 hours at sintering temperatures between 480 °C-600 °C. The aim was to define the optimum sintering temperature prior to glass crystallization. The density of the samples was found to decrease when the temperature was increased up to 580 °C; probably due to the inhibition of the viscous flow of the particles during sintering thereby reducing the densification of the material. Such low porosity is not suitable in tissue engineering. To process highly porous scaffolds with porosity required for scaffold applicable to tissue engineering, the powders were further mixed with 60 vol.% and 70 vol.% of NH4(HCO3) as foaming agent. Meanwhile, the density of the samples sintered with NH4(HCO3) was found to decrease with an increase in NH4(HCO3) content. This indicates an increase in porosity of the samples. The glass compositions reached an open porosity of more than 60% at the addition of 70 vol.% NH4(HCO3). In addition, SEM micrograph revealed large pores with good interconnection between the pores.

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Gold nanoparticles approach to detect chondroitin sulphate and hyaluronic acid urothelial coating
This study investigated the location of hyaluronic acid (HA)- and chondroitin sulphate (CS)-coated gold nanoparticles in rabbit bladder and evaluated gene expression of CD44, RHAMM and ICAM-1 receptors involved in HA and CS transport into the cell. Gold nanoparticles were synthesised by reduction of gold salts with HA or CS to form HA-AuNPs and CS-AuNPs. Bladder samples were incubated with CS-AuNPs and HA-AuNPs or without glycosaminoglycans. Transmission electron microscopy, optic microscopy and scanning electron microscopy were used to determine the location of the synthesised AuNPs. Real-time PCR was used to analyse expression of urothelial cell receptors CD44, RHAMM, ICAM-1, after ex vivo administration of CS-AuNPs and HA-AuNPs. We showed that HA-AuNPs and CS-AuNPs were located in the cytoplasm and tight junctions of urothelial umbrella cells; this appearance was absent in untreated bladders. There were no significant differences in gene expression levels for CD44, RHAMM, ICAM-1 receptors in treated versus control bladder tissues. In conclusion, we clearly showed the presence of exogenous GAGs in the bladder surface and the tight junctions between umbrella cells, which is important in the regeneration pathway of the urothelium. The GAGs-AuNPs offer a promising approach to understanding the biophysical properties and imaging of urothelial tissue.

General information
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Actigraphy in evaluation and follow up of physical functioning of older adults

For older adults, physical functioning status describes how well a person is able to manage necessary daily activities independently. Different tools exist for testing and follow-up of physical functioning state at different levels of health and age. However, technologies have not been widely adapted for monitoring the physical functioning status during daily life in a longitudinal setup.

In this thesis, the actigraph's characteristics for evaluating the physical functioning of older adults at various levels of health and functioning are studied. An actigraph measures activity level estimates continuously and is typically worn on the wrist for extended periods. The actigraph is a mature technology that has been used in the sleep research since the 1970s. In addition to sleep patterns, the actigraph can assess a subject's physical activity levels, and sleep-wake rhythms. Furthermore, a novel processing concept for evaluating long-term activity pattern responses to external stimuli, such as facility's common activities or weather has been developed in this thesis.

This thesis utilizes three different datasets in which actigraph data have been collected online, parallel with physical functioning estimates. The first dataset includes subjects from a nursing home with intermediate to demanding care need, the second dataset subjects are assisted living residents who are mostly independent but might receive some support services, and the third dataset subjects are from a demanding nursing home unit. The third dataset includes longitudinal data (over three years at longest). In addition, a fourth dataset was used to compare the actigraph processing methods between a traditional actigraph and the online actigraph to understand how well the encountered results with datasets 1–3 could be generalized.

In the thesis, the actigraph estimates for sleep, activity level and diurnal rhythms are compared with physical functioning results by utilizing datasets 1–3. In combined data from datasets 1 and 2 (demented subjects were excluded from the analysis) higher physical functioning estimate (activities of daily living assessment) was associated with higher physical activity level and with more night-time activity variance. In addition, subjects with better functioning tend to have more similar activity rhythms with the facility activities (novel concept) and less-stable day-to-day activity patterns. In Dataset 3 (now including subjects with and without dementia) better physical functioning was associated with more stable and stronger diurnal activity rhythm. However, the correlation between the diurnal rhythm stability and physical functioning might be explained by the severity of dementia according to the results. In the longitudinal case analysis, most of the activity rhythm patterns were associated with physical functioning changes as expected according to cross sectional analysis. In Dataset 2, the amount of time the subjects spent outside the facility correlated positively with better physical functioning. This suggests that different context information can provide meaningful information on the older adults' health in addition to traditional actigraph estimates.

Since the correlations slightly differed depending on the study population we suggest that monitoring activity level, activity
rhythm strength, similarity and variability simultaneously is recommended. Sleep patterns were not connected with physical functioning in the utilized datasets. The thesis results suggest that the actigraph is a feasible health monitoring concept to be utilized in assisted living and nursing home settings and is suitable for follow up of changes in activity patterns associated with changes in physical functioning.

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**Contactless health-care sensing**

**General information**

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Nocturnal Heart Rate Variability Spectrum Characterization in Preschool Children with Asthmatic Symptoms

Asthma is a chronic lung disease that usually develops during childhood. Despite that symptoms can almost be controlled with medication, early diagnosis is desirable in order to reduce permanent airway obstruction risk. It has been suggested that abnormal parasympathetic nervous system (PSNS) activity might be closely related with the pathogenesis of asthma, and that this PSNS activity could be reflected in cardiac vagal control. In this work, an index to measure the spectral regularity of the high frequency (HF) component of heart rate variability (HRV) spectrum, named peakness (P), is proposed. Three different implementations of P, based on electrocardiogram (ECG) recordings, impedance pneumography (IP) recordings and a combination of both, were employed in the characterization of a group of pre-school children classified attending to their risk of developing asthma. Peakier components were observed in the HF band of those children classified as high-risk (p < 0.005), who also presented reduced sympathovagal balance. Results suggest that high-risk of developing asthma might be related with a lack of adaptability of PSNS.
The Role of Nucleoid Exclusion in the Intracellular Spatial Organization of Escherichia coli

Not long ago, bacterial cells were regarded as organisms with hardly any internal organization, due to lack of visible physical compartments and, thus, proteins were believed to be distributed randomly. Since then, advances in microscopy, in vivo protein labeling with fluorescent tags, and in image analysis techniques have enabled us to probe biological events at a single-cell, singletime moment, and single-molecule level. The results from these observations have led to a radical change in this view and, thus, revolutionized the field of bacterial cell biology. Namely, this novel source of information has made evident that proper bacterial functioning is not possible without a highly spatially organized, dynamic internal composition that depends on the deployment of functional proteins and other cellular components in specific locations, at specific moments.

The spatiotemporal organization of the functional proteins and other cellular components play a fundamental role in several key regulatory processes, such as transcription, translation and cell division. One class of proteins, termed as ‘DNA-binding proteins’, are associated with DNA replication and segregation. Not surprisingly, they preferentially locate at midcell, where the chromosomal DNA is condensed into a dynamic structure called ‘nucleoid’. Another class of proteins, termed as ‘polar proteins’, are majorly involved in physiological behaviors such as chemotaxis, sugar uptake, motility and adhesion. In agreement, they are preferentially localized at the cell poles in the case of rod-shaped bacteria such as E. coli. Finally, there is a third class of proteins, called as ‘cytoskeletal proteins’, whose location differ widely during cell growth. For example, the Min system, a major cell division regulatory system, consisting of MinCDE proteins have a remarkable dynamic pattern inside the cell. These proteins localize for about half a minute in one cell half and then switch rapidly to the opposite half. This back and forth motion continues until the polymerization of the division protein FtsZ results in a ring-like structure at the cell center prior to cell division.

Cellular components, other than functional proteins, also exhibit a highly-organized spatial distribution. These components include plasmids, enzyme megacomplexes and unwanted protein aggregates. For example, protein aggregates, formed as a result of environment stress or errors in protein homeostasis, are generally sequestered into inclusion bodies (IBs) that localize at the cell poles. This process of polar localization is symmetric. However, following several cell division events, results in progeny cells containing the old pole having more aggregates than the new pole possessing progeny cells. Subsequent divisions lead to cell generations where some cells inherit more aggregates than others. Importantly, this was found to be positively correlated with increased division times, i.e., cellular aging. It is believed that such asymmetric partitioning of unwanted aggregates may be critical for the rejuvenation of bacterial populations. It is thus of major importance to understand the underlying mechanisms that are responsible for the above-described events.

In this thesis, using Escherichia coli as our model organism, we started by investigating and validating the hypothesis that the presence of the nucleoid at midcell is responsible for the ability of this organism to segregate unwanted protein aggregates to the cell poles. We next investigated and characterized the robustness of these mechanisms to external perturbations and stressful environmental conditions. Afterwards, we hypothesized that the phenomenon of nucleoid exclusion should not be limited to protein aggregates alone but, instead, for physical reasons, it should influence any large macromolecule that is not affected by a transport or self-propelling mechanism (which is the case of all proteins in E. coli). Consequently, we hypothesized and subsequently proved that it should influence self-assembling proteins, such as the transmembrane Tsr chemoreceptors, which have a major role in bacterial chemotaxis. In addition, we also investigated to what extent cell-to-cell diversity in nucleoid sizes contributes to the cell-to-cell diversity in the spatial distribution of polar-localized proteins. For these studies, we made use of efficient fluorescent tags, in vivo single-cell, single-molecule time-lapse microscopy, tailored image and signal processing techniques and stochastic biophysical models.

Our results provide new perspectives regarding the role of the nucleoid in the spatial organization of protein aggregates as well as chemoreceptor clusters in E. coli. Interestingly, regarding the latter, nucleoid exclusion from midcell was shown not to be the sole phenomenon for the proper localization of Tsr protein clusters. However, it is expected to be the most robust, namely, in stressful environments or when the cell is subject to external perturbations, than the diffusion-and-capture mechanism mediated by the Tol-Pal complexes, as it does not require production of proteins or is under stringent control. Further, unlike the other mechanism, it is energy-free.

Given the rapid developments in single-cell biology techniques, particularly the emergence of super-resolution microscopy techniques, improved fluorescent probes, high-throughput and largescale biochemical methods and theoretical tools, we expect several developments in the near future that will allow assessing further the role of the nucleoid as a ‘spatial organizer’ of the cellular architecture of E. coli.
Evaluation of optogenetic electrophysiology tools in human stem cell-derived cardiomyocytes

Current cardiac drug safety assessments focus on hERG channel block and QT prolongation for evaluating arrhythmic risks, whereas the optogenetic approach focuses on the action potential (AP) waveform generated by a monolayer of human cardiomyocytes beating synchronously, thus assessing the contribution of several ion channels on the overall drug effect. This novel tool provides arrhythmogenic sensitizing by light-induced pacing in combination with non-invasive, all-optical measurements of cardiomyocyte APs and will improve assessment of drug-induced electrophysiological aberrancies. With the help of patch clamp electrophysiology measurements, we aimed to investigate whether the optogenetic modifications alter human cardiomyocytes' electrophysiology and how well the optogenetic analyses perform against this gold standard. Patch clamp electrophysiology measurements of non-transduced stem cell-derived cardiomyocytes compared to cells expressing the commercially available optogenetic constructs Optopatch and CaViar revealed no significant changes in action potential duration (APD) parameters. Thus, inserting the optogenetic constructs into cardiomyocytes does not significantly affect the cardiomyocyte's electrophysiological properties. When comparing the two methods against each other (patch clamp vs. optogenetic imaging) we found no significant differences in APD values measured with optogenetic imaging. Thus, to broaden the screen, we combined optogenetic measurements of membrane potential and calcium transients with contractile motion measured by video motion tracking. Furthermore, to assess how optogenetic measurements can predict changes in membrane potential, or early afterdepolarizations (EADs), cells were exposed to cumulating doses of E-4031, a hERG potassium channel blocker, and drug effects were measured at both spontaneous and paced beating rates (1, 2 Hz). Cumulating doses of E-4031 produced prolonged APDs, followed by EADs and drug-induced quiescence. These observations were corroborated by patch clamp and contractility measurements. Similar responses, although more modest were seen with the IKs potassium channel blocker JNJ-303. In conclusion, optogenetic measurements of AP waveforms combined with optical pacing compare well with the patch clamp gold standard. Combined with video motion contractile measurements, optogenetic imaging provides an appealing alternative for electrophysiological screening of human cardiomyocyte responses in pharmacological efficacy and safety testings.
Optimised PDMS tunnel devices on MEAs increase the probability of detecting electrical activity from human stem cell-derived neuronal networks

Measurement of the activity of human pluripotent stem cell (hPSC)-derived neuronal networks with microelectrode arrays (MEAs) plays an important role in functional in vitro brain modelling and in neurotoxicological screening. The previously reported hPSC-derived neuronal networks do not, however, exhibit repeatable, stable functional network characteristics similar to rodent cortical cultures, making the interpretation of results difficult. In earlier studies, microtunnels have been used both to control and guide cell growth and amplify the axonal signals of rodent neurons. The aim of the current study was to develop tunnel devices that would facilitate signalling and/or signal detection in entire hPSC-derived neuronal networks containing not only axons, but also somata and dendrites. Therefore, MEA-compatible polydimethylsiloxane (PDMS) tunnel devices with 8 different dimensions were created. The hPSC-derived neurons were cultured in the tunnel devices on MEAs, and the spontaneous electrical activity of the networks was measured for 5 weeks. Although the tunnel devices improved the signal-to-noise ratio only by 1.3-fold at best, they significantly increased the percentage of electrodes detecting neuronal activity (52–100%) compared with the controls (27%). Significantly higher spike and burst counts were also obtained using the tunnel devices. Neuronal networks inside the tunnels were amenable to pharmacological manipulation. The results suggest that tunnel devices encompassing the entire neuronal network can increase the measured spontaneous activity in hPSC-derived neuronal networks on MEAs. Therefore, they can increase the efficiency of functional studies of hPSC-derived networks on MEAs.
Manipulating Superparamagnetic Microparticles with an Electromagnetic Needle

Selective, precise, and high-throughput manipulation of individual superparamagnetic microparticles has profound applications in performing location-tailored in vitro biomedical studies. The current techniques for manipulation of microparticles allow only a single particle in the manipulation workspace, or simultaneous transportation of multiple microparticles in batches. In this work, a method based on a robotized electromagnetic needle for manipulation of individual superparamagnetic microparticles within a microparticle population is introduced. By automatically controlling the highly localized magnetic field of the needle, a single microparticle is selectively picked when its neighboring particle is few micrometers away. Supported by the nanometer resolution of the robotic positioner, particles are placed at sub-micrometer precision. This manipulation technique allows the creating of arbitrary patterns, sorting of microparticles based on size and morphology, and transporting of individual microparticles in 3D space. Therefore, this approach has the potential to enable more deterministic and quantitative microanalysis and microsynthesis using superparamagnetic microparticles.
differentiated into several cell types, such as neurons, astrocytes, and oligodendrocytes, they offer a promising cell source for cell culture models. Overall, four different custom-built 2PP-DLW fabrication setups based on either Nd:YAG or Ti:sapphire lasers were used for the polymerization experiments. First, the processability of photosensitive custom-synthesized methacrylated poly(caprolactone) oligomer (PCL-o) and commercial poly(ethylene glycol)diacylate (PEGda) were studied together with Irgacure®127 photoinitiator. Although both PCL-o and PEGda could be successfully fabricated into simple microstructures with a picosecond Nd:YAG laser, the PCL-o required the use of very slow scanning speed in order to achieve complete polymerization. Thus, it was concluded that the fabrication of larger or more complex structures from PCL-o was not feasible. The inability of PEGda and PCL-o to support the migration or functionality of neuronal cells make them therefore poor candidates for cell culture purposes.

Next, avidin and biotinylated bovine serum albumin (bBSA) proteins together with flavin mononucleotide (FMN) photosensitizer were fabricated into surface patterns using several protein concentrations in combination with different average laser power and scanning speed values to determine the range of fabrication conditions suitable for protein crosslinking. It was demonstrated that the bioactivity of proteins are retained during the exposure to the high laser intensities required for photocrosslinking with the Nd:YAG laser. Avidin and bBSA together with Irgacure® 2959 photoinitiator were also photocrosslinked into 2D single neuron guidance patterns, functionalized with extracellular matrix-derived peptides, and used for the study of cell growth guidance with hPSC-derived neuronal cells for 14 days. As several difficulties were encountered during the fabrication of the protein patterns and cell culture experiment, proteins were excluded from any further studies and replaced with the commercially available hybrid polymer-ceramic Ormocomp® that possesses superior photocrosslinking properties.

Ormocomp® combined with Irgacure®127 was fabricated into 3D confinement microstructures and 3D tubular microtowers with or without intraluminal guidance cues. The applicability of the confinement structures to control the location of neurons and to direct the growth of neurites on predefined axes was evaluated during the cell culture experiments. The functionality of three different microtower designs for the long-term 3D culturing of human neuronal cells and their ability to orient neurites was assessed with a four-week cell culture study. The observations achieved in this thesis support the use of the microtower-based platform for long-term cell culture as the microtowers were proven to facilitate neurite orientation and 3D network formation via suspended neurite bridges. Thus, the proposed microstructure-based culturing concept could in future be used as a substitute for the hydrogel matrices commonly used to mechanically support the formation of 3D cell networks.

Parathyroid Scintigraphy: Optimization of 99mTc-sestamibi/123I subtraction SPECT/CT

Hyperparathyroidism is a common endocrine disorder caused by one or more hyperfunctioning parathyroid glands secreting excess amounts of parathyroid hormone. This leads to hypercalcemia that may lead to numerous clinical manifestations, such as osteoporotic fractures. Surgery is the only curative treatment, with current trends towards minimally invasive operations. A prerequisite for targeted operation is a sensitive and specific preoperative localization that is, also capable of identifying ectopic glands and multiple gland disease.

Preoperative localization is performed using nuclear medicine, i.e., scintigraphic techniques, with 99mTc-sestamibi being the imaging agent of choice. Unfortunately, 99mTc-sestamibi is not a specific agent for parathyroid tissue, and several protocols are in use with variable sensitivity and specificity figures.
The aim of this thesis was to find the optimal protocol for parathyroid scintigraphy with the highest sensitivity and specificity. Subsequently, the national status of protocols was investigated. These protocols were tested in the clinical environment and finally the protocol of choice was optimized with the use of phantoms.

Our results indicate that the dual-isotope method with 99mTc-sestamibi and 123I is superior when compared with the use of 99mTc-sestamibi alone. 99mTc-sestamibi/123I subtraction SPECT/CT is a highly sensitive and specific protocol for parathyroid scintigraphy and should be preferred over planar acquisition techniques due to important anatomical 3D information. However, acquisition and processing parameters have a profound effect on the outcome of 99mTc-sestamibi/123I subtraction SPECT/CT. The protocol should therefore be tested with known anthropomorphic phantoms. With careful optimization, 99mTc-sestamibi/123I subtraction SPECT/CT is an adequate technique for parathyroid scintigraphy without additional acquisitions. The results of this thesis will provide guidelines for proposing recommendations for parathyroid scintigraphy.
An ensemble of visual features for Gaussians of local descriptors and non-binary coding for texture descriptors

This paper presents an improved version of a recent state-of-the-art texture descriptor called Gaussians of Local Descriptors (GOLD), which is based on a multivariate Gaussian that models the local feature distribution that describes the original image. The full rank covariance matrix, which lies on a Riemannian manifold, is projected on the tangent Euclidean space and concatenated to the mean vector for representing a given image. In this paper, we test the following features for describing the original image: scale-invariant feature transform (SIFT), histogram of gradients (HOG), and weber's law descriptor (WLD). To improve the baseline version of GOLD, we describe the covariance matrix using a set of visual features that are fed into a set of Support Vector Machines (SVMs). The SVMs are combined by sum rule. The scores obtained by an SVM trained using the original GOLD approach and the SVMs trained with visual features are then combined by sum rule. Experiments show that our proposed variant outperforms the original GOLD approach. The superior performance of the proposed system is validated across a large set of datasets. Particularly interesting is the performance obtained in two widely used person re-identification datasets, CAVIAR4REID and IAS, where the proposed GOLD variant is coupled with a state-of-the-art ensemble to obtain an improvement of performance on these two datasets. Moreover, we performed further tests that combine GOLD with non-binary features (local ternary/quinary patterns) and deep transfer learning. The fusion among SVMs trained with deep features and the SVMs trained using the ternary/quinary coding ensemble is demonstrated to obtain a very high performance across datasets. The MATLAB code for the ensemble of classifiers and for the extraction of the features will be publicly available to other researchers for future comparisons.

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Authors: Nanni, L., Paci, M., Brahnam, S., Ghidoni, S.
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Fluorimetric oxygen sensor with an efficient optical read-out for in vitro cell models

This paper presents a phase fluorimetric sensor for the monitoring of the oxygen concentration in in vitro cell models. The sensing surface of the sensor consists of oxygen sensitive fluorescent dyes (platinum(II) octaethylporphyrinketone) embedded in a thin polystyrene film. In order to optimize the optical read-out scheme of the sensor, we carried out electromagnetic simulations of a fluorescently doped polystyrene film deposited on a glass-water interface. The simulation results showed highly anisotropic angular emission distribution with the maximum irradiance being at super critical angles, which attracts tailored optical designs to maximize the fluorescence collection efficiency. For this purpose, we applied an efficient optical read-out scheme based on an in-contact parabolic lens. The use of parabolic lens also facilitates confocal total internal reflection excitation from the substrate side. This makes the excitation effective and insensitive to biofouling or other optical changes in the sensing surface and, more importantly, greatly reduces the amount of excitation power radiated into the cell culture chamber. Experimental results show that when applied together with phase fluorimetric lifetime sensing, this optical scheme allows one to use thin films.
Highly unique network descriptors based on the roots of the permanental polynomial

In this paper, we examine the zeros of permanental polynomials as highly unique network descriptors. We employ exhaustively generated networks and demonstrate that our defined graph measures based on the moduli of the zeros of permanental polynomials are quite efficient when distinguishing graphs structurally. In this work, we continue with a line of research that relates to the search of almost complete graph invariants. These highly unique network measures may serve as a powerful tool for tackling graph isomorphism.

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Ecosystem approach on medical game development: The relevant actors, value propositions and innovation barriers

This paper explores the medical game ecosystem and reveals the reciprocal value propositions of the relevant actors of medical game ecosystems, as well as barriers that may be complicating or hindering realization of the value propositions. The case comprises an emerging medical game ecosystem in Finland in the traumatic brain injury (TBI) rehabilitation context. This study presents 12 actor groups, their value propositions, and the barriers between the actors. This paper gives a comprehensive view of the actual medical game ecosystem that is needed to utilize the full potential of gamification and serious games in the health care sector.

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Assessment of support vector machines and convolutional neural networks to detect snoring using Emfit mattress
Snoring (SN) is an essential feature of sleep breathing disorders, such as obstructive sleep apnea (OSA). In this study, we evaluate epoch-based snoring detection methods using an unobtrusive electromechanical film transducer (Emfit) mattress sensor using polysomnography recordings as a reference. Two different approaches were investigated: a support vector machine (SVM) classifier fed with a subset of spectral features and convolutional neural network (CNN) fed with spectrograms. Representative 10-min normal breathing (NB) and SN periods were selected for analysis in 30 subjects and
divided into thirty-second epochs. In the evaluation, average results over 10 fold Monte Carlo cross-validation with 80% training and 20% test split were reported. Highest performance was achieved using CNN, with 92% sensitivity, 96% specificity, 94% accuracy, and 0.983 area under the receiver operating characteristics curve (AROC). Results showed a 6% average increase of performance of the CNN over SVM and greater robustness, and similar performance to ambient microphones.

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Authors: Perez-Macias, J. M., Adavanne, S., Viik, J., Värri, A., Himanen, S., Tenhunen, M.
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Tuning extrinsic noise effects on a small genetic circuit
Measurements at the single cell level showed that monoclonal Escherichia coli cells differ widely in the numbers of components affecting gene expression dynamics. Using a stochastic model of a 2-genes symmetric toggle switch with realistic multi-step promoter initiation kinetics and empirically validated parameter values, we investigate the role of transcription initiation kinetics on the degree with which cell-to-cell variability in cellular components generates cell-to-cell diversity in switch dynamics. We find that while the mean switching frequency is determined by the promoter kinetics, the cell to cell diversity of this frequency depends both on promoter kinetics and diversity in RNA polymerase numbers. At a microscale level, the main regulator of the cell to cell variability in protein numbers (of both genes in ON and OFF states) is the promoters kinetics, not the diversity in RNA polymerase numbers. We conclude that the promoters kinetics is a critical regulator of the toggle switch dynamics and that can be used as a regulatable filter of extrinsic noise.

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Authors: Mohamed Bahrudeen, M., S. Ribeiro, A.
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Lääkintätietokuntien prosessien järjestäminen sairaanhoitotyön tietotyöllä
The Medical Technical Department of Pirkanmaa Hospital District is part of the Information Management Unit of the Hospital Service Center. Medical Technology is responsible of the strategic services, whereas Istekki Oy is responsible of the operative services of medical devices. Information Management Unit is responsible of the computer services,
information management, patient information services and changes of information management. Medical devices are strictly regulated and the legislation requires quantitative measurements of quality, safety and functionality. This is possible by using a process approach of medical device management. Common policies for all interactive devices in the hospital district enables efficient and safe environment for healthcare.

Medical technology and information management processes have common interfaces, since most of the current medical devices are in a network and connected to other devices. Medical devices connected to a network require maintenance with special competences from both computer sciences and medical devices functionalities, as well as legislation of medical devices. As digitalization makes progress also in medical technology, the organization should ensure that processes are being renewed and the policies are kept in cooperation with the medical technology professionals. Medical technology life cycle control benefits if the services are focused on one actor.

Direct Laser Writing of Tubular Microtowers for 3D Culture of Human Pluripotent Stem Cell-Derived Neuronal Cells
As the complex structure of nervous tissue cannot be mimicked in two-dimensional (2D) cultures, the development of three-dimensional (3D) neuronal cell culture platforms is a topical issue in the field of neuroscience and neural tissue engineering. Computer-assisted laser-based fabrication techniques such as direct laser writing by two-photon polymerization (2PP-DLW) offer a versatile tool to fabricate 3D cell culture platforms with highly ordered geometries in the size scale of natural 3D cell environments. In this study, we present the design and 2PP-DLW fabrication process of a novel 3D neuronal cell culture platform based on tubular microtowers. The platform facilitates efficient long-term 3D culturing of human neuronal cells and supports neurite orientation and 3D network formation. Microtower designs both with or without intraluminal guidance cues and/or openings in the tower wall are designed and successfully fabricated from Ormocomp. Three of the microtower designs are chosen for the final culture platform: a design with openings in the wall and intraluminal guidance cues (webs and pillars), a design with openings but without intraluminal structures, and a plain cylinder design. The proposed culture platform offers a promising concept for future 3D cultures in the field of neuroscience.
Measures of spike train synchrony for data with multiple time scales

Background: Measures of spike train synchrony are widely used in both experimental and computational neuroscience. Time-scale independent and parameter-free measures, such as the ISI-distance, the SPIKE-distance and SPIKE-synchronization, are preferable to time scale parametric measures, since by adapting to the local firing rate they take into account all the time scales of a given dataset. New method: In data containing multiple time scales (e.g. regular spiking and bursts) one is typically less interested in the smallest time scales and a more adaptive approach is needed. Here we propose the A-ISI-distance, the A-SPIKE-distance and A-SPIKE-synchronization, which generalize the original measures by considering the local relative to the global time scales. For the A-SPIKE-distance we also introduce a rate-independent extension called the RIA-SPIKE-distance, which focuses specifically on spike timing. Results: The adaptive generalizations A-ISI-distance and A-SPIKE-distance allow to disregard spike time differences that are not relevant on a more global scale. A-SPIKE-synchronization does not any longer demand an unreasonably high accuracy for spike doublets and coinciding bursts. Finally, the RIA-SPIKE-distance prove to be independent of rate ratios between spike trains. Comparison with existing methods: We find that compared to the original versions the A-ISI-distance and the A-SPIKE-distance yield improvements for spike trains containing different time scales without exhibiting any unwanted side effects in other examples. A-SPIKE-synchronization matches spikes more efficiently than SPIKE-synchronization. Conclusions: With these proposals we have completed the picture, since we now provide adaptive generalized measures that are sensitive to firing rate only (A-ISI-distance), to timing only (RIA-SPIKE-distance), and to both at the same time (A-SPIKE-distance).
The effect of equiaxial stretching on the osteogenic differentiation and mechanical properties of human adipose stem cells

Although mechanical cues are known to affect stem cell fate and mechanobiology, the significance of such stimuli on the osteogenic differentiation of human adipose stem cells (hASCs) remains unclear. In this study, we investigated the effect of long-term mechanical stimulation on the attachment, osteogenic differentiation and mechanical properties of hASCs. Tailor-made, pneumatic cell stretching devices were used to expose hASCs to cyclic equiaxial stretching in osteogenic medium. Cell attachment and focal adhesions were visualised using immunocytochemical vinculin staining on days 3 and 6, and the proliferation and alkaline phosphatase activity, as a sign of early osteogenic differentiation, were analysed on days 0, 6 and 10. Furthermore, the mechanical properties of hASCs, in terms of apparent Young's modulus and normalised contractility, were obtained using a combination of atomic force microscopy based indentation and computational approaches. Our results indicated that cyclic equiaxial stretching delayed proliferation and promoted osteogenic differentiation of hASCs. Stretching also reduced cell size and intensified focal adhesions and actin cytoskeleton. Moreover, cell stiffening was observed during osteogenic differentiation and especially under mechanical stimulation. These results suggest that cyclic equiaxial stretching modifies cell morphology, focal adhesion formation and mechanical properties of hASCs. This could be exploited to enhance osteogenic differentiation.

General information

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Scopus rating (2013): SJR 1.083 SNIP 1.575 CiteScore 3.15
Scopus rating (2012): SJR 0.88 SNIP 1.549 CiteScore 2.77
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Estimating Heart Rate, Energy Expenditure, and Physical Performance With a Wrist Photoplethysmographic Device During Running

BACKGROUND: Wearable sensors enable long-term monitoring of health and wellbeing indicators. An objective evaluation of sensors' accuracy is important, especially for their use in health care.

OBJECTIVE: The aim of this study was to use a wrist-worn optical heart rate (OHR) device to estimate heart rate (HR), energy expenditure (EE), and maximal oxygen intake capacity (VO2Max) during running and to evaluate the accuracy of the estimated parameters (HR, EE, and VO2Max) against golden reference methods.

METHODS: A total of 24 healthy volunteers, of whom 11 were female, with a mean age of 36.2 years (SD 8.2 years) participated in a submaximal self-paced outdoor running test and maximal voluntary exercise test in a sports laboratory. OHR was monitored with a PulseOn wrist-worn photoplethysmographic device and the running speed with a phone GPS sensor. A physiological model based on HR, running speed, and personal characteristics (age, gender, weight, and height) was used to estimate EE during the maximal voluntary exercise test and VO2Max during the submaximal outdoor running test. ECG-based HR and respiratory gas analysis based estimates were used as golden references.

RESULTS: OHR was able to measure HR during running with a 1.9% mean absolute percentage error (MAPE). VO2Max estimated during the submaximal outdoor running test was closely similar to the sports laboratory estimate (MAPE 5.2%). The energy expenditure estimate (n=23) was quite accurate when HR was above the aerobic threshold (MAPE 6.7%), but MAPE increased to 16.5% during a lighter intensity of exercise.

CONCLUSIONS: The results suggest that wrist-worn OHR may accurately estimate HR during running up to maximal HR. When combined with physiological modeling, wrist-worn OHR may be used for an estimation of EE, especially during higher intensity running, and VO2Max, even during submaximal self-paced outdoor recreational running.
Aberrantly binding microRNAs and their interactions with nuclear hormone receptors

Nuclear Hormone Receptors (NHRs) are the most important targets that play a vital role in cellular signaling pathways of disease. Regulation of NHRs by using potential non-coding RNAs, miRNA, is clinically important to control a disease. However, the detailed status of miRNA interactions with NHRs remains unclear. Hence, the focus of the present study is to investigate the interface at the genome-wide level in human, mouse, and rat using computational biology approach. This big-data analysis explored thousands of available miRNAs interactions with the NHRs and the results showed that 11 miRNAs have conserved targets, where six miRNAs genetically conserved among different species. This implies that both conserved and non-conserved miRNAs have a potential role in NHRs regulation. We found several "Aberrantly Binding miRNAs" (ABMs) that can bind to the target NHR genes. In this study, for human miR-548, rat miR-Let-7 and miR-30, mouse miR-466 are identified as potential ABMs families. We also found the list of genes targeting ABMs. Specifically, these miRNAs majorly targeted to bind nuclear subfamily receptor genes in all studied animal species. ABMs family interaction with NHR genes is favored by AT richness and the length of the gene. Our findings suggest that, specific ABMs family targeting NHRs may act as potential candidates to regulate the downstream signaling pathways.

Monitoring pH, temperature and humidity in long-term stem cell culture in CO2 incubator

Cell culture in stem cell research is on the rise, not only for basic research but also for its potential medical and therapeutic applications. Monitoring culture process using sensors throughout the culture helps to optimize culture conditions for optimal growth and maximize yield from the cells. Further, the sensor data gives insight into developing better cell culture systems. Typical stem cell culture platforms, e.g. well plates or flasks, cannot be easily equipped with sensors and impose many challenges in periodic process measurements in a CO2 incubator. We present an incubator compatible modular measurement system with three sensors, to monitor pH, temperature and humidity continuously throughout the culture. Sensors are assembled around a flow through cuvette for highly sterile non-contact measurements. No sample preparation or sample extraction from the incubator is needed and the measurements are carried out in a closed flow loop without wasting any medium. The modular assembly is novel, reusable and feasible for humid incubator environments. The system has been tested, validated and used in mesenchymal stem cell expansion and differentiation, for periods ranging from two to three weeks. Once the measurement has commenced at the beginning of culture, continuous measurements without sensor recalibration or special manual attention are carried out till the end of the culture. Measurement data clearly show the interplay between measured parameters, indicating a few stress sources present all through the culture. Additionally, it gives an overall picture of behavior of critical control parameters in an incubator and points out the need for bioprocess systems with automatic process monitoring and smart control for maximum yield, optimal growth and maintenance of the cells.
Application of air bladders for medical compression hosieries

The research work presents a new design of compression hosiery where compression around a human limb is generated using special air bladders. The pressure inside the air bladders is adjustable. The objective of the research was to study graduated compression and its control on the limb using the prototype with air bladders and two commercial compression products. The compression forces were measured around the limb under a knee in three sectors: a foot, a middle part and an upper part of the leg. Measurements were mainly done in vivo using the limb of a test person – although some pre-trials were done in vitro. During the tests it was concluded that the exact control of the compression was very difficult to achieve due to, for example, the shape and the composition of the limb. Based on the results, the compression values were unstable under the sectors and the graduated compression was nonlinear in the vertical direction for every tested hosiery. There is some analogy concerning the pressure distribution reported about standard mechanical compression hosiery. The results prove that our prototype enables one to achieve very high compression values in seconds, and to manage and to adjust instantly the compression rate in each sector. Efficient controllability and comfort are important matters in the medical treatment, where a patient wears the hosieries for prolonged times.

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Scopus rating (2010): SJR 0.714 SNIP 1.422
Scopus rating (2009): SJR 0.964 SNIP 1.25
Scopus rating (2008): SJR 0.984 SNIP 1.415
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Scopus rating (2005): SJR 0.396 SNIP 1.217
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Scopus rating (2003): SJR 0.482 SNIP 1.252
Scopus rating (2002): SJR 0.39 SNIP 1.217
Scopus rating (2001): SJR 0.389 SNIP 1.446
Order reduction for a signaling pathway model of neuronal synaptic plasticity
In this study a nonlinear mathematical model of plasticity in the brain is reduced using the Proper Orthogonal Decomposition and Discrete Empirical Interpolation Method. Such methods are remarkably useful for connecting reduced small scale models via the inputs and outputs to form optimally performing large scale models. Novel results were obtained as mathematical model order reduction has not been applied in neuroscience without linearization of the mathematical model and never to the model presented here. The reduced order model consumes considerably less computational resources than the original while maintaining a low root mean square error between the original and reduced model.

The relationship between loading history and proximal femoral diaphysis cross-sectional geometry
Objectives: We investigated the relationship between loading history and bone biomechanical properties used in physical activity reconstructions. These bone properties included bone bending and torsional strength (J), cortical area (CA), the direction of the major axis (theta angle), and element shape ratios determined from cross sections of standardized bone length. In addition, we explored the applicability of anatomically determined cross sections. Methods: Our material consisted of hip and proximal thigh magnetic resonance images of Finnish female athletes (N = 91) engaged in high-jump, triple-jump, endurance running, swimming, power-lifting, soccer and squash; along with a group of active non-athlete individuals (N = 20). We used regression analysis for size-adjustment, and the extracted residuals were then used to compare differences in the bone properties between groups. Results: We found that triple-jumpers, soccer players, and squash players had the greatest values in CA and J, swimmers and non-athletes had the smallest, whereas high-jumpers, power-lifters, and endurance runners exhibited interim values. No between-the-group differences in element shape ratios or theta angles were found. We found that influences of activity were similar regardless of whether standardized length or anatomically determined cross sections were used. Conclusions: Extreme (triple-jump) and directionally inconsistent loading (soccer and squash) necessitate a more robust skeleton compared to directionally consistent loading (high-jump,
power-lifting, and endurance running) or non-impact loading (swimming and non-athletes). However, not all of these relationships were statistically significant. Thus, information gained about physical activity using bone properties is informative but limited. Accounting for the limitations, the method is applicable on fragmented skeletal material as anatomically determined cross sections can be used.

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Authors: Niinimäki, S., Narra, N., Härkönen, L., Abe, S., Nikander, R., Hyttnen, J., Knüsel, C., Sievänen, H.
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Scopus rating (2013): SJR 1.036 SNIP 0.983 CiteScore 2.25
Scopus rating (2012): SJR 1.045 SNIP 0.964 CiteScore 2.34
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Scopus rating (2007): SJR 0.841 SNIP 0.902
Scopus rating (2006): SJR 0.68 SNIP 0.915
Scopus rating (2005): SJR 0.579 SNIP 0.984
Scopus rating (2004): SJR 0.611 SNIP 0.732
Scopus rating (2003): SJR 0.463 SNIP 0.745
Scopus rating (2002): SJR 0.39 SNIP 0.726
Scopus rating (2001): SJR 0.449 SNIP 0.725
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Research output: Scientific - peer-review › Article

Lead field theory provides a powerful tool for designing microelectrode array impedance measurements for biological cell detection and observation
Background: Our aim is to introduce a method to enhance the design process of microelectrode array (MEA) based electric bioimpedance measurement systems for improved detection and viability assessment of living cells and tissues. We propose the application of electromagnetic lead field theory and reciprocity for MEA design and measurement result interpretation. Further, we simulated impedance spectroscopy (IS) with two- and four-electrode setups and a biological cell to illustrate the tool in the assessment of the capabilities of given MEA electrode constellations for detecting cells on or in the vicinity of the microelectrodes. Results: The results show the power of the lead field theory in electromagnetic simulations of cell-microelectrode systems depicting the fundamental differences of two- and four-electrode IS measurement configurations to detect cells. Accordingly, the use in MEA system design is demonstrated by assessing the differences between the two- and four-electrode IS configurations. Further, our results show how cells affect the lead fields in these MEA system, and how we can utilize the differences of the two- and four-electrode setups in cell detection. The COMSOL simulator model is provided freely in public domain as open source. Conclusions: Lead field theory can be successfully applied in MEA design for the IS based assessment of biological cells providing the necessary visualization.
and insight for MEA design. The proposed method is expected to enhance the design and usability of automated cell and tissue manipulation systems required for bioreactors, which are intended for the automated production of cell and tissue grafts for medical purposes. MEA systems are also intended for toxicology to assess the effects of chemicals on living cells. Our results demonstrate that lead field concept is expected to enhance also the development of such methods and devices.

**General information**

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Scopus rating (2012): SJR 0.443 SNIP 1.059 CiteScore 1.81
Scopus rating (2011): SJR 0.401 SNIP 1.054 CiteScore 1.73
Scopus rating (2010): SJR 0.428 SNIP 1.102
Scopus rating (2009): SJR 0.521 SNIP 1.408
Scopus rating (2008): SJR 0.537 SNIP 0.97
Scopus rating (2007): SJR 0.453 SNIP 1.205
Scopus rating (2006): SJR 0.622 SNIP 1.282
Scopus rating (2005): SJR 0.502 SNIP 0.947
Scopus rating (2004): SJR 0.404 SNIP 1.181
Scopus rating (2003): SJR 0.151 SNIP 0.313
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**Bioimpedance measurement based evaluation of wound healing**

Objective: Our group has developed a bipolar bioimpedance measurement-based method for determining the state of wound healing. The objective of this study was to assess the capability of the method. Methods: To assess the performance of the method, we arranged a follow-up study of four acute wounds. The wounds were measured using the method and photographed throughout the healing process. Results: Initially the bioimpedance of the wounds was significantly lower than the impedance of the undamaged skin, used as a baseline. Gradually, as healing progressed, the wound impedance increased and finally reached the impedance of the undamaged skin. Conclusion: The clinical appearance of the wounds examined in this study corresponded well with the parameters derived from the bioimpedance data. Significance: Hard-to-heal wounds are a significant and growing socioeconomic burden, especially in the developed countries, due to aging populations and to the increasing prevalence of various lifestyle related diseases. The assessment and the monitoring of chronic wounds are mainly based on visual inspection by medical professionals. The dressings
covering the wound must be removed before assessment; this may disturb the wound healing process and significantly increases the work effort of the medical staff. There is a need for an objective and quantitative method for determining the status of a wound without removing the wound dressings. This study provided evidence of the capability of the bioimpedance based method for assessing the wound status. In the future measurements with the method should be extended to concern hard-to-heal wounds.

**General information**

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- Scopus rating (2012): SJR 0.576 SNIP 1.285 CiteScore 2
- Scopus rating (2011): SJR 0.654 SNIP 1.252 CiteScore 2.19
- Scopus rating (2010): SJR 0.619 SNIP 1.544
- Scopus rating (2009): SJR 0.622 SNIP 1.445
- Scopus rating (2008): SJR 0.675 SNIP 1.342
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- Scopus rating (2006): SJR 0.797 SNIP 1.3
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- Scopus rating (2004): SJR 0.501 SNIP 1.047
- Scopus rating (2003): SJR 0.591 SNIP 0.958
- Scopus rating (2002): SJR 0.592 SNIP 0.975
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**Injectable and thermoresponse pericardial matrix derived conductive scaffold for cardiac tissue engineering**

Scaffolds derived from decellularized cardiac tissue offer an enormous advantage for cardiac applications as they recapitulate biophysical and cardiac specific cues. However, poor electrical conductivity and mechanical properties severely compromise the therapeutic potential of these matrices. Dispersion of multiwall carbon nanotubes (MWCTs) in these scaffolds could improve their mechanical and electrical properties. However, the inherent hydrophobicity and poor dispersibility of these materials under aqueous conditions limit their outcome. We have developed a modified MWCNT functionalized with carbodiimide (CDH) residues that significantly improved their dispersibility and suppressed cytotoxicity in HL-1 cardiomyocytes. We found that the doping of CDH functionalized MWCNT (CDH-MWCNT) as low as 0.5 wt% to the pericardial matrix hydrogel (PMNT) induced the necessary electrical conductivity and significantly improved the mechanical properties of the hydrogel. Cardiomyocytes cultured on a PMNT scaffold triggered proliferation and significantly increased the expression of cardiac-specific gap junction protein, namely connexin 43. Such a phenomenon was not observed when cardiomyocytes were cultured on the pericardial matrix derived gels without MWCNT or on gelatin-fibronectin coated 2D cultures. The PMNT gels displayed excellent biophysical characteristics resulting in the clustering of cardiomyocytes with synchronous contraction, which is crucial for the successful integration to the host tissue.
Automatic Classification of Forum Posts: A Finnish Online Health Discussion Forum Case

Online health discussion forums play a key role in accessing, distributing and exchanging health information at an individual and societal level. Due to their free nature, using and regulating these forums require substantial amount of manual effort. In this study, we propose a computational approach, i.e., a machine learning framework, in order to categorize the messages from Finland’s largest online health discussion forum into 16 categories. An accuracy of 70.8% was obtained with a Naïve Bayes classifier, applied on term frequency-inverse document frequency features.
3D-Printed Graphene Antennas and Interconnections for Textile RFID Tags: Fabrication and Reliability towards Humidity

We present the possibilities of 3D direct-write dispensing in the fabrication of passive UHF RFID graphene tags on a textile substrate. In our method, the graphene tag antenna is deposited directly on top of the IC strap, in order to simplify the manufacturing process by removing one step, that is, the IC attachment with conductive glue. Our wireless measurement results confirm that graphene RFID tags with printed antenna-IC interconnections achieve peak read ranges of 5.2 meters, which makes them comparable to graphene tags with epoxy-glued ICs. After keeping the tags in high humidity, the read ranges of the tags with epoxy-glued and printed antenna-IC interconnections decrease 0.8 meters and 0.5 meters, respectively. However, after drying, the performance of both types of tags returns back to normal.

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Scopus rating (2013): SJR 0.337 SNIP 0.677 CiteScore 1.04
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Research output: Scientific - peer-review › Article

Surface curvature in triply-periodic minimal surface architectures as a distinct design parameter in preparing advanced tissue engineering scaffolds

Reproduction of the anatomical structures and functions of tissues using cells and designed 3D scaffolds is an ongoing challenge. For this, scaffolds with appropriate biomorphic surfaces promoting cell attachment, proliferation and differentiation are needed. In this study, eight triply-periodic minimal surface (TPMS)-based scaffolds were designed using specific trigonometric equations, providing the same porosity and the same number of unit cells, while presenting different surface curvatures. The scaffolds were fabricated by stereolithography using a photocurable resin based on the biocompatible, biodegradable and rubber-like material, poly(trimethylene carbonate) (PTMC). A numerical approach was developed to calculate the surface curvature distributions of the TPMS architectures. Moreover, the scaffolds were characterized by scanning electron microscopy, microcomputed tomography and water permeability measurements. These original scaffold architectures will be helpful to decipher the biofunctional role of the surface curvature of scaffolds intended for tissue engineering applications.

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Geometry-based Computational Modeling of Calcium Signaling in an Astrocyte

In the last two decades, astrocytes have gained more interest due to the realization that they are involved not only in information processing and memory formation but are also linked with several neurodegenerative disorders and brain diseases. Communicating indirectly with synapses via released gliotransmitters such as glutamate, astrocytes take part in the neuronal activity by propagating intracellular and intercellular waves of calcium (Ca2+). However, it is not clear what effect does the astrocyte geometry have on these Ca2+ wave dynamics. In this study, we present a geometry-based computational model of an astrocyte that is used to simulate the stimulation and propagation of intracellular astrocytic Ca2+ waves. To our best knowledge, this is the first computational model to study the effect of the single astrocyte geometry on the Ca2+ wave propagation, while taking into account the intricate biological pathways that regulate internal Ca2+ dynamics. By simulating theoretical astrocyte geometries with a fixed glutamate stimulus, we found that narrower astrocyte processes lead to stronger Ca2+ wave dynamics, in comparison to wider processes. From this study, we concluded that the geometry does have a visible effect on the overall intracellular Ca2+ dynamics.
Sensitivity Distribution of Electrical Impedance Epithelial Measurement Systems

Epithelia are essential tissues that separate body compartments from each other and are affected by a plethora of diseases and conditions. Electrical properties are a convenient method to study the state of these tissues. There are various measurement setups for studying these properties. However, there has been no studies on how the setup of the electrodes affects the sensitivity distribution of the measurement system. We created a computational model of a 4-electrode electrical impedance measurement system to study how the placement of the electrode as well as defects in the epithelium affect the sensitivity distribution. Our results show that the sensitivity is highly dependent on the frequency as well as on the distance between the electrodes and the epithelium. The sensitivity becomes more concentrated to areas between the electrodes when they were moved closer to the epithelium. The sensitivity should be taken into account when developing measurement systems to study localized phenomena with the electrodes placed close to the epithelium.

Network-wide adaptive burst detection depicts neuronal activity with improved accuracy

Neuronal networks are often characterized by their spiking and bursting statistics. Previously, we introduced an adaptive burst analysis method which enhances the analysis power for neuronal networks with highly varying firing dynamics. The adaptation is based on single channels analyzing each element of a network separately. Such kind of analysis was adequate for the assessment of local behavior, where the analysis focuses on the neuronal activity in the vicinity of a single electrode. However, the assessment of the whole network may be hampered, if parts of the network are analyzed using different rules. Here, we test how using multiple channels and measurement time points affect adaptive burst detection. The main emphasis is, if network-wide adaptive burst detection can provide new insights into the assessment of network activity. Therefore, we propose a modification to the previously introduced inter-spike interval (ISI) histogram based cumulative moving average (CMA) algorithm to analyze multiple spike trains simultaneously. The network size can be freely defined, e.g., to include all the electrodes in a microelectrode array (MEA) recording. Additionally, the method can be applied on a series of measurements on the same network to pool the data for statistical analysis. Firstly, we apply both the original CMA-algorithm and our proposed network-wide CMA-algorithm on artificial spike trains to investigate how the modification changes the burst detection. Thereafter, we use the algorithms on MEA data of spontaneously active chemically manipulated in vitro rat cortical networks. Moreover, we compare the synchronization of the detected bursts introducing a new burst synchrony measure. Finally, we demonstrate how the bursting statistics can be used to classify networks by applying k-means clustering to the bursting statistics. The results show that the proposed network-wide adaptive burst detection provides a method to unify the burst definition in the whole network and thus improves the assessment and classification of the neuronal activity, e.g., the effects of different pharmaceuticals. The results indicate that the novel method is adaptive enough to be usable on networks with different dynamics, and it is especially feasible when comparing the behavior of differently spiking networks, for example in developing networks.
The European Union and the USA collaborate in developing the skills of the application of information technology in the health care workforce. A part of this activity is a project which studies the gaps in the present education and proposes methods of filling these gaps. The objective of this paper is to identify the existing IT related education to the health care work force in Finland. A secondary objective was to get an impression of the experience and attitudes of the members of this workforce about health IT education.

This paper presents the results of the survey of how information technology is educated to the students of the health care professions in Finland in the year 2017. In addition to literature search including also the study guides of many major health care professional education organizations, 24 telephone interviews of health care professionals in different fields in Finland were made.

The results show that although basic information technology education is often available at every level of education, it is expected that the health care professionals learn to use the health information systems during their training periods or later in working life. The interviews showed that the given education varied considerably and some of the personnel had received no or only a little education on IT during studies. As the amount and quality of on-the-job information technology education varies, many health care professionals are not able to fully benefit from the information systems if their general feeling is that they just "survive" from daily activities with them.
Effects of extrinsic noise are promoter kinetics dependent
Studies in Escherichia coli using in vivo single-RNA detection and time-lapse confocal microscopy showed that transcription is a multiple rate-limiting steps process, in agreement with previous in vitro measurements. Here, from simulations of a stochastic model of transcription validated empirically that accounts for cell-to-cell variability in RNA polymerase (RNAP) numbers, we investigate the hypothesis that the cell-to-cell variability in RNA numbers due to RNAP variability differs with the promoter rate-limiting steps dynamics. We find that increasing the cell-to-cell variability in RNAP numbers increases the cell-to-cell diversity in RNA numbers, but the degree with which it increases is promoter kinetics dependent. Namely, promoters whose open complex formation is relatively longer lasting dampen more efficiently this noise propagation phenomenon. We conclude that cell-to-cell variability in RNA numbers due to variability in RNAP numbers is promoter-sequence dependent and, thus, evolvable.
Clinical association analysis of ependymomas and pilocytic astrocytomas reveals elevated FGFR3 and FGFR1 expression in aggressive ependymomas

Background: Fibroblast growth factor receptors (FGFRs) are well-known proto-oncogenes in several human malignancies and are currently therapeutically targeted in clinical trials. Among glioma subtypes, activating FGFR1 alterations have been observed in a subpopulation of pilocytic astrocytomas while FGFR3 fusions occur in IDH wild-type diffuse gliomas, resulting in high FGFR3 protein expression. The purpose of this study was to associate FGFR1 and FGFR3 protein levels with clinical features and genetic alterations in ependymoma and pilocytic astrocytoma. Methods: FGFR1 and FGFR3 expression levels were detected in ependymoma and pilocytic astrocytoma tissues using immunohistochemistry. Selected cases were further analyzed using targeted sequencing. Results: Expression of both FGFR1 and FGFR3 varied within all tumor types. In ependymomas, increased FGFR3 or FGFR1 expression was associated with high tumor grade, cerebral location, young patient age, and poor prognosis. Moderate-to-strong expression of FGFR1 and/or FGFR3 was observed in 76% of cerebral ependymomas. Cases with moderate-to-strong expression of both proteins had poor clinical prognosis. In pilocytic astrocytomas, moderate-to-strong FGFR3 expression was detected predominantly in non-pediatric patients. Targeted sequencing of 12 tumors found no protein-altering mutations or fusions in FGFR1 or FGFR3. Conclusions: Elevated FGFR3 and FGFR1 protein expression is common in aggressive ependymomas but likely not driven by genetic alterations. Further studies are warranted to evaluate whether ependymoma patients with high FGFR3 and/or FGFR1 expression could benefit from treatment with FGFR inhibitor based therapeutic approaches currently under evaluation in clinical trials.

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Cell Adhesion on Dynamic Supramolecular Surfaces Probed by Fluid Force Microscopy-Based Single-Cell Force Spectroscopy

Biomimetic and stimuli-responsive cell-material interfaces are actively being developed to study and control various cell-dynamics phenomena. Since cells naturally reside in the highly dynamic and complex environment of the extracellular matrix, attempts are being made to replicate these conditions in synthetic biomaterials. Supramolecular chemistry, dealing with noncovalent interactions, has recently provided possibilities to incorporate such dynamicity and responsiveness in various types of architectures. Using a cucurbit[8]uril-based host-guest system, we have successfully established a dynamic and electrochemically responsive interface for the display of the integrin-specific ligand, Arg-Gly-Asp (RGD), to promote cell adhesion. Due to the weak nature of the noncovalent forces by which the components at the interface are held together, we expected that cell adhesion would also be weaker in comparison to traditional interfaces where ligands are usually immobilized by covalent linkages. To assess the stability and limitations of our noncovalent interfaces, we performed single-cell force spectroscopy studies using fluid force microscopy. This technique enabled us to measure rupture forces of multiple cells that were allowed to adhere for several hours on individual substrates. We found that the rupture forces of cells adhered to both the noncovalent and covalent interfaces were nearly identical for up to several hours. We have analyzed and elucidated the reasons behind this result as a combination of factors including the weak rupture force between linear Arg-Gly-Asp and integrin, high surface density of the ligand, and increase in effective concentration of the supramolecular components under spread cells. These characteristics enable the construction of highly dynamic biointerfaces without compromising cell-adhesive properties.
The Effect of an Applied Electric Current on Cell Proliferation, Viability, Morphology, Adhesion, and Stem Cell Differentiation

The importance of electrical stimulus is often underrated in cell biology and tissue engineering, although electric fields and currents, both endogenous and applied, play a great role in many cellular functions. Electrical stimulation of the cells causes direct effects on cells, such as rearrangement of the cytoskeleton, redistribution of membrane receptors and changes in calcium dynamics, as well as electrochemical reactions at the electrode/electrolyte interface. In this thesis, the effect of an applied electric current on cell proliferation, viability, morphology, adhesion, and stem cell differentiation was studied. The electric stimulation was applied to two different types of mammalian cells, mouse myoblasts and adipose-derived stem cells that were either in a direct contact with the electrodes or in a contact with the electrodes through the electrolyte.

The applied electric current changed the cell spreading characteristics on the electrode, and induced the more elongated cell morphology even when the cells were not cultured directly on the electrode. However, after a certain threshold, the increase in current dose resulted in decrease in the cell viability and sometimes also on the cell proliferation rates. The stimulation influenced the cell adhesion as well, studied by both quantitative and qualitative methods on the electrode and in a biomaterial scaffold. The low currents decreased and higher currents increased the cell-substrate adhesion forces. The highest adhesion forces were related to the poor cell viability and at the highest current values, it was impossible to detach the cell from the substrate. The increase in electric current also decreased the cell migration and adhesion to the scaffold. In addition to the changes in their morphology, the stimulation of the adipose-derived stem cells also modified their differentiation pattern. Stimulation of the stem cells with electric current and electrochemically released Cu2+ induced the upregulation of neuron-specific genes and proteins, whereas stimulation with current only mainly induced changes in the cell morphology.

As demonstrated in this thesis, electric stimulation induces changes in many cellular functions and might offer an easy and cost-effective method to regulate them in future in vitro and in vivo applications. For instance, electric current could be used for a controlled arrangement of cells within the scaffold or for inducing the neuronal differentiation of stem cells.

Bioamine-crosslinked gellan gum hydrogel for neural tissue engineering

Neural tissue engineering and three-dimensional in vitro tissue modeling require the development of biomaterials that take into account the specified requirements of human neural cells and tissue. In this study, an alternative method of producing biomimetic hydrogels based on gellan gum (GG) was developed by replacing traditional crosslinking methods with the bioamines spermidine and spermine. These bioamines were proven to function as crosslinkers for GG hydrogel at +37 °C, allowing for the encapsulation of human neurons. We studied the mechanical and rheological properties of the formed hydrogels, which showed biomimicking properties comparable to naive rabbit brain tissue under physiologically relevant stress and strain. Human pluripotent stem cell-derived neuronal cells demonstrated good cytocompatibility in the GG-based hydrogels. Moreover, functionalization of GG hydrogels with laminin resulted in cell type-specific behavior: neuronal
cell maturation and neurite migration.

Quantitative characterization of pore structure of several biochars with 3D imaging

Pore space characteristics of biochars may vary depending on the used raw material and processing technology. Pore structure has significant effects on the water retention properties of biochar amended soils. In this work, several biochars were characterized with three-dimensional imaging and image analysis. X-ray computed microtomography was used to image biochars at resolution of 1.14 μm and the obtained images were analysed for porosity, pore size distribution, specific surface area and structural anisotropy. In addition, random walk simulations were used to relate structural anisotropy to diffusive transport. Image analysis showed that considerable part of the biochar volume consist of pores in size range relevant to hydrological processes and storage of plant available water. Porosity and pore size distribution were found to depend on the biochar type and the structural anisotropy analysis showed that used raw material considerably affects the pore characteristics at micrometre scale. Therefore, attention should be paid to raw material selection and quality in applications requiring optimized pore structure.
Cell culture chamber with gas supply for prolonged recording of human neuronal cells on microelectrode array

Background Typically, live cell analyses are performed outside an incubator in an ambient air, where the lack of sufficient CO₂ supply results in a fast change of pH and the high evaporation causes concentration drifts in the culture medium. That limits the experiment time for tens of minutes. In many applications, e.g. in neurotoxicity studies, a prolonged measurement of extracellular activity is, however, essential. New method We demonstrate a simple cell culture chamber that enables stable culture conditions during prolonged extracellular recordings on a microelectrode array (MEA) outside an incubator. The proposed chamber consists of a gas permeable silicone structure that enables gas transfer into the chamber. Results We show that the culture chamber supports the growth of the human embryonic stem cell (hESC)-derived neurons both inside and outside an incubator. The structure provides very low evaporation, stable pH and osmolarity, and maintains strong signaling of hESC-derived neuronal networks over three-day MEA experiments. Comparison with existing methods Existing systems are typically complex including continuous perfusion of medium or relatively large amount of gas to supply. The proposed chamber requires only a supply of very low flow rate (1.5 ml/min) of non-humidified 5% CO₂ gas. Utilizing dry gas supply makes the proposed chamber simple to use. Conclusion Using the proposed culture structure on top of MEA, we can maintain hESC-derived neural networks over three days outside an incubator. Technically, the structure requires very low flow rate of dry gas supporting, however, low evaporation and maintaining the pH of the culture.

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Asumisen turvallisuusinnovaatiot

Selvityksen kohdemaissa (Suomi, USA, Tanska, Hollanti ja Japani) ollaan yhtäläisen haasteen edessä, kun väestön elinajanodote nousee. Suomessa oli 65+ vuotta täyttäneitä henkilöitä 20,5 % (v.2015), Tanskassa 19 % (v. 2015), Hollannissa 18,2% (v. 2015), USA:ssa 14,5% (v. 2014) ja Japanissa 26,7% (v. 2015). Kotona asuvien 65+ -vuotta täyttäneiden määrä Suomessa tulee olemaan vuoteen 2030 mennessä noin 1,5 miljoonaa. Sosiaalinen eristyneys saattaa olla suurin uhka, koska aiempaa huonokuntoisemmat ikääntyneet asuvat omissa kodeissaan eivätkä pysty enää lähtemään kodin ulkopuolelle. Älyteknologioiden kehys etenee nopeasti, eivätkä kaikki ikääntyneet välttämättä pysy talallaan. Merkittävä osa ikääntyneistä henkilöistä on yhä taudittomia tietotekniikan käyttäjänä.


Turvateknologia, kuten kaatumisen automaattinen tunnistus ja henkilön paikannusteknologiat, ovat kehittyneet nykymuotoisena jo melko pitkälle. Keskeinen tässä selvityksessä tehty havainto liittyy tietoturvan puutteeseen. Älyteknologian osalta ongelmaa pahentaa se, että standardit tietoturvalle puuttuvat kodin automaation osalta.

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Liiketoimintamahdollisuuksien luominen kodin älyteknonologian tehokkaampaan hyödyntämiseen
Selvityksen kohdemaissa (Suomi, USA, Tanska, Hollanti ja Japani) ollaan yhtäläisen haasteen edessä, kun väestön elinajanodote nousee. Suomessa oli 65+ vuotta täyttäneitä henkilöitä 20,5 % (v.2015), Tanskassa 19 % (v. 2015), Hollannissa 18,2% (v. 2015), USA:ssa 14,5 % (v. 2014) ja Japanissa 26,7% (v. 2015). Kotona asuvien 65+ -vuotta täyttäneiden määrä Suomessa tulee olemaan vuoteen 2030 mennessä noin 1,5 miljoonaa. Sosiaalinen eristyneisyys saattaa olla suuri uhka, koska aiempaa huonokuntoisemmat ikääntyneet asuvat omissa kodeissaan eivätkä pysty enää lähtemään kodin ulkopuolelle. Älyteknologioiden kehitys etenee nopeasti, eivätkä kaikki ikääntyneet välttämättä pysy tai halua pysyä tässä kehityksessä mukan. Merkittävää osa ikääntyneistä henkilöistä on yhä tottumattomia tietotekniikan käyttäjäitä.

Parameters extracted from arterial pulse waves as markers of atherosclerotic changes: performance and repeatability

Arterial diseases are significant and increasing cause of mortality and morbidity. In this study, we analyze and compare the discrimination capability of different arterial pulse wave (PW) based indices, both earlier proposed and novel ones, for describing the vascular health. The repeatability of the indices is also evaluated. Both volume PWs and dynamic pressure PWs are recorded by using photoplethysmographic and electromechanical film (EMFi) sensors connected to a wireless body sensor network. The study population consists of 82 subjects, 30 atherosclerotic patients and 52 control subjects. In addition, day-to-day variability of the derived indices is studied with 10 test subjects examined on three different days. The results are evaluated in terms of statistical tests and receiver operating characteristic (ROC) curves as well as coefficient of variation (CV) and intra-class correlation coefficient (ICC). Altogether 24 out of the evaluated 40 PW parameters showed statistical differences (p < 0.05 or less) between controls and atherosclerotic patients. Maximum area under curve was 0.88. Most of the indices had ICCs higher than 0.8 and average CVs less than 0.1. The study shows that the amplitude ratios and time intervals between different PW peaks could be a useful additional tool for the detection of atherosclerosis. The results encourage us for further studies in this field. Up to our knowledge, the performance and the repeatability of different PW derived indices have previously not been studied and compared with each other this extensively. Our findings also provide evidence for the utility of PW measurements for the detection of atherosclerotic changes.
Collagen-immobilized polyimide membranes for retinal pigment epithelial cell adherence and proliferation

Degenerative retinal diseases are a leading cause of visual loss and irreversible blindness, particularly in the developed world. Retinal pigment cell (RPE) transplantation is nowadays considered the most promising therapeutic approach for certain retinal diseases, and the presence of a supportive scaffold has been considered essential to ensure the success of the implant. In this work, collagen IV was covalently immobilized to the surface of polyimide membranes, with the purpose of developing scaffold materials for RPE cell culture. The covalent modification method involved four steps: argon-plasma treatment, acrylic acid graft polymerization, surface activation, and finally immobilization of collagen type IV. Collagen-modified membranes did not become more rough but became significantly more hydrophilic than the unmodified and dip-coated controls. ARPE-19 cell morphology and attachment were studied by immunofluorescence staining and confocal microscopy. Covalently modified surfaces showed cell attachment and cell properties comparable to the uncoated and dip-coated controls. This work demonstrated the potential of collagen IV-immobilized polyimide membranes as substrates for the growth of ARPE-19 cells.

Do properties of bioactive glasses exhibit mixed alkali behavior?

The effect of substituting K₂O for Na₂O on the physical and chemical properties of 15 glasses in the system Na₂O–K₂O–CaO–P₂O₅–SiO₂ was studied for three series: low (52 mol% SiO₂), medium (60 mol% SiO₂) and high (66 mol% SiO₂) silica. The SiO₂ content expressed as weight-% varied from 46 to 64 wt%, thus suggesting that the compositions were either bioactive or biocompatible. The crystallization tendency and sintering behavior were studied using differential thermal analysis and hot stage microscopy. Formation of silica- and hydroxy-apatite-rich layers were studied for glass plates immersed in static simulated body fluid. The release of inorganic ions into Tris buffer solution was analyzed using...
inductively coupled plasma optical emission spectrometer in dynamic and static conditions. Substitution of K₂O for Na₂O suggested mixed alkali effect (MAE) for the thermal properties with a minimum value around 25% substitution. With increased share of K₂O in total alkali oxides, the hot working window markedly expanded in each series. Silica and hydroxyapatite layers were seen only on the low silica glasses, while a thin silica-rich layer formed on the other glasses. In each series, greater dissolution of alkali and alkali earth ions was seen from K-rich glasses. Clear MAE and preferential ion dissolution were recorded for medium and high silica series, while for low silica glasses, the initial MAE dissolution trends become rapidly covered by other simultaneous surface reactions. MAE enables designing especially low silica bioactive glasses for improved hot working properties and medium and high silica glasses for controlled dissolution.

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From in silico astrocyte cell models to neuron-astrocyte network models: A review
The idea that astrocytes may be active partners in synaptic information processing has recently emerged from abundant experimental reports. Because of their spatial proximity to neurons and their bidirectional communication with them, astrocytes are now considered as an important third element of the synapse. Astrocytes integrate and process synaptic information and by doing so generate cytosolic calcium signals that are believed to reflect neuronal transmitter release. Moreover, they regulate neuronal information transmission by releasing gliotransmitters into the synaptic cleft affecting both pre- and postsynaptic receptors. Concurrent with the first experimental reports of the astrocytic impact on neural network dynamics, computational models describing astrocytic functions have been developed. In this review, we give an overview over the published computational models of astrocytic functions, from single-cell dynamics to the tripartite synapse level and network models of astrocytes and neurons.
The Association Between Liver and Tumor $[^{18}F]$FDG Uptake in Patients with Diffuse Large B Cell Lymphoma During Chemotherapy

Purpose: The aim of this study was to explore the association between liver, mediastinum and tumor 2-deoxy-2-$[^{18}F]$fluoro-d-glucose ($[^{18}F]$FDG) uptake during chemotherapy in diffuse large B cell lymphoma (DLBCL). Procedures: Nineteen patients with proven DLBCL underwent positron emission tomography (PET)/X-ray computed tomography scan at baseline, 1 week and 2 cycles after rituximab, cyclophosphamide, doxorubicin, vincristine, and prednisolone (R-CHOP) therapy, and again after chemotherapy completion. The mean and maximal standardized uptake value (SUVmean and SUVmax) of the liver and mediastinum were measured and correlated with the tumor SUVmax, SUVsum, whole-body metabolic tumor volume (MTVwb), and total lesion glycolysis (TLG). Results: At baseline, both the liver and mediastinum SUVmean and SUVmax correlated inversely with the tumor MTVwb or TLG ($p < 0.01$ or $0.001$). The liver SUVmean and SUVmax increased significantly after 1 week of R-CHOP therapy and remained at the high level until chemotherapy completion. The mediastinum SUVmean and SUVmax remained stable during chemotherapy. The tumor SUVmax, SUVsum, MTVwb, and TLG decreased significantly after 1 week of R-CHOP therapy. The change of the liver SUVmean correlated inversely with the change of tumor MTVwb and TLG after 1 week of chemotherapy ($p < 0.01$ or $0.001$). The liver SUVmean and SUVmax increased significantly after R-CHOP therapy. One of the possible reasons is the distribution of a greater fraction of the tracer to healthy tissues rather than tumor after effective chemotherapy. The variability of the liver SUVmean and SUVmax during chemotherapy might affect the visual analysis of the interim PET scan and this needs to be confirmed in future studies with a large patient cohort. In addition, the intersubject variability of the liver and mediastinum SUVmax should be considered.
Background: Gene set analysis (in a form of functionally related genes or pathways) has become the method of choice for analyzing omics data in general and gene expression data in particular. There are many statistical methods that either summarize gene-level statistics for a gene set or apply a multivariate statistic that accounts for intergene correlations. Most available methods detect complex departures from the null hypothesis but lack the ability to identify the specific alternative hypothesis that rejects the null. Results: GSAR (Gene Set Analysis in R) is an open-source R/Bioconductor software package for gene set analysis (GSA). It implements self-contained multivariate non-parametric statistical methods testing a complex null hypothesis against specific alternatives, such as differences in mean (shift), variance (scale), or net correlation structure. The package also provides a graphical visualization tool, based on the union of two minimum spanning trees, for correlation networks to examine the change in the correlation structures of a gene set between two conditions and highlight influential genes (hubs). Conclusions: Package GSAR provides a set of multivariate non-parametric statistical methods that test a complex null hypothesis against specific alternatives. The methods in package GSAR are applicable to any type of omics data that can be represented in a matrix format. The package, with detailed instructions and examples, is freely available under the GPL (>= 2) license from the Bioconductor web site.
Comparison of non-invasive blood pressure monitoring using modified arterial applanation tonometry with intra-arterial measurement

Intermittent non-invasive blood pressure measurement with tourniquets is slow, can cause nerve and skin damage, and interferes with other measurements. Invasive measurement cannot be safely used in all conditions. Modified arterial tonometry may be an alternative for fast and continuous measurement. Our aim was to compare arterial tonometry sensor (BPro®) with invasive blood pressure measurement to clarify whether it could be utilized in the postoperative setting. 28 patients who underwent elective surgery requiring arterial cannulation were analyzed. Patients were monitored post-operatively for 2 h with standard invasive monitoring and with a study device comprising an arterial tonometry sensor (BPro®) added with a three-dimensional accelerometer to investigate the potential impact of movement. Recordings were collected electronically. The results revealed inaccurate readings in method comparison between the devices based on recommendations by Association for the Advancement of Medical Instrumentation (AAMI). On a Bland–Altman plot, the bias and precision between these two methods was 19.8 ± 16.7 (Limits of agreement − 20.1 to 59.6) mmHg, Spearman correlation coefficient r = 0.61. For diastolic pressure, the difference was 4.8 ± 7.7 (LoA − 14.1 to 23.6) mmHg (r = 0.72), and for mean arterial pressure it was 11.18 ± 11.1 (LoA − 12.1 to 34.2) mmHg (r = 0.642). Our study revealed inaccurate agreement (AAMI) between the two methods when measuring systolic and mean blood pressures during post-operative care. The readings for diastolic pressures were inside the limits recommended by AAMI. Movement increased the failure rate significantly (p <0.001). Thus, arterial tonometry is not an appropriate replacement for invasive blood pressure measurement in these patients.
Facial paralysis due to damage of the facial nerve affects the function of facial muscles, including the muscles responsible for eye blinking. The absence of the eye blink can lead to severe and permanent corneal damage as the protection and lubrication of the eye is decreased. Thus, it would be highly important to provide an aid to sustain the eye health. The present aim was to study the effects of long-term electrical eye blink stimulation using a facial stimulation prototype. Five healthy participants watched a movie for 78 minutes, while the eye blinks were produced to their left eye by pre-programmed, timer-triggered blink stimulation at fixed intervals. We analyzed the functionality of the stimulation prototype, potential changes in the quality of the produced blinks, and the ratings of experiences in terms of pain, discomfort, and naturalness. We also analyzed the acuity of vision before and after the stimulation. The results showed that the stimulated eye blink was rated as not painful, somewhat uncomfortable, and slightly unnatural. With three participants the stimulation evoked a full eye closure throughout the study, and with two participants, the stimulation evoked partial blink after some time. Further, on four of the cases, the vision of the stimulated eye was better after the movie than before it. The participants told that the stimulation did not disturb the movie watching. As the findings were promising, the next steps include more comprehensive tests both with intact participants and with persons having an acute facial paralysis.
A strategy for dissecting the kinetics of transcription repression mechanisms

Promoters in Escherichia coli include an ‘OFF’ state, during which transcription is halted. Here, we propose a novel empirical method for assessing the time-length spent by promoters in this state. It relies on direct measurements of RNA production kinetics at the single molecule level at different induction levels, followed by an estimation of the RNA production rate under infinite induction, which is then compared to this rate under real, maximum induction. We apply it to the LacO3O1 promoter and infer that, under full induction, on average, 15% of the time between successful transcription events is spent in the OFF state. We verify this result by comparing the kinetics of a mutant strain lacking repressor molecules with that of the inferred rate under infinite induction. We expect this strategy of dissecting the kinetics of transcription repression to be applicable to a wide number of promoters in E. coli.
Automated pipeline for brain ROI analysis with results comparable to previous freehand measures in clinical settings

Diffusion tensor imaging (DTI) has become a relatively common MR imaging technique in only 10 years. DTI can provide important information of brain microstructure in vivo. Many quantitative DTI analysis methods utilize either region of interest (ROI) or voxel-wise whole-brain methods. ROI methods do not require potentially bias-inducing image data altering, e.g., resampling and smoothing, and are the preferred method in clinical settings. We present an automated pipeline for quantitative ROI analysis of brain DTI data. The pipeline includes pre-processing, registrations, and calculation of mean (and SD) DTI scalar values from the automated ROIs. In addition to atlas regions, the pipeline accepts freehand ROIs, as long as the frame of reference is also provided. By the uniquely designed pipeline, we ensure that the results can be retrospectively compared to previously conducted manual freehand ROI measurement results, if desired. We validated the feasibility of the pipeline by comparing manual freehand ROI measurement results from 40 subjects against the results obtained from automated ROIs. A single set of freehand ROIs (drawn similarly to the original freehand manual ROIs in the population) was input to the pipeline, and the resulting scalar values from the automated ROIs were compared to the manual freehand ROIs’ data. Adopting a limit for goodness of fit of $z = \pm 1.6$ resulted in 94% success rate for the pipeline's automated ROI registrations in the whole population. The pipeline can reduce the time taken in clinical ROI measurements.

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Better understanding of the role of SiO$_2$, P$_2$O$_5$ and Al$_2$O$_3$ on the spectroscopic properties of Yb$^{3+}$ doped silica sol-gel glasses

Yb$^{3+}$ doped silica sol-gel glass powders were prepared with different concentrations of SiO$_2$, Al$_2$O$_3$ and P$_2$O$_5$ in order to understand the impact of the glass composition on the Yb$^{3+}$ emission properties. In this paper, we clearly show that not only the Al/P ratio but also the SiO$_2$ content have an impact on the Yb$^{3+}$ spectroscopic properties. Our results provide new insight on the real impact of the composition on the spectroscopic properties of Yb$^{3+}$ doped sol-gels: we demonstrate that an increase in the Al$_2$O$_3$ content at the expense of P$_2$O$_5$ leads to an increase in the intensity of the emission at 1000nm of the Yb$^{3+}$ ions whereas an increase in the SiO$_2$ content decreases it. We clearly showed that the inexpensive sol-gel approach can be easily used when investigating new Yb$^{3+}$ doped silica glasses.

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Characterization of chloride channels in human embryonic stem cell derived retinal pigment epithelium

Retinal pigment epithelium (RPE) is vital for vision. Its ion channels play important roles in the various functions of RPE that are critical for retinal welfare. These functions are often disrupted in degenerative eye diseases leading to visual impairment and even blindness. New treatments are currently being developed and transplantation of human embryonic stem cell (hESC)-derived RPE is showing great promise. For the success of these therapies, functionality of the transplantable cells needs to be verified. Presence of ion channels in hESC-derived RPE remains poorly known, particularly regarding the various chloride (Cl⁻) channels. We addressed this issue by investigating the Cl⁻ conductivity of hESC-derived RPE by whole-cell patch clamp recordings followed by immunolabeling of the Cl⁻ channels typical to RPE. Our recordings showed a diverse pattern of slowly inactivating currents characteristic to voltage-dependent Cl⁻ channels (ClC) previously reported for RPE. Some of the identified currents were modulated by changes in intracellular calcium concentration. This data, together with the immunolabeling, demonstrated the presence of bestrophin-1, cystic fibrosis transmembrane regulator (CFTR) and ClC-2 channels in hESC-derived RPE thus indicating their capability to mimic native Cl⁻ physiology.

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Combining finger and toe photoplethysmograms for the detection of atherosclerosis

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Comparison of linear and non-linear heart rate variability indices between preterm infants at their theoretical term age and full term newborns

Heart rate variability (HRV) enables non-invasive evaluation of cardiac autonomic activity. Preterm infants are known to have altered HRV characteristics that remain even when reaching their term age. Little is known about non-linear HRV measures between full term and preterm babies close to their theoretical full term. In this study, we calculated sample entropy, shape-describing parameters (skewness and kurtosis) and detrended fluctuation analysis coefficients $\alpha_1$ and $\alpha_2$ from RR time series of 16 very preterm babies (37 weeks, "FT group") infants. Compared to the FT group, smaller values of sample entropy and lower values of $\alpha_1$ were found in the PT group. No difference in $\alpha_2$, kurtosis, or skewness was found. This indicates decrease in overall complexity of HR dynamics in the PT group. When various HRV indices, that included also non-linear indices, were projected to the principal component analysis space obtained from the FT group, a good separation between the PT and FT groups was found. The study was limited by a small sample but the results were in line with literature. The combinations of several HRV parameters can be of interest for future studies on the degree of ANS maturity.

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Connectivity analysis of full montage EEG in traumatic brain injury patients in the ICU

Long-term full montage (19 channels) electroencephalographic (EEG) recordings of 6 patients, treated in the Intensive Care Unit (ICU) for severe Traumatic Brain Injury (TBI), were analyzed using the methodology of connectivity analysis. Two connectivity measures, Coherence and Cross Frequency Coupling (CFC) were calculated for each pair of channels in two frequency bands, 8−13 Hz and 13−35 Hz. In the case of CFC, frequencies below 2 Hz were considered as the modulating rhythm. The ability of the measures to indicate the outcome of treatment was evaluated using the Mann-Whitney U-test. The results indicate that CFC values tend to be higher in good outcome patients for (modulating) frontal EEG channels. For the Coherence measure, U-statistic values close to 0.9 were obtained for some channel pairs, however, no clear pattern could be observed.

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Day-to-day repeatability of the results of the finger-toe-plot analysis

Non-invasive arterial pulse wave (PW) measurement provides valuable information on the vascular health. The aim of the study is to characterize the between-visit or day-to-day repeatability of combined finger and toe photoplethysmographic (PPG) signal analysis method called finger-toe plot (FT-plot) and compare it with the repeatability of other methods proposed for vascular characterization. Ten 22–36-year-old subjects were examined on 3 different days in order to find out the day-to-day repeatability of the results. The repeatability of the extracted parameters was analyzed by means of intra-class correlation coefficients (ICC) and free-marginal multirater κ agreement. ICCs varied widely from below 0.2 to almost 0.9, but κ coefficients higher than 0.7 were achieved for most of the results. Based on the presented results, the FT-plot analysis has at least sufficient day-to-day repeatability. However, further studies with real patients and different stages of cardiovascular diseases are required for confirming the findings.
Detection and assessment of sleep-disordered breathing with emfit mattress

Measuring respiratory effort during sleep is a demanding job. It needs intrathoracic pressure monitoring via nostril inserted catheter in the esophagus. Though the size and material of catheter are nowadays more comfortable than earlier, it is still quite invasive and cumbersome technique, and it does not suit for clinical use. It is known that mattress-type contactless sensors can be used to detect respiratory movements and overall cross-body movements. Beating heart produces mechanical activity called ballistocardiography (BCG), which can be assessed with Emfit (Electromechanical film transducer) mattress sensor too. These heart-related movements with increased breathing effort cause patterns called spiking in the mattress signal. We have studied esophageal pressure changes during this spiking and showed that this phenomenon appears when intrathoracic pressure decreases under -8 cmH2O. These increased breathing efforts quite often appeared together with loud snoring. That is why we have also studied the spectral content of Emfit signal using the power spectral density (PSD). Snoring epochs displayed a power increase in all frequency bands. This increase was best quantified using the power ratio between 60–100 Hz (BW3) and 16–30 Hz (BW2). We have shown that this type of contactless sensors suits well for the screening of snoring, and the increased respiratory effort was visualized too. Mattress-type movement sensors are inexpensive and unobtrusive, and thus provide an interesting tool for sleep research.
Electric field of eeg during anesthesia

Electroencephalogram (EEG) has been clinically used to estimate the level of consciousness during anesthesia, but its physiology and biophysics are poorly understood in anesthesiological literature. The electrical sources of EEG are in cortical structures. EEG currents create closed-loops, which flow from the surface of the cortex and then return to the inside of the hemispheres. In the case of widespread synchronous activity like physiological sleep or anesthesia, the currents return through the base of brain and skull. Here we show with a typical EEG pattern of anesthesia, burst-suppression, that due to those currents EEG is recordable outside of scalp area. We also present the sensitivity field of electrodes located submentally, as well as the electrodes used for anesthesia monitoring, calculated from a realistic head model of the potential distribution and currents of EEG. Our results show that anesthesia EEG can be recorded with a pair of electrodes anywhere on the surface of head, as well as inside of head and brain, because the EEG current loops produce recordable voltage gradients in the whole head. A pair of electrodes submentally is most sensitive to basal parts of the brain. The typical electrodes used in anesthesia monitoring are most sensitive to basal surface of frontal lobes as well as frontal and mesial parts of temporal lobes.
Tampere, Finland, in June 2017.

The proceedings present all traditional biomedical engineering areas, but also highlight new emerging fields, such as tissue engineering, bioinformatics, biosensing, neurotechnology, additive manufacturing technologies for medicine and biology, and bioimaging, to name a few. Moreover, it emphasizes the role of education, translational research, and commercialization.

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**Evaluating different shapes of cranial fixation mini-plates using finite element method**
Medical grade 3D printing offers the possibility to manufacture patient-specific implants to treat cranial defects. The performance of the implant assembly depends on many factors, such as material, thickness, size and manufacturing accuracy. A significant factor in the stability and success of the assembly is the fixation method. Cranial implants are usually fixed to the skull by means of mini-plates. Biomechanical assessment of fixing the implant to the skull might be helpful not only for mini-plate design but might be beneficial also for the surgeons. In this study, four different mini-plate designs were analyzed and compared based on the stress-strain analysis of one cranial implant fixed at three locations by mini-plates. Computational simulations were done using Finite Element Method.

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Evaluation of the accuracy and reliability for photoplethysmography based heart rate and beat-to-beat detection during daily activities

With the advances in sensor technology and the emergence of new sensor systems, it is important to assess the accuracy of these devices. In this paper, we describe an evaluation study for two wrist-worn devices, namely PulseOn (PO) and Empatica E4 (E4), measuring photoplethysmography – based heart rate (PPG HR) and inter-beat intervals (IBIs). The accuracy and reliability of PPG HR and beat-to-beat detection are evaluated with respect to electrocardiography (ECG) – based HR and IBIs during different daily activities, such as sitting, standing, household work and cycling. The evaluation study employed data from twenty male subjects. The absolute difference of PPG and ECG HR was less than 10 bpm for 90-99% and 81-97% of time for PO and E4, respectively. The accuracy and reliability of the devices were decreased during household work due to the excess hand movements. On average, the mean absolute error in HR was 2.5 bpm higher in PO and 3.7 bpm higher in E4 during household work than during sitting. The percentage of correctly detected heartbeats was 89% for PO and 68% for E4 during sitting but 76% for PO and only 9% for E4 during household work. PO showed better beat-to-beat detection accuracy than E4 in all activities. The errors in heart rate variability measure (HRV) of root mean square of successive inter-beat interval differences were 3.5±3.9 ms for PO and 10.2±6.7 ms for E4 during sitting, but 18.0±10.9 ms for PO and 48.7±21.8 ms for E4 during cycling. As a conclusion, PPG – based wrist-worn devices are accurate and reliable for HR and beat-to-beat detection when the amount of hand movements is not excess but HRV can be estimated from PPG IBI data reliably only during resting conditions. Moreover, there were significant differences in accuracy between different devices.


Recent developments in live-cell microscopy imaging have led to the emergence of Single Cell Biology. This field has also been supported by the development of cell segmentation and tracking algorithms for data extraction. The validation of these algorithms requires benchmark databases, with manually labeled or artificially generated images, so that the ground truth is known. To generate realistic artificial images, we have developed a simulation platform capable of generating biologically inspired objects with various shapes and size, which are able to grow, divide, move and form specific clusters. Using this platform, we compared four tracking algorithms: Simple Nearest-Neighbor (NN), NN with Morphology (NNm) and two DBSCAN-based methodologies. We show that Simple NN performs well on objects with small velocities, while the
others perform better for higher velocities and when objects form clusters. This platform for benchmark images generation and image analysis algorithms testing is openly available at (http://griduni.uninova.pt/Clustergen/ClusterGen_v1.0.zip).

**Human activity recognition using a single optical heart rate monitoring wristband equipped with triaxial accelerometer**

This paper investigates activity monitoring using a single wrist-worn optical heart rate monitoring sensor that is equipped with a triaxial accelerometer. Wearing accelerometers on the wrist provides more convenience and therefore improved wear-time compliance compared to other measurement sites. Reliability of wrist acceleration for activity monitoring has been addressed in former research. However, integration of wrist acceleration with physiological signals has not been comprehensively explored yet. We investigated a variety of home-specific activities (sitting, standing, household, and stationary cycling) performed by 20 male participants. Random Forest (RF) and Support Vector Machines (SVM) were applied for activity classification. Various features calculated from acceleration, heart rate (HR), and heart rate variability (HRV) were used as classified inputs. Results of leave-one-subject-out cross-validation showed 89.2% and 85.6% average recognition accuracies for RF and SVM, respectively. HR and HRV features improved the classification rates of high-intensity cycling by 8% for RF and 7% for SVM.
Influence of exercise history on fall-induced hip fracture risk.

Hip fracture is a major public health problem. Thin superolateral cortex of the femoral neck experiences unusually high stress in a sideway fall, contributing to hip fracture risk. The aim of this study is to examine how exercise based loading history, known to affect the femoral neck cortical structure, influences fall-induced fracture risk. For this purpose, finite element models were created from the proximal femur MRI of 91 young athletic and 20 control females. Fall-induced superolateral cortical safety factors (SF) were estimated in the distal volume of femoral neck. Significantly higher (p < 0.05) SFs were observed from femoral necks with high impact (H-I), odd impact (O-I), and repetitive impact (R-I) exercise history, indicating lower fracture risk. The results indicate that it is advisable to include some impact exercise in a fracture preventive exercise program.
Modeling neuron-astrocyte interactions: towards understanding synaptic plasticity and learning in the brain

Spiking neural networks represent a third generation of artificial neural networks and are inspired by computational principles of neurons and synapses in the brain. In addition to neuronal mechanisms, astrocytic signaling can influence information transmission, plasticity and learning in the brain. In this study, we developed a new computational model to better understand the dynamics of mechanisms that lead to changes in information processing between a postsynaptic neuron and an astrocyte. We used a classical stimulation protocol of long-term plasticity to test the model functionality. The long-term goal of our work is to develop extended synapse models including neuron-astrocyte interactions to address plasticity and learning in cortical synapses. Our modeling studies will advance the development of novel learning algorithms to be used in the extended synapse models and spiking neural networks. The novel algorithms can provide a basis for artificial intelligence systems that can emulate the functionality of mammalian brain.

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**Nocturnal use of light compression garments and recovery**

The aim of the study was to investigate nocturnal effect of wearing whole-body light compression garments on post-exercise recovery. HRV analysis was used to evaluate the recovery. The study involved sixteen female Finnish baseball players for four three-day-periods. The participants wore light compression garments every other three-day period and kept record of daily events. The analyzed period was 4 hours starting from the moment subjects fell asleep. The HRV analysis was performed for the time domain, frequency domain and nonlinear measurements. There were no statistical differences in HRV parameters between nights when subjects used or did not use light compression garments. This indicates that whole-body light compression garments had no benefits on the post-exercise recovery during the night.

**Nonlinear dynamics of heart rate variability in children with asthmatic symptoms**

Asthma is a chronic lung disease that is prone to start during childhood. Although symptoms can be usually controlled with medication, early diagnosis is crucial to reduce the risk of permanent airway obstruction. Despite the fact that origin of asthma is still uncertain, abnormal parasympathetic nervous system (PNS) activity has been pointed out to play a major role in its pathogenesis. In this work the use of nonlinear heart rate variability (HRV) indexes is proposed in order to look for differences between children classified as high- or low-risk of suffering from asthma in the future. PNS activity is assessed trough a filtered HRV signal. Correlation dimension analysis showed statistically significant differences distinguishing high-and low-risk. Decreased complexity observed in high-risk group suggests that abnormal PNS activity might be related with increased risk of developing asthma.
Nonlinear local projection filter for impedance pneumography

The ability of impedance pneumography (IP) for recording tidal flow during long periods of free breathing make it a promising tool for assessing temporal complexity of respiration. However, techniques quantifying complexity may be sensitive to the noise in the IP signal resulting from the current processing method. A nonlinear local projection filter (NLPF) is presented as the solution to the current linear processing method, failing to reduce noise without distorting the flow signal. Current and proposed NLPF methods were applied to and existing data set of raw IP recorded in 21 infants during a methacholine challenge test. Methods’ performance was compared in a battery of test using mouth flow as a reference. NLPF achieved lower sample-by-sample error, and higher frequency attenuation, while linearity with mouth flow was maintained. Therefore, we concluded that NLPF superiorly reduces noise without distorting respiratory information.
Optical projection tomography imaging of single cells in 3D gellan gum hydrogel

3D cell culturing has become attractive in biology and tissue engineering laboratories as it mimics the natural environment for the cells to grow, differentiate and interact in all directions. To study cells and cellular interactions within 3D, cell culture requires a non-invasive, non-toxic, and high resolution imaging technique. The existing imaging techniques face challenges to image cells in 3D macro-scale environment because of the sample size, photo-bleaching or resolution requirements. Optical projection tomography (OPT) is a non-invasive 3D imaging technique for samples in the range of 1-10 mm. It works in both emission and transmission modes for fluorescence and bright-field imaging, respectively. Here, we demonstrate the use of OPT for imaging of cells and cellular materials in 3D gellan gum hydrogel. Fluorescence projection images showed alive and dead human lung fibroblast cells encapsulated in hydrogel. The mineralized extracellular matrix secreted by the human adipose stem cells in the hydrogel was evenly distributed throughout the sample and analyzable in 3D volume.

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Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Computational Biophysics and Imaging Group, Research group: Biomaterials and Tissue Engineering Group, BioMediTech, International Iberian Nanotechnology Laboratory
Authors: Belay, B., Koivisto, J. T., Vuornos, K., Montonen, T., Koskela, O., Lehti-Polojärvi, M., Miettinen, S., Kellomäki, M., Figueiras, E., Hyttinen, J.
Number of pages: 4
Pages: 996-999
Publication date: 2017

Optimization of $^{99m}$Tc-sestamibi/$^{123}$I subtraction SPECT/CT protocol for parathyroid scintigraphy

The purpose of this study was to optimize effective, but technically challenging $^{99m}$Tc-sestamibi/$^{123}$I subtraction SPECT/CT protocol for parathyroid scintigraphy. An anthropomorphic parathyroid phantom was set up using a small sphere, a thyroid phantom and a thorax phantom with clinical range of activities of $^{123}$I and $^{99m}$Tc. SPECT/CT acquisitions were performed using three collimators (Low Energy High Resolution (LEHR), Low Energy Ultra High Resolution (LEUHR) and Medium Energy Low Penetration (MELP)) and two energy window settings. Images were reconstructed with a combination of four different numbers of iterations and with or without scatter correction. Images were subjected to visual and quantitative evaluation. The effect of collimator, energy window selection and reconstruction parameters had a significant effect on visual appearance and adenoma contrast in parathyroid $^{99m}$Tc-sestamibi/$^{123}$I subtraction SPECT/CT. Symmetrical energy windows and ultra-high resolution collimator yielded best results with some improvement with scatter correction.

General information
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Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Quantitative medical imaging, Satakunta Central Hospital, Helsinki University Central Hospital, Department of Radiology, Tampere University Hospital
Authors: Tunninen, V., Kauppinen, T., Eskola, H.
Phenotypic variability in LQT3 human induced pluripotent stem cell-derived cardiomyocytes and their response to antiarrhythmic pharmacologic therapy: An in silico approach

Background: Human induced pluripotent stem cell-derived cardiomyocytes (hiPSC-CMs) are in vitro models with the clear advantages of their human origin and suitability for human disease investigations. However, limitations include their incomplete characterization and variability reported in different cell lines and laboratories. Objective: The purpose of this study was to investigate in silico ionic mechanisms potentially explaining the phenotypic variability of hiPSC-CMs in long QT syndrome type 3 (LQT3) and their response to antiarrhythmic drugs. Methods: Populations of in silico hiPSC-CM models were constructed and calibrated for control (n = 1,463 models) and LQT3 caused by INaL channelopathy (n = 1,401 models), using experimental recordings for late sodium current (INaL) and action potentials (APs). Antiarrhythmic drug therapy was evaluated by simulating mexiletine and ranolazine multichannel effects. Results: As in experiments, LQT3 hiPSC-CMs yield prolonged action potential duration at 90% repolarization (APD90) (+34.3% than controls) and large electrophysiological variability. LQT3 hiPSC-CMs with symptomatic APs showed overexpression of ICaL, IK1, and INaL, underexpression of IKr, and increased sensitivity to both drugs compared to asymptomatic LQT3 models. Simulations showed that both mexiletine and ranolazine corrected APD prolongation in the LQT3 population but also highlighted differences in drug response. Mexiletine stops spontaneous APs in more LQT3 hiPSC-CMs models than ranolazine (784/1,401 vs 53/1,401) due to its stronger action on INaL. Conclusion: In silico simulations demonstrate our ability to recapitulate variability in LQT3 and control hiPSC-CM phenotypes, and the ability of mexiletine and ranolazine to reduce APD prolongation, in agreement with experiments. The in silico models also identify potential ionic mechanisms of phenotypic variability in LQT3 hiPSC-CMs, explaining APD prolongation in symptomatic vs asymptomatic LQT3 hiPSC-CMs.
Physical characteristics of collimators for dual-isotope imaging with $^{99m}\text{Tc}$ and $^{123I}$

The purpose of this study was to compare the physical characteristics of Low Energy High Resolution (LEHR), Low Energy Ultra High Resolution (LEUHR) and Medium Energy Low Penetration (MELP) collimators for simultaneous $^{99m}\text{Tc}$ and $^{123I}$ imaging. MELP collimator performed well with $^{123I}$ high-energy gamma photons, but low resolution makes it unsuitable to use for acquisition of small structures such as parathyroid adenomas. LEUHR collimators optimized for $^{99m}\text{Tc}$ have highest resolution, but the differences in septal penetration and sensitivity in favor of LEHR collimator needs to be tested with specific parathyroid phantoms.

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Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Quantitative medical imaging, Satakunta Central Hospital, Helsinki University Central Hospital, Department of Radiology, Tampere University Hospital
Authors: Tunninen, V., Kauppinen, T., Eskola, H.
Number of pages: 5
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Keywords: I, Tc, Collimator, Dual-isotope, SPECT/CT
DOIs: 10.1007/978-981-10-5122-7_62

Bibliographical note
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jufoid=58152
Source: Scopus
Source-ID: 85021729569
Research output: Scientific - peer-review › Conference contribution
Reproducibility and Comparability of Computational Models for Astrocyte Calcium Excitability

The scientific community across all disciplines faces the same challenges of ensuring accessibility, reproducibility, and efficient comparability of scientific results. Computational neuroscience is a rapidly developing field, where reproducibility and comparability of research results have gained increasing interest over the past years. As the number of computational models of brain functions is increasing, we chose to address reproducibility using four previously published computational models of astrocyte excitability as an example. Although not conventionally taken into account when modeling neuronal systems, astrocytes have been shown to take part in a variety of in vitro and in vivo phenomena including synaptic transmission. Two of the selected astrocyte models describe spontaneous calcium excitability, and the other two neurotransmitter-evoked calcium excitability. We specifically addressed how well the original simulation results can be reproduced with a reimplementation of the models. Additionally, we studied how well the selected models can be reused and whether they are comparable in other stimulation conditions and research settings. Unexpectedly, we found out that three of the model publications did not give all the necessary information required to reimplement the models. In addition, we were able to reproduce the original results of only one of the models completely based on the information given in the original publications and in the errata. We actually found errors in the equations provided by two of the model publications; after modifying the equations accordingly, the original results were reproduced more accurately. Even though the selected models were developed to describe the same biological event, namely astrocyte calcium excitability, the models behaved quite differently compared to one another. Our findings on a specific set of published astrocyte models stress the importance of proper validation of the models against experimental wet-lab data from astrocytes as well as the careful review process of models. A variety of aspects of model development could be improved, including the presentation of models in publications and databases. Specifically, all necessary mathematical equations, as well as parameter values, initial values of variables, and stimuli used should be given precisely for successful reproduction of scientific results.
present results, the FT-plot based detection of atherosclerotic changes has at least equal repeatability compared with a current clinical standard, ankle-to-brachial pressure index. However, further studies should validate the findings before the method is ready for the screening of atherosclerotic changes.

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Keywords: Atherosclerosis, Photoplethysmography
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Source: Scopus
Source-ID: 85021722258
Research output: Scientific - peer-review › Conference contribution

Spinal cord injury induces widespread chronic changes in cerebral white matter
Traumatic spinal cord injuries (SCIs) lead to axonal damage at the trauma site, as well as disconnections within the central nervous system. While the exact mechanisms of the long-term pathophysiological consequences of SCIs are not fully understood, it is known that neuronal damage and degeneration are not limited to the direct proximity of the trauma. Instead, the effects can be detected even in the cerebrum. We examined SCI-induced chronic brain changes with a case-control design using 32 patients and 70 control subjects. Whole-brain white matter (WM) tracts were assessed with diffusion tensor imaging (DTI). In addition, we analysed associations between DTI metrics and several clinical SCI variables. Whole-brain analyses were executed by tract-based spatial statistics (TBSS), with an additional complementary atlas-based analysis (ABA). We observed widespread, statistically significant (P≤0.01) changes similar to neural degeneration in SCI patients, both in the corticospinal tract (CST) and beyond. In addition, associations between DTI metrics and time since injury were found with TBSS and ABA, implying possible long-term post-injury neural regeneration. Using the ABA approach, we observed a correlation between SCI severity and DTI metrics, indicating a decrease in WM integrity along with patient sensory or motor scores. Our results suggest a widespread neurodegenerative effect of SCI within the cerebrum that is not limited to the motor pathways. Furthermore, DTI-measured WM integrity of chronic SCI patients seemed to improve as time elapsed since injury.

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Organisations: Faculty of Biomedical Sciences and Engineering, Research group: Quantitative medical imaging, BioMediTech
Authors: Ilvesmäki, T., Koskinen, E., Brander, A., Luoto, T., Öhman, J., Eskola, H.
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Peer-reviewed: Yes

Publication information
Journal: Human Brain Mapping
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Texture-property relations of bioamine crosslinked gellan gum hydrogels

Gellan gum is a hydrogel with potential for soft tissue engineering but a quick and thorough method is needed for screening of different possible compositions for more extensive studies. Here optical projection tomography in bright field mode was used to image nearly transparent hydrogels to record their optical texture in 3D. The gained Haralick's textural features were then analyzed with multiple discriminant analysis and combined with data from mechanical testing and neuronal cell culturing. We show the usefulness of optical texture analysis in screening of hydrogel compositions when aiming for tissue engineering applications.
Time characteristics of prolonged partial obstruction periods using an Emfit mattress

Prolonged partial obstruction (PPO) is a sleep disordered breathing (SDB) characterized by increased respiratory efforts for extended periods of time. In this research, we analyzed the time characteristics differences of the Emfit (Electromechanical film transducer) signal between PPO and normal breathing (NB) periods. An experienced neurophysiologist selected ten-minute periods of PPO and NB from a sample of 10 patients suffering from PPO using the esophageal pressure as a Gold reference. Time features were extracted to study the differences between the two types of breathing. Statistical differences of a set of time-related features were assessed with Mann-Whitney U–test. The individual diagnostic performance was determined using receiver operating characteristics (ROC) analysis. Additionally, the diagnostic performance of a subset of features was evaluated using a support vector machine (SVM) classifier. In the evaluation, average results over ten-fold Monte Carlo cross-validation with 80% training and 20% testing splits were reported. Sixteen features reached statistical significance. The classifier achieved sensitivity and specificity of 85±12%, 87±14%, respectively.

Twelve years follow-up of ballistocardiography

The purpose of this work is to study the effect of long term alterations of ballistocardiography during 12 years time recorded in sitting position by using EMFi (Electromechanical Film) sensors. ECG, BCG, ankle pulse signal and carotid pulse (CP) signal from the neck near the carotid artery were recorded from a single person and duration of the signal components according to R spike of the ECG and amplitudes of the signals were studied. The time domain properties of BCG, CP and ankle pulse signals at different times (time interval around 1 year during 12 years time) remained rather stable within the same person. The BCGs signal stability endured during 12 years time showing that no major changes happened in the condition of the heart-vasculature system.
Measurement of tidal breathing flows in infants using impedance pneumography

Tidal breathing flow volume (TBFV) profiles have been used to characterise altered lung function. Impedance pneumography (IP) is a novel option for assessing TBFV curves noninvasively. The aim of this study was to extend the application of IP for infants and to estimate the agreement between IP and direct pneumotachograph (PNT) measurements in assessing tidal airflow and flow-derived indices.

Tidal flow profiles were recorded for 1 min simultaneously with PNT and uncalibrated IP at baseline in 44 symptomatic infants, and after methacholine-induced bronchoconstriction in a subgroup (n=20).

The agreement expressed as the mean deviation from linearity ranged between 3.9 and 4.3% of tidal peak inspiratory flow, but was associated with specific airway conductance (p=0.002) and maximal flow at functional residual capacity (V′maxFRC) (p=0.004) at baseline. Acute bronchoconstriction induced by methacholine did not significantly affect the agreement of IP with PNT. TBFV indices derived from IP were slightly underestimated compared to PNT, but were equally well repeatable and associated with baseline V′maxFRC (p=0.012 and p=0.013, respectively).

TBFV profiles were consistent between IP and PNT in most infants, but the agreement was affected by reduced lung function. TBFV parameters were not interchangeable between IP and PNT, but had a similar association with lung function in infants.

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Peer-reviewed: Yes

Publication information
Journal: European Respiratory Journal
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Issue number: 6
ISSN (Print): 0903-1936
Printed, skin-mounted hybrid system for ECG measurements

In this paper we report a design and fabrication process for a screen printed, skin-mounted hybrid system for electrocardiogram (ECG) measurements. The system consists of printed electrodes on a stretchable bandage substrate designed to be attached to the chest, an electronics module, and a data receiving device. The electronics unit is reversibly attached to the single-use electrode bandage to measure the ECG data. The ECG data is then transmitted to a mobile device via Bluetooth Low Energy and the mobile device then displays the data graphically and sends it further to a cloud for storing and further analysis. The attained quality of the measured ECG signals is fully satisfactory to compute important cardiac parameters and after preprocessing the signal could be used for more profound analysis of ECG wave shapes.

General information

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Organisations: Department of Electronics and Communications Engineering, Research group: Laboratory for Future Electronics, Department of Automation Science and Engineering, Research area: Microsystems, Research area: Measurement Technology and Process Control, Electronics and Communications Engineering
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Bibliographical note

INT=ase,"Jeyhani, Vala"
INT=elt,"Kankkunen, Timo"
Source: Bibtex
Source-ID: urn:800dbeeb66a4405ab77658eb807825ec
Research output: Scientific - peer-review › Conference contribution
**Inner ear barriers to nanomedicine-augmented drug delivery and imaging**

Abstract There are several challenges to inner ear drug delivery and imaging due to the existence of tight biological barriers to the target structure and the dense bone surrounding it. Advances in imaging and nanomedicine may provide knowledge for overcoming the existing limitations to both the diagnosis and treatment of inner ear diseases. Novel techniques have improved the efficacy of drug delivery and targeting to the inner ear, as well as the quality and accuracy of imaging this structure. In this review, we will describe the pathways and biological barriers of the inner ear regarding drug delivery, the beneficial applications and limitations of the imaging techniques available for inner ear research, the behavior of engineered nanomaterials in inner ear applications, and future perspectives for nanomedicine-based inner ear imaging.

**General information**

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Organisations: Department of Electronics and Communications Engineering, Research group: Computational Biophysics and Imaging Group, BioMediTech

Authors: Zou, J., Pyykkö, I., Hyttinen, J.

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**Publication information**

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Source: RIS

Source-ID: urn:F6EE718E196C2AB62B345F71AD1DB12D

Research output: Scientific - peer-review › Article

**Suppressing Functional Electrical Stimulation Artifact from Facial Surface EMG Measurements**

Methods for suppressing the electrical artifact that functional electrical stimulation introduces to surface electromyography (EMG) measurements are demonstrated. The methods are targeted for facial pacing for people who suffer from unilateral facial paralysis. The pacing includes the measurement of EMG signals from the healthy side of the face as a control signal to simultaneously activate the paralysed side with functional electrical stimulation.

Facial EMG signals typically have amplitudes up to a few hundreds of microvolts. The activation of facial muscles with functional electrical stimulation may require stimulation voltages that are more than $10^6$ times larger. When electrical stimulation is fed to the paralysed one side of the face, the introduced voltage will also couple to the EMG measurements on the healthy side. This coupling is called the stimulation artifact. In the worst case, the EMG measurement inputs will saturate leaving it impossible to correctly detect facial muscle activations and their activation intensities. Additionally, the stimulation artifact may be erroneously detected as a muscle activation.

The presented methods for suppressing the stimulation artifact from EMG measurements include filtering implemented in the hardware and software, manipulating the stimulation waveform to help removing it with filtering, and sample-and-hold functionality implemented in the hardware of the EMG signal measurement chain to prevent amplifier saturation and to allow faster recovery from the artifacts. The methods are demonstrated with experimental results.

**General information**

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Authors: Rantanen, V., Vehkaoja, A., Verho, J.

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Keywords: electromyography, facial pacing, functional electrical stimulation, prosthetic technology, stimulation artifact, unilateral facial paralysis

Research output: Scientific › Paper, poster or abstract

**Bioimpedance measurement system for evaluation of the status of wound healing**

Hard-to-heal wounds are usually evaluated visually by a medical professional. Visual inspection as a method is subjective and in order to evaluate the wound the dressings have to be removed. Our group has developed a wound patch, a
bioimpedance device and a PC software for mapping the wound area and to evaluate the status of wound healing. This study introduces the patch and the measurement system. We also present the test measurement results obtained using an early version of the wound patch. The results confirmed that the patch can be used for the evaluation of the wound status.

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Organisations: Department of Electronics and Communications Engineering, Research group: Personal Electronics Group, Research group: Physiological Measurement Systems and Methods Group, BioMediTech
Authors: Kekonen, A., Bergelin, M., Eriksson, J., Ylänen, H., Kielosto, S., Viik, J.
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Research output: Scientific - peer-review » Conference contribution

Electrically Stimulated Adipose Stem Cells on Polypyrrole-Coated Scaffolds for Smooth Muscle Tissue Engineering
We investigated the use of polypyrrole (PPy)-coated polymer scaffolds and electrical stimulation (ES) to differentiate adipose stem cells (ASCs) towards smooth muscle cells (SMCs). Since tissue engineering lacks robust and reusable 3D ES devices we developed a device that can deliver ES in a reliable, repeatable, and cost-efficient way in a 3D environment. Long pulse (1 ms) or short pulse (0.25 ms) biphasic electric current at a frequency of 10 Hz was applied to ASCs to study the effects of ES on ASC viability and differentiation towards SMCs on the PPy-coated scaffolds. PPy-coated scaffolds promoted proliferation and induced stronger calponin, myosin heavy chain (MHC) and smooth muscle actin (SMA) expression in ASCs compared to uncoated scaffolds. ES with 1 ms pulse width increased the number of viable cells by day 7 compared to controls and remained at similar levels to controls by day 14, whereas shorter pulses significantly decreased viability compared to the other groups. Both ES protocols supported smooth muscle expression markers. Our results indicate that electrical stimulation on PPy-coated scaffolds applied through the novel 3D ES device is a valid approach for vascular smooth muscle tissue engineering.

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Authors: Björninen, M., Gilmore, K., Pelto, J., Seppänen-Kajansinkko, R., Kellomäki, M., Miettinen, S., Wallace, G., Grijpma, D., Haimi, S.
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Scopus rating (2014): SJR 1.095 SNIP 1.521 CiteScore 3.29
Scopus rating (2013): SJR 1.257 SNIP 1.451 CiteScore 3.38
Scopus rating (2012): SJR 0.926 SNIP 1.242 CiteScore 2.77
Scopus rating (2011): SJR 0.863 SNIP 1.135 CiteScore 2.54
Scopus rating (2010): SJR 0.812 SNIP 1.266
In this paper we present measurements of the magnetic flux density in an office and three different welding environments. The measured values are compared with the thresholds set by the EU Directive 2013/35/EU. For the office environment, a magnetic field survey is presented at different heights with the electrical appliances operating in different modes. For the welding workshop, measurements were taken in the proximity to the welder during different welding practices. On comparing the magnetic flux density results for both environments with the low Action Levels stated in the EU Directive for occupational exposure, there is evidence that the measured values are below the safety threshold.

The aim of this study is to explore the capability of an Emfit (electromechanical film transducer) mattress to detect snoring (SN) by analyzing the spectral differences between normal breathing (NB) and SN. Episodes of representative NB and SN of a maximum of 10 min were visually selected for analysis from 33 subjects. To define the bands of interest, we studied the statistical differences in the power spectral density (PSD) between both breathing types. Three bands were selected for further analysis: 6-16 Hz (BW1), 16-30 Hz (BW2) and 60-100 Hz (BW3). We characterized the differences between NB and SN periods in these bands using a set of spectral features estimated from the PSD. We found that 15 out of the 29 features reached statistical significance with the Mann-Whitney U-test. Diagnostic properties for each feature were assessed using receiver operating characteristic analysis. According to our results, the highest diagnostic performance was achieved using the power ratio between BW2 and BW3 (0.85 area under the receiver operating curve, 80% sensitivity, 80% specificity and 80% accuracy). We found that there are significant differences in the defined bands between the NB and SN periods. A peak was found in BW3 for SN epochs, which was best detected using power ratios. Our work suggests that it is possible to detect snoring with an Emfit mattress. The mattress-type movement sensors are...
The relationship between recognition memory for emotion-laden words and white matter microstructure in normal older individuals

Functional neuroimaging studies have shown age-related differences in brain activation and connectivity patterns for emotional memory. Previous studies with middle-aged and older adults have reported associations between episodic memory and white matter (WM) microstructure obtained from diffusion tensor imaging, but such studies on emotional memory remain few. To our knowledge, this is the first study to explore associations between WM microstructure as measured by fractional anisotropy (FA) and recognition memory for intentionally encoded positive, negative, and emotionally neutral words using tract-based spatial statistics applied to diffusion tensor imaging images in an elderly sample (44 cognitively intact adults aged 50-79 years). The use of tract-based spatial statistics enables the identification of WM tracts important to emotional memory without a priori assumptions required for region-of-interest approaches that have been used in previous work. The behavioral analyses showed a positivity bias, that is, a preference for positive words, in recognition memory. No statistically significant associations emerged between FA and memory for negative or neutral words. Controlling for age and memory performance for negative and neutral words, recognition memory for positive words was negatively associated with FA in several projection, association, and commissural tracts in the left hemisphere. This likely reflects the complex interplay between the mnemonic positivity bias, structural WM integrity, and functional brain compensatory mechanisms in older age. Also, the unexpected directionality of the results indicates that the WM microstructural correlates of emotional memory show unique characteristics in normal older individuals.
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Organisations: BioMediTech, Department of Electronics and Communications Engineering
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Scopus rating (2015): SJR 0.811 SNIP 0.48 CiteScore 1.47
Scopus rating (2014): SJR 0.872 SNIP 0.508 CiteScore 1.6
Scopus rating (2013): SJR 0.912 SNIP 0.543 CiteScore 1.75
Scopus rating (2012): SJR 1.026 SNIP 0.579 CiteScore 1.84
Scopus rating (2011): SJR 1.081 SNIP 0.618 CiteScore 1.96
Scopus rating (2010): SJR 1.063 SNIP 0.614
Scopus rating (2009): SJR 1.2 SNIP 0.626
Scopus rating (2008): SJR 1.334 SNIP 0.718
Scopus rating (2007): SJR 1.308 SNIP 0.755
Scopus rating (2006): SJR 1.28 SNIP 0.742
Scopus rating (2005): SJR 1.276 SNIP 0.718
Scopus rating (2004): SJR 1.328 SNIP 0.834
Scopus rating (2003): SJR 1.419 SNIP 0.79
Scopus rating (2002): SJR 1.259 SNIP 0.681
Scopus rating (2001): SJR 1.308 SNIP 0.797
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ASJC Scopus subject areas: Neuroscience(all)
Keywords: diffusion tensor imaging, emotional memory, normal aging, white matter
DOIs:
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Source-ID: 84995801666
Research output: Scientific - peer-review › Article

Method and Apparatus for Treating Skin

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Organisations: Tampere University of Technology, Department of Electronics and Communications Engineering, TEKNOLOGIAN TUTKIMUSKESKUS VTT OY, Åbo Akademi
Authors: Tuurala, S., Vaari, A., Bergelin, M., Eriksson, J., Kekonen, A., Ylönen, H.
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Textural Features in Medical Magnetic Resonance Image Analysis of the Brain and Thigh Muscles

Magnetic resonance imaging (MRI) provides high-quality images with excellent contrast detail of soft tissues and anatomic structures. MR images contain a large amount of detailed information – some of which is invisible to the human eye. Detailed information can be analysed with computer-assisted texture analysis (TA), which is based on features describing the grey level relationships between image pixels.

The aim of this thesis was to assess the information content of textural features based on the image histogram, grey level co-occurrence matrix, and grey level run-length matrix. The strengths and limitations of the various textural features in medical MR image analysis were evaluated. The study was conducted by analysing different clinical data with TA in the clinical environment, and the results of the learning process were then gathered in this thesis.

Our results indicated that all features have limitations in terms of their discrimination capacity in medical MR images and their dependence on the size of the region of interest and MR imaging parameters. By considering these limitations, TA may help in various MR imaging applications by revealing textural information of the images of various human organs.
MoE publication type: A1 Journal article-refereed
Organisations: Department of Pervasive Computing, Research area: Software engineering, Department of Electronics and Communications Engineering, Research group: Computational Biophysics and Imaging Group
Authors: Kapucu, F. E., Välkki, I., Mikkonen, J. E., Leone, C., Lenk, K., Tanskanen, J. M., Hyttinen, J. A.
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Scopus rating (2013): SJR 1.409 SNIP 0.819 CiteScore 2.07
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Scopus rating (2011): SJR 1.476 SNIP 0.688 CiteScore 3
Scopus rating (2010): SJR 1.728 SNIP 0.863
Scopus rating (2009): SJR 1.331 SNIP 0.43
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Spectral Entropy Based Neuronal Network Synchronization Analysis Based on Microelectrode Array Measurements

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Research output: Scientific - peer-review › Article

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**Understanding the role of astrocytic GABA in simulated neural networks**

Astrocytes actively influence the behavior of the surrounding neuronal network including changes of the synaptic plasticity and neuronal excitability. These dynamics are altered in diseases like Alzheimer's, where the release of the gliotransmitter GABA is increased by affected, so called reactive astrocytes. In this paper, we aim to simulate a neural network with altered astrocytic GABA release. Therefore, we use our developed neuron-astrocyte model, called INEXA, which includes astrocyte controlled tripartite synapses and the astrocyte-astrocyte interaction. Our results show that GABA released by astrocytes may be responsible for synchronous inhibition of postsynaptic neurons. With increased GABA inhibition, the spike and burst rate decreased while the burst duration and spikes per burst remain similar. To our knowledge, it is the first time that the effect of this gliotransmitter to the neural network was simulated.

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**General information**

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Organisations: BioMediTech, Department of Electronics and Communications Engineering, Research group: Computational Biophysics and Imaging Group
Authors: Lenk, K., Räisänen, E., Hyttinen, J. A. K.
Pages: 6121-6124
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**Ensembles of dense and dense sampling descriptors for the HEp-2 cells classification problem**

The classification of Human Epithelial (HEp-2) cells images, acquired through Indirect Immunofluorescence (IIF) microscopy, is an effective method to identify staining patterns in patient sera. Indeed it can be used for diagnostic purposes, in order to reveal autoimmune diseases. However, the automated classification of IIF HEp-2 cell patterns
represents a challenging task, due to the large intra-class and the small inter-class variability. Consequently, recent HEP-2 cell classification contests have greatly spurred the development of new IIF image classification systems. Here we propose an approach for the automatic classification of IIF HEP-2 cell images by fusion of several texture descriptors by ensemble of support vector machines combined by sum rule. Its effectiveness is evaluated using the HEP-2 cells dataset used for the “Performance Evaluation of Indirect Immunofluorescence Image Analysis Systems” contest, hosted by the International Conference on Pattern Recognition in 2014: the accuracy on the testing set is 79.85%. The same dataset was used to test an ensemble of ternary-encoded local phase quantization descriptors, built by perturbation approaches: the accuracy on the training set is 84.16%. Finally, this ensemble was validated on 14 additional datasets, obtaining the best performance on 11 datasets. Our MATLAB code is available at https://www.dei.unipd.it/node/2357.

Increased survival rate by local release of diclofenac in a murine model of recurrent oral carcinoma
Despite aggressive treatment with radiation and combination chemotherapy following tumor resection, the 5-year survival rate for patients with head and neck cancer is at best only 50%. In this study, we examined the therapeutic potential of localized release of diclofenac from electrospun nanofibers generated from poly(3-lactide-co-glycolide) polymer. Diclofenac was chosen since anti-inflammatory agents that inhibit cyclooxygenase have shown great potential in their ability to directly inhibit tumor growth as well as suppress inflammation-mediated tumor growth. A mouse resection model...
of oral carcinoma was developed by establishing tumor growth in the oral cavity by ultrasound-guided injection of 1 million SCC-9 cells in the floor of the mouth. Following resection, mice were allocated into four groups with the following treatment: 1) no treatment, 2) implanted scaffolds without diclofenac, 3) implanted scaffolds loaded with diclofenac, and 4) diclofenac given orally. Small animal ultrasound and magnetic resonance imaging were utilized for longitudinal determination of tumor recurrence. At the end of 7 weeks following tumor resection, 33% of mice with diclofenac-loaded scaffolds had a recurrent tumor, in comparison to 90%-100% of the mice in the other three groups. At this time point, mice with diclofenac-releasing scaffolds showed 89% survival rate, while the other groups showed survival rates of 10%-25%. Immunohistochemical staining of recurrent tumors revealed a near 10-fold decrease in the proliferation marker Ki-67 in the tumors derived from mice with diclofenac-releasing scaffolds. In summary, the local application of diclofenac in an orthotopic mouse tumor resection model of oral cancer reduced tumor recurrence with significant improvement in survival over a 7-week study period following tumor resection. Local drug release of anti-inflammatory agents should be investigated as a therapeutic option in the prevention of tumor recurrence in oral squamous carcinoma.

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Scopus rating (2012): SJR 1.039 SNIP 1.589 CiteScore 3.85
Scopus rating (2011): SJR 1.193 SNIP 1.111 CiteScore 3.96
Scopus rating (2010): SJR 1.428 SNIP 1.557
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Scopus rating (2008): SJR 0.568 SNIP 0.631
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Research output: Scientific - peer-review › Article

Exposure to biological and chemical agents at biomass power plants
The increasing use and production of bioenergy means that the number of employees working in this area will inevitably grow, making it ever more important to know the health and safety issues involved in the biomass supply chain. Our aim was to determine the exposure of employees to biological and chemical agents during various work tasks at different biomass-fuelled power plants in Finland. The study included technical surveys on biomass operations and occupational measurements at three CHP plants. Workers' main health risks were bacteria and fungi, which were easily spread to the air during heavy biomass processes. The exposure levels of actinobacteria, bacterial endotoxins and fungi were high, especially during the unloading of peat and wood chips. In addition, workers were exposed to mechanical irritation caused by organic dust, and chemical irritation caused by volatile organic compounds and components of diesel exhausts.
Multiple exposures to these agents may simultaneously have synergistic health effects on workers' lower and upper respiratory tracts. During operations, workers were also exposed to endotoxins, actinobacteria and fungi, especially during the cleaning and handling of wood chips in silos and while working near screens or crushers. The measured concentrations exceeded the limit values proposed for these agents. The highest concentration of volatile organic compounds was found near conveyors. On the basis of these measurements, we suggested best practices for the power plants. The levels of biological agents in outdoor measurements reflected only low spreading of contaminants from power plants to the environment.

**General information**

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Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, Työterveyslaitos, VTT Technical Research Centre of Finland, Finnish Institute of Occupational Health, University of Eastern Finland

Authors: Laitinen, S., Laitinen, J., Fagernäs, L., Korpijärvi, K., Korpinen, L., Ojanen, K., Atamila, M., Jumpponen, M., Koponen, H., Jokiniemi, J.

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**Whole-body Electric Bioimpedance Measurement in the Evaluation of Vascular Function**

Background: Two pathologies affecting the arterial wall, atherosclerosis and arterial stiffening, are strong predictors of cardiovascular diseases and mortality. The identification of these at the sub-clinical, asymptomatic stages is potentially
useful for the prevention of cardiovascular risk. Arterial stiffness can be evaluated locally by measuring carotid artery elasticity or segmentally by measuring pulse wave velocity (PWV), and of these two methods, PWV is considered the gold standard for assessing arterial stiffness. Whole-body impedance cardiography (ICGWB) has previously been shown to be a fast and operator-independent method to measure PWV, but the lack of reference values has limited its use in clinical practice. Moreover, the applicability of the ICGWB method in measuring PWV in large-scale epidemiological studies has not been tested previously.

Carotid artery intima-media thickness (IMT) and brachial artery flow-mediated dilation (FMD) are well-known non-invasive markers of early atherosclerosis. Although the pathophysiology of atherosclerosis involves many features similar to arterial stiffness, whether IMT and FMD reflect similar or different aspects of vascular damage in comparison to PWV is not known. In addition, PWV and indices of carotid artery elasticity are often used interchangeably, but the relationship between these has received little interest to date.

Aims: The objective of the present study was to establish reference values for PWV as measured by ICGWB and gain more insight into the association of PWV with the markers of sub-clinical atherosclerosis (IMT, FMD) and local arterial elasticity. In addition, the aim of the current study was to study the applicability of the ICGWB method for measuring PWV in an epidemiological study. Furthermore, the objective of the present study was to develop a new integrated cardiovascular parameter reflecting several aspects of the cardiovascular system—i.e. arterial stiffness, arterial wall structure and cardiac pump function.

Subjects and Methods: The study population was combined from three distinct studies: 455 subjects from the Health 2000 Survey (supplemental study), 1872 subjects from the Cardiovascular Risk in Young Finns Study and 87 subjects from the Tampere Ambulatory Blood Pressure Study. Pulse wave velocity, stroke volume and systemic vascular resistance were measured from all subjects using the commercially available ICGWB monitor (CircMon™). Indices of carotid artery elasticity and carotid artery IMT were measured by ultrasound in the Health 2000 Survey (supplemental study) and the Cardiovascular Risk in Young Finns Study. Moreover, brachial FMD was measured by ultrasound in the Cardiovascular Risk in Young Finns Study.

Results: In subjects aged 46–76 years, IMT was directly and independently associated with PWV, but in younger subjects, IMT and PWV were not independently correlated. Carotid artery distensibility was inversely and independently associated with PWV, whereas FMD and PWV were not independently related. Metabolic syndrome and several other cardiovascular risk factors were found to associate with increased PWV, a finding which is in line with previous epidemiological studies using different methods to measure PWV.

The present thesis introduces and evaluates a new ICGWB-based hemodynamic parameter known as arterial tension time (ATT), which is defined as the time difference between the stroke-volume-introduced arterial distension and maximal integrated arterial distension. Decreased ATT was associated with increased arterial stiffness, increased subclinical atherosclerosis and decreased stroke volume. The current study also reports reference values for PWV measured by ICGWB for males and females in different age groups with no evidence of cardiovascular disease and a low burden of risk factors.

Conclusion: The present study has four main findings. Firstly, the current study establishes reference values for ICGWB-based PWV in an adult Finnish population. Reference values can be useful in the clinical management of patients in future studies. Secondly, PWV was not found to associate with IMT or FMD in young adults, but in older individuals, PWV and IMT were directly and independently correlated. Therefore, the current findings suggest that PWV may reflect a different aspect of vascular damage than FMD or IMT in young adults, whereas in older adults, the information provided by PWV and IMT may be, to some extent, similar. The present findings encourage the use of a combination of complementary non-invasive methods to evaluate arterial wall alterations, particularly in young adults. Thirdly, ICGWB provides a convenient and reliable tool for evaluating arterial stiffness in epidemiological studies. Fourthly, ATT developed in this study could potentially include information on several aspects of cardiovascular structure and function, and possibly serve as a new integrated parameter of cardiovascular health.
Simulation of developing human neuronal cell networks

Background: Microelectrode array (MEA) is a widely used technique to study for example the functional properties of neuronal networks derived from human embryonic stem cells (hESC-NN). With hESC-NN, we can investigate the earliest developmental stages of neuronal network formation in the human brain. Methods: In this paper, we propose an in silico model of maturing hESC-NNs based on a phenomenological model called INEX. We focus on simulations of the development of bursts in hESC-NNs, which are the main feature of neuronal activation patterns. The model was developed with data from developing hESC-NN recordings on MEAs which showed increase in the neuronal activity during the investigated six measurement time points in the experimental and simulated data. Results: Our simulations suggest that the maturation process of hESC-NN, resulting in the formation of bursts, can be explained by the development of synapses. Moreover, spike and burst rate both decreased at the last measurement time point suggesting a pruning of
synapses as the weak ones are removed. Conclusions: To conclude, our model reflects the assumption that the interaction between excitatory and inhibitory neurons during the maturation of a neuronal network and the spontaneous emergence of bursts are due to increased connectivity caused by the forming of new synapses.

**Automatic objective thresholding to detect neuronal action potentials**

In this paper, we introduce a fully objective method to set thresholds (THs) for neuronal action potential spike detection from extracellular field potential signals. Although several more sophisticated methods exist, thresholding is still the most used spike detection method. In general, it is employed by setting a TH as per convention or operator decision, and without considering either the undetected or spurious spikes. Here, we demonstrate with both simulations and real microelectrode measurement data that our method can fully automatically and objectively yield THs comparable to those set by an expert operator. A Matlab function implementation of the method is described, and provided freely in Matlab Central File Exchange.
Detection of spine structures with Bioimpedance Probe (BIP) Needle in clinical lumbar punctures

Lumbar puncture is a relatively safe procedure, but some serious, even fatal, complications can occur. Needle guidance can increase puncture accuracy, decrease the number of attempts, and make the procedure easier. We tested the feasibility of a bioimpedance-based tissue-sensing technology for needle guidance in clinical use. The Bioimpedance Probe (BIP) Needle has a removable BIP styllet enabling measurement of bioimpedance spectra during the procedure. The BIP Needle is connected to a measurement device that uses tissue-classification software, and the device provides audiovisual feedback when it detects cerebrospinal fluid (CSF). We performed spinal anesthesia with the BIP Needle in 45 patients. The device performance and needle tip location were verified by an experienced anesthesiologist confirming CSF leakage. The device detected CSF in all cases (sensitivity of 100 %). Six cases with false detections lowered the specificity to 81 %, but in practice, most of these were easy to differentiate from true detections because their duration was short and they occurred during backward movement of the needle. The epidural spectrum differentiated as fatty tissue from surrounding tissues, but the ligamentum flavum was not clearly detectable in the data. The BIP Needle is a reliable tool for detecting CSF in lumbar puncture. It can make the puncture procedure smoother, as repeated CSF flow tests are avoided. The correct needle tip location is immediately detected, thus unnecessary needle movements close to spinal nerves are prevented. Physicians could benefit from the information provided by the BIP Needle, especially in patients with obesity or anatomic alterations.
A survey on the feasibility of surface EMG in facial pacing

A survey on the feasibility of surface electromyography (EMG) measurements in facial pacing is presented. Pacing for unilateral facial paralysis consists of the measurement of activity from the healthy side of the face and functional electrical stimulation to reanimate the paralyzed one. The goal of this study is to evaluate the feasibility of surface EMG as a measurement method to detect muscle activations and to determine their intensities. Prior work is discussed, and results from experiments where 12 participants carried out a set of facial movements are presented. EMG was registered from zygomaticus major (smile), orbicularis oris (lip pucker), orbicularis oculi (eye blink), corrugator supercilii (frown), and masseter (chew). Most important facial functions that are limited due to the paralysis are blinking, smiling, and puckering. With majority of the participants, crosstalk between the measured EMG channels was found to be acceptably small to be able to pace smiling and puckering based on detecting their contraction intensities from the healthy side. However, pacing blinking based on orbicularis oculi EMG measurement does not seem possible due to crosstalk from other muscles, but the electro-oculographic (EOG) signals that couple to the same measurement channel could help to detect eye blinks and trigger stimuli. Furthermore, masseter greatly disturbs EMG measurement of most facial muscles, which needs to be addressed in the pacing system to avoid falsely interpreting its activity as the activity of another muscle.

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Authors: Rantanen, V., Ilves, M., Vehkaoja, A., Kontunen, A., Lylykangas, J., Mäkelä, E., Rautiainen, M., Surakka, V., Lekkala, J.
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Links:
Research output: Scientific - peer-review » Conference contribution
Combating Unilateral Facial Paralysis With Low-Latency Muscle Reanimation

The Challenge:
Addressing unilateral facial paralysis by creating a measurement and control system for facial pacing, which measures facial movements from the healthy side of the face and uses functional electrical stimulation to simultaneously reanimate the paralysed side.

The Solution:
Using myRIO combined with custom electronics to measure multiple channels of surface EMG, process the acquired signals, and produce stimulation waveforms to activate facial muscles with the low-latency and reliability required for this novel medical system.

General information
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Authors: Rantanen, V., Verho, J., Vehkaoja, A., Veselý, P.
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Research output: Scientific › Digital or Visual Products

Improved antifouling properties and selective biofunctionalization of stainless steel by employing heterobifunctional silane-polyethylene glycol overlayers and avidin-biotin technology

A straightforward solution-based method to modify the biofunctionality of stainless steel (SS) using heterobifunctional silane-polyethylene glycol (silane-PEG) overlayers is reported. Reduced nonspecific biofouling of both proteins and bacteria onto SS and further selective biofunctionalization of the modified surface were achieved. According to photoelectron spectroscopy analyses, the silane-PEGs formed less than 10 Å thick overlayers with close to 90% surface coverage and reproducible chemical compositions. Consequently, the surfaces also became more hydrophilic, and the observed non-specific biofouling of proteins was reduced by approximately 70%. In addition, the attachment of E. coli was reduced by more than 65%. Moreover, the potential of the overlayer to be further modified was demonstrated by successfully coupling biotinylated alkaline phosphatase (bAP) to a silane-PEG-biotin overlayer via avidin-biotin bridges. The activity of the immobilized enzyme was shown to be well preserved without compromising the achieved antifouling properties. Overall, the simple solution-based approach enables the tailoring of SS to enhance its activity for biomedical and biotechnological applications.

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Honeycomb porous films as permeable scaffold materials for human embryonic stem cell-derived retinal pigment epithelium

Age-related macular degeneration (AMD) is a leading cause of blindness in developed countries, characterised by the degeneration of the retinal pigment epithelium (RPE), a pigmented cell monolayer that closely interacts with the photoreceptors. RPE transplantation is thus considered a very promising therapeutic option to treat this disease. In this work, porous honeycomb-like films are for the first time investigated as scaffold materials for human embryonic stem cell-derived retinal pigment epithelium (hESC-RPE). By changing the conditions during film preparation, it was possible to produce films with homogeneous pore distribution and adequate pore size (3-5 μm), that is large enough to ensure high permeability but small enough to enable cell adherence and spreading. A brief dip-coating procedure with collagen type IV enabled the homogeneous adsorption of the protein to the walls and bottom of pores, increasing the hydrophilicity of the surface. hESC-RPE adhered and proliferated on all the collagen-coated materials, regardless of small differences in pore size. The differentiation of hESC-RPE was confirmed by the detection of specific RPE protein markers. These results suggest that the porous honeycomb films can be promising candidates for hESC-RPE tissue engineering, importantly enabling the free flow of ions and molecules across the material.
protein receptor kinase (Grk1) and subsequent binding of arrestin 1 (Arr1). Meta II exists in equilibrium with the more stable inactive form of rhodopsin, Meta III. Dark adaptation of rods requires the complete thermal decay of Meta II/Meta III into opsin and all-trans retinal and the subsequent regeneration of rhodopsin with 11-cis retinal chromophore. In this study, we examine the regulation of Meta III decay by Grk1 and Arr1 in intact mouse rods and their effect on rod dark adaptation. We measure the rates of Meta III decay in isolated retinas of wild-type (WT), Grk1-deficient (Grk1(-/-)), Arr1-deficient (Arr1(-/-)), and Arr1-overexpressing (Arr1(ox)) mice. We find that in WT mouse rods, Meta III peaks similar to 6 min after rhodopsin activation and decays with a time constant (tau) of 17 min. Meta III decay slows in Arr1(-/-) rods (tau of similar to 27 min), whereas it accelerates in Arr1(ox) rods (tau of similar to 8 min) and Grk1(-/-) rods (tau of similar to 13 min). In all cases, regeneration of rhodopsin with exogenous 11-cis retinal is rate limited by the decay of Meta III. Notably, the kinetics of rod dark adaptation in vivo is also modulated by the levels of Arr1 and Grk1. We conclude that, in addition to their well-established roles in Meta II inactivation, Grk1 and Arr1 can modulate the kinetics of Meta III decay and rod dark adaptation in vivo.

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Scopus rating (2013): SJR 2.873 SNIP 1.352 CiteScore 3.19
Scopus rating (2012): SJR 2.65 SNIP 1.111 CiteScore 3.35
Scopus rating (2011): SJR 2.376 SNIP 1.11 CiteScore 2.81
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Scopus rating (2006): SJR 3.956 SNIP 1.29
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Scopus rating (2004): SJR 3.646 SNIP 1.261
Scopus rating (2003): SJR 3.615 SNIP 1.25
Scopus rating (2002): SJR 4.228 SNIP 1.418
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Scopus rating (2000): SJR 4.025 SNIP 1.442
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Research output: Scientific - peer-review › Article
Effect of rhodopsin phosphorylation on dark adaptation in mouse rods

Rhodopsin is a prototypical G-protein-coupled receptor (GPCR) that is activated when its 11-cis-retinal moiety is photoisomerized to all-trans retinal. This step initiates a cascade of reactions by which rods signal changes in light intensity. Like other GPCRs, rhodopsin is deactivated through receptor phosphorylation and arrestin binding. Full recovery of receptor sensitivity is then achieved when rhodopsin is regenerated through a series of steps that return the receptor to its ground state. Here, we show that dephosphorylation of the opsin moiety of rhodopsin is an extremely slow but requisite step in the restoration of the visual pigment to its ground state. We make use of a novel observation: isolated mouse retinae kept in standard media for routine physiologic recordings display blunted dephosphorylation of rhodopsin for up to 4 h in darkness, even under conditions when rhodopsin was completely regenerated. Isoelectric focusing followed by Western blot analysis of bleached isolated retinae showed little dephosphorylation of rhodopsin for up to 4 h in darkness, even under conditions when rhodopsin was completely regenerated. Microspectrophotometric determinations of rhodopsin spectra show that regenerated phospho-rhodopsin has the same molecular photosensitivity as unphosphorylated rhodopsin and that flash responses measured by trans-retinal electroretinogram or single-cell suction electrode recording displayed dark-adapted kinetics. Single quantal responses displayed normal dark-adapted kinetics, but rods were only half as sensitive as those containing exclusively unphosphorylated rhodopsin. We propose a model in which light-exposed retinae contain a mixed population of phosphorylated and unphosphorylated rhodopsin. Moreover, complete dark adaptation can only occur when all rhodopsin has been dephosphorylated, a process that requires >3 h in complete darkness.

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**In vivo single-molecule dynamics of transcription of the viral T7 Phi 10 promoter in Escherichia coli**

We study the dynamics of transcription initiation of the T7 Phi 10 promoter as a function of temperature, using quantitative polymerase chain reaction (qPCR) and in vivo single-cell, single-ribonucleic acid (RNA) time-lapse microscopy. First, from the mean and squared coefficient of variation of the empirical distribution of intervals between consecutive RNA appearances in individual cells, we find that both the mean rate and noise in RNA production increase with temperature (from 20 °C to 43 °C). Next, the process is shown to be sub-Poissonian in all conditions, suggesting the existence of more than one rate-limiting step and absence of a significant ON-OFF mechanism. Next, from the kinetics of RNA production for varying amounts of T7 RNA polymerases, we find that as temperature increases, the fraction of time that the T7 RNA polymerase spends in open complex formation increases relative to the time to commit to closed complex formation, due to changes in the kinetics of open complex, closed complex, and reversibility of the closed complex formation. We conclude that the initiation kinetics of the T7 Phi 10 promoter changes with temperature due to changes in the kinetics of its rate-limiting steps.

**Using a synthetic probe to study the robustness of the segregation process of protein aggregates in Escherichia coli**

Even though the processes of protein production and folding are not immune to errors, Escherichia coli lineages are capable to maintain a stable cell lineage, provided viable environmental conditions. One of the internal processes that makes this possible consists of segregating unwanted protein aggregates to the cell poles by nucleoid exclusion, which, combined with cell divisions, generates asymmetries in the aging process of the population, with some individuals aging faster while others exhibit rejuvenation. A recent study showed that this process is not immune to sub-optimal temperature conditions due to increased cytoplasm viscosity, which weakens the anisotropy in aggregate displacements at the nucleoid borders. This was made possible by the usage of a synthetic fluorescent probe, consisting of a RNA sequence with multiple binding sites for the MS2-GFP synthetic protein, which can be tracked in time-lapse microscopy images. Here we provide a description of the findings from these measurements and investigate with an In Silico model the consequences in the context of cell lineages.

**Titanium Nitride Microelectrodes Deposited by Ion Beam Assisted E-beam Evaporation**

An alternative method for fabricating titanium nitride (TiN) microelectrodes is presented. In order to decrease the impedance and noise levels of microelectrodes, one of the most common methods is to coat the electrodes with TiN. Usually that has required the use of a sputtering device, but we have demonstrated that also an e-beam coater can be
used for TiN deposition, if equipped with an ion source. Our first 30 µm microelectrodes fabricated by ion beam assisted deposition (IBAD) have impedances around 75 kΩ, which is close to the impedances reported for sputter deposited TiN microelectrodes.

**Supervised method for cell counting from bright field focus stacks**

We present a novel method for cell counting using bright field focus stacks. Our method is based on the use of supervised learning and out-of-focus appearance of cells. Logistic regression was used for classification with intensity values of 25 focal planes as features. Binary erosion with a large circular structuring element was applied as post-processing step. With this simple method we obtained mean F-score of 0.87 for cell counting with 12 test images, including images of extremely dense populations. The most important features were obtained from out-of-focus images. Thus, we conclude that using several focal planes provides valuable intensity information for cell counting from bright field microscopy.

**Tidal flow variability measured by impedance pneumography relates to childhood asthma risk**

Lung function variability is a fundamental feature of asthma but has been difficult to quantify in children due to methodological limitations. We assessed the feasibility and clinical implications of overnight flow variability measurement at home using impedance pneumography in young children. 44 children aged 3-7 years with recurrent or persistent lower airway symptoms were recruited. Patients were divided into high- or lower-risk groups (HR and LR groups) based on their risk of asthma (modified Asthma Predictive Index), and a third group was formed of children who had a history of wheeze and who were treated with inhaled corticosteroids (ICS group). Tidal volume and the derived flow were recorded through skin electrodes using impedance pneumography at home during sleep. Quantities describing overnight change in expiratory flow-volume minimum curve shape correlation (CSRmin) and respiratory chaoticity (minimum noise limit (NLmin)) were derived. Recordings were successful in 34 children. CSRmin differed between the HR and LR groups (p=0.002) and between the HR and ICS groups (p=0.003), indicating a stronger change in flow profile shape in the HR group. NLmin differed between the HR and LR groups (p=0.014), indicating momentarily lowered chaoticity in the HR group. Impedance pneumography was found feasible for quantifying nocturnal lung function variability and the measured variability was associated with risk of asthma in young children.
Differentiation of Diffuse Large B-cell Lymphoma From Follicular Lymphoma Using Texture Analysis on Conventional MR Images at 3.0 Tesla

Rational and Objectives: Diffuse large B-cell lymphoma (DLBCL) represents the most common type of aggressive non-Hodgkin lymphoma (NHL); follicular lymphoma (FL) is the most frequent indolent NHL. The aim of this study was to investigate whether texture-based analysis of conventional magnetic resonance imaging (MRI) allows discrimination of DLBCL from FL, and further, to correlate the MRI texture features with diffusion-weighted imaging apparent diffusion coefficient (ADC) value and tumor tissue cellularity. Materials and Methods: Forty-one patients with histologically proven NHL (30 DLBCL and 11 FL) underwent conventional MRI and diffusion-weighted imaging examination before treatment. Based on regions of interest, texture analysis was performed on T1-weighted images pre- and postcontrast enhancement and on T2-weighted images with and without fat suppression, and features derived from the run-length matrix- and co-occurrence matrix-based methods were analyzed. Receiver operating characteristic curves were performed for the three most discriminative texture features for the differentiation of the two most common types of lymphoma. The analyzed MRI texture features were correlated with the ADC value and the tumor tissue cellularity. Results: We found that on T1-weighted images postcontrast enhancement, run-length matrix-based texture analysis for lesion classification differentiated DLBCL from FL, with specificity and sensitivity of 76.6% and 76.5%, respectively. There was no correlation between the texture features and the ADC value or tumor tissue cellularity. Conclusions: DLBCL and FL can be differentiated by means of texture analysis on T1-weighted MRI postcontrast enhancement. These results could serve as a basis for the use of the texture features on conventional MRI as adjunct to clinical examination to distinguish DLBCL from FL.
Simple estimation of induced electric fields in nervous system tissues for human exposure to non-uniform electric fields at power frequency

Most results regarding induced current in the human body related to electric field dosimetry have been calculated under uniform field conditions. We have found in previous work that a contact current is a more suitable way to evaluate induced electric fields, even in the case of exposure to non-uniform fields. If the relationship between induced currents and external non-uniform fields can be understood, induced electric fields in nervous system tissues may be able to be estimated from measurements of ambient non-uniform fields. In the present paper, we numerically calculated the induced electric fields and currents in a human model by considering non-uniform fields based on distortion by a cubic conductor under an unperturbed electric field of 1 kV m$^{-1}$ at 60 Hz. We investigated the relationship between a non-uniform external electric field with no human present and the induced current through the neck, and the relationship between the current through the neck and the induced electric fields in nervous system tissues such as the brain, heart, and spinal cord. The results showed that the current through the neck can be formulated by means of an external electric field at the central position of the human head, and the distance between the conductor and the human model. As expected, there is a strong correlation between the current through the neck and the induced electric fields in the nervous system tissues. The combination of these relationships indicates that induced electric fields in these tissues can be estimated solely by measurements of the external field at a point and the distance from the conductor.
Optical Projection Tomography Technique for Image Texture and Mass Transport Studies in Hydrogels Based on Gellan Gum

The microstructure and permeability are crucial factors for the development of hydrogels for tissue engineering, since they influence cell nutrition, penetration, and proliferation. The currently available imaging methods able to characterize hydrogels have many limitations. They often require sample drying and other destructive processing, which can change hydrogel structure, or they have limited imaging penetration depth. In this work, we show for the first time an alternative nondestructive method, based on optical projection tomography (OPT) imaging, to characterize hydrated hydrogels without the need of sample processing. As proof of concept, we used gellan gum (GG) hydrogels obtained by several cross-linking methods. Transmission mode OPT was used to analyze image microtextures, and emission mode OPT to study mass transport. Differences in hydrogel structure related to different types of cross-linking and between modified and native GG were found through the acquired Haralicks image texture features followed by multiple discriminant
In mass transport studies, the mobility of FITC-dextran (MW 20, 150, 2000 kDa) was analyzed through the macroscopic hydrogel. The FITC-dextran velocities were found to be inversely proportional to the size of the dextran as expected. Furthermore, the threshold size in which the transport is affected by the hydrogel mesh was found to be 150 kDa (Stokes radii between 69 and 95 Å). On the other hand, the mass transport study allowed us to define an index of homogeneity to assess the cross-linking distribution, structure inside the hydrogel, and repeatability of hydrogel production. As a conclusion, we showed that the set of OPT imaging based material characterization methods presented here are useful for screening many characteristics of hydrogel compositions in relatively short time in an inexpensive manner, providing tools for improving the process of designing hydrogels for tissue engineering and drugs/cells delivery applications.

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The type of the functional cardiovascular response to upright posture is associated with arterial stiffness: a cross-sectional study in 470 volunteers

Background: In a cross-sectional study we examined whether the haemodynamic response to upright posture could be divided into different functional phenotypes, and whether the observed phenotypes were associated with known determinants of cardiovascular risk.
Methods: Volunteers (n = 470) without medication with cardiovascular effects were examined using radial pulse wave analysis, whole-body impedance cardiography, and heart rate variability analysis. Based on the passive head-up tilt induced changes in systemic vascular resistance and cardiac output, the principal determinants of blood pressure, a cluster analysis was performed.

Results: The haemodynamic response could be clustered into 3 categories: upright increase in vascular resistance and decrease in cardiac output were greatest in the first (+ 45 % and -27 %, respectively), smallest in the second (+ 2 % and -2 %, respectively), and intermediate (+ 22 % and -13 %, respectively) in the third group. These groups were named as 'constrictor' (n = 109), 'sustainer' (n = 222), and 'intermediate' (n = 139) phenotypes, respectively. The sustainers were characterized by male predominance, higher body mass index, blood pressure, and also by higher pulse wave velocity, an index of large arterial stiffness, than the other groups (p <0.01 for all). Heart rate variability analysis showed higher supine and upright low frequency/high frequency (LF/HF) ratio in the sustainers than constrictors, indicating increased sympathovagal balance. Upright LF/HF ratio was also higher in the sustainer than intermediate group. In multivariate analysis, independent explanatory factors for higher pulse wave velocity were the sustainer (p <0.022) and intermediate phenotypes (p <0.046), age (p <0.001), body mass index (p <0.001), and hypertension (p <0.001).

Conclusions: The response to upright posture could be clustered to 3 functional phenotypes. The sustainer phenotype, with smallest upright decrease in cardiac output and highest sympathovagal balance, was independently associated with increased large arterial stiffness. These results indicate an association of the functional haemodynamic phenotype with an acknowledged marker of cardiovascular risk.
Automatic detection of carotid arteries in computed tomography angiography: a proof of concept protocol

Atherosclerosis is one of the leading causes of mortality in the western world. Computed tomography angiography (CTA) is the conventional imaging method used for pre-surgery assessment of the blood flow within the carotid vessel. In this paper, we present a proof of concept of a novel, fast and operator independent protocol for the automatic detection (seeding) of the carotid arteries in CTA in the thorax and upper neck region. The dataset is composed of 14 patients' CTA images of the neck region. The performance of this method is compared with manual seeding by four trained operators. Inter-operator variation is also assessed based on the dataset. The minimum, average and maximum coefficient of variation among the operators was (0, 2, 5 %), respectively. The performance of our method is comparable with the state of the art alternative, presenting a detection rate of 75 and 71 % for the lowest and uppermost image levels, respectively. The mean processing time is 167 s per patient versus 386 s for manual seeding. There are no significant differences between the manual and automatic seed positions in the volumes (p=0.29). A fast, operator independent protocol was developed for the automatic detection of carotid arteries in CTA. The results are encouraging and provide the basis for the creation of automatic detection and analysis tools for carotid arteries.

Articular cartilage repair with recombinant human type II collagen/polylactide scaffold in a preliminary porcine study

The purpose of this study was to investigate the potential of a novel recombinant human type II collagen/polylactide scaffold (rhCo-PLA) in the repair of full-thickness cartilage lesions with autologous chondrocyte implantation technique (ACI). The forming repair tissue was compared to spontaneous healing (spontaneous) and repair with a commercial porcine type I/III collagen membrane (pCo). Domestic pigs (4-month-old, n = 20) were randomized into three study groups.
and a circular full-thickness chondral lesion with a diameter of 8 mm was created in the right medial femoral condyle. After 3 weeks, the chondral lesions were repaired with either rhCo-PLA or pCo together with autologous chondrocytes, or the lesion was only debrided and left untreated for spontaneous repair. The repair tissue was evaluated 4 months after the second operation. Hyaline cartilage formed most frequently in the rhCo-PLA treatment group. Biomechanically, there was a trend that both treatment groups resulted in better repair tissue than spontaneous healing. Adverse subchondral bone reactions developed less frequently in the spontaneous group (40%) and the rhCo-PLA treated group (50%) than in the pCo control group (100%). However, no statistically significant differences were found between the groups. The novel rhCo-PLA biomaterial showed promising results in this proof-of-concept study, but further studies will be needed in order to determine its effectiveness in articular cartilage repair.
Human induced pluripotent stem cells (hiPSCs) offer significant opportunities for cardiac research. With this technology, it is possible to create patient-specific stem cell lines and differentiate them into cardiomyocytes for cardiac research. hiPSC technology has created many expectations for new therapeutic possibilities, and it holds promise for use in drug-testing platforms and in patient-specific drug therapy optimization, as well as later in regenerative medicine.

Catecholaminergic polymorphic ventricular tachycardia (CPVT) is an inherited, highly lethal arrhythmogenic cardiac disorder. It is primarily caused by cardiac ryanodine receptor gene (RyR2) mutations that result in abnormal calcium release from the sarcoplasmic reticulum to the cytosol, leading to the generation of afterdepolarizations and triggered activity. The estimated clinical prevalence of CPVT is 1:10000. Intracellular calcium ions are crucial to the function of the heart muscle, and disturbances in this process can have fatal consequences, as observed in CPVT. Understanding the mechanisms of arrhythmia and the role of intracellular calcium in CPVT pathophysiology is important for improving disease prevention, diagnosis, and treatment.

The main objective of this work was to develop and characterize models of cardiac cells and to develop and improve techniques for studying electrical field stimulation and calcium cycling of cardiomyocytes. Utilizing electrical field stimulation, the orientation and maturation of neonatal rat cardiomyocytes and the increase in the beating rate of an in vitro disease model for CPVT were studied. For the cell model of CPVT, human iPSC-derived cardiomyocytes were obtained from CPVT patients carrying RyR2 mutations. These iPSCs disease models were used to study the disease mechanisms of CPVT, mutation-specific differences in intracellular calcium cycling and the effect of antiarrhythmic treatment of the cells. Mechanistic insights regarding CPVT arrhythmias and drug responses were also validated in the index patients. Additionally, a new calcium cycling analysis software tool was developed for characterizing abnormal intracellular calcium transients of disease-specific cardiomyocytes.

The results of this work demonstrate that patient-specific iPSC-derived cardiomyocytes corresponded to the clinical phenotype in both the pathophysiology and drug responses of CPVT and encourages the continuation of disease modeling utilizing iPSCs. These studies also presented a new mechanism for arrhythmias in CPVT. These findings encourage the translation of findings in basic research to benefit patients in clinical practice, e.g., in the form of potentially new medications.
An arrangement for facilitating wound healing, a method for measuring wound healing and a wound dressing

The present invention relates to the field of electrotherapy and measuring by means of electric currents for diagnostic purposes, and more particularly to an electrode arrangement for facilitating wound healing, a method for measuring wound healing and a wound dressing having an electrode arrangement. A wound dressing according to the present invention comprises at least two impedance reference electrodes, a frame like counter-electrode and stimulation electrodes in a form of an array; and a bioadhesive affinity layer surrounding the stimulation electrodes; said wound dressing being suited for applying on top of the wound so that the stimulation electrode array is on the wound area, and that the at least two impedance reference electrodes and the frame like counter-electrode are suited for placing in contact with the healthy skin surrounding the wound area; which electrodes, are suited for applying LIDC type electrical stimulation current to the wound area and for bioimpedance measurement. The wound dressing according to the present invention provide a continuous, non-invasive and objective solution for monitoring chronic wound healing without disturbing the delicate healing process.

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Fully-automated quantitative estimation of volumetric breast density from digital breast tomosynthesis images

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Arrangement for facilitating wound healing, a method for measuring wound healing and a wound dressing

The present invention relates to the field of electrotherapy and measuring by means of electric currents for diagnostic purposes, and more particularly to an electrode arrangement for facilitating wound healing, a method for measuring wound healing and a wound dressing having an electrode arrangement. A wound dressing according is described which includes at least two impedance reference electrodes, a frame like counter-electrode and stimulation electrodes in a form of an array; and a bioadhesive affinity layer surrounding the stimulation electrodes; said wound dressing being suited for applying on top of the wound so that the stimulation electrode array is on the wound area, and that the at least two impedance reference electrodes and the frame like counter-electrode are suited for placing in contact with the healthy skin surrounding the wound area; which electrodes, are suited for applying LIDC type electrical stimulation current to the wound area and for bioimpedance measurement. The wound dressing can provide a continuous, non-invasive and objective solution for monitoring chronic wound healing without disturbing the delicate healing process.

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Large scale study on the variation of RF energy absorption in the head & brain regions of adults and children and evaluation of the SAM phantom conservativeness

This paper presents the results of two computational large scale studies using highly realistic exposure scenarios, MRI based human head and hand models, and two mobile phone models. The objectives are (i) to study the relevance of age when people are exposed to RF by comparing adult and child heads and (ii) to analyze and discuss the conservativeness of the SAM phantom for all age groups. Representative use conditions were simulated using detailed CAD models of two mobile phones operating between 900 MHz and 1950 MHz including configurations with the hand holding the phone, which were not considered in most previous studies. The peak spatial-average specific absorption rate (psSAR) in the head and the pinna tissues is assessed using anatomically accurate head and hand models. The first of the two mentioned studies involved nine head-, four hand-and two phone-models, the second study included six head-, four hand- and three simplified phone-models (over 400 configurations in total). In addition, both studies also evaluated the exposure using the SAM phantom. Results show no systematic differences between psSAR induced in the adult and child heads. The exposure level and its variation for different age groups may be different for particular phones, but no correlation between psSAR and model age was found. The psSAR from all exposure conditions was compared to the corresponding configurations using SAM, which was found to be conservative in the large majority of cases.

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Biodegradable biliary stents have a different effect than covered metal stents on the expression of proteins associated with tissue healing in benign biliary strictures

Background Benign biliary strictures (BBS) are primarily treated endoscopically with covered self-expandable metal stents (CSEMS). Biodegradable biliary stents (BDBS) may be the future of endoscopic therapy of BBS. The aim was to assess the expression of proteins related to tissue healing in BBS compared with the intact bile duct (BD), and to study the protein expression after therapy with CSEMS or BDBS. Methods Pigs with ischemic BBS were endoscopically treated either with BDBS or CSEMS. Samples were harvested from pigs with intact BD (n=5), untreated BBS (n=5), and after six months of therapy with BDBS (n=4) or CSEMS (n=5) with subsequent histologic analysis. Two-dimensional electrophoresis with protein identification was performed to evaluate protein expression patterns. Results In BBS, the expression of galectin-2 and annexin-A4 decreased, compared to intact BD. Treatment with biodegradable stents normalized galectin-2 level; with CSEMS therapy it remained low. Transgelin expression of intact BD and BBS remained low after BDBS treatment but increased after CSEMS therapy. Histologic analysis did not show unwanted foreign body reaction or hyperplasia in the BD in either group. Conclusions The expression of proteins related to tissue healing in BBS is different after treatment with biodegradable stents and CSEMS. Treatment with biodegradable stents may bring protein expression towards what is seen in intact BD. BDBS seem to have a good biocompatibility.
Human Adipose Stem Cells Differentiated on Braided Polylactide Scaffolds is a Potential Approach for Tendon Tissue Engineering

Growing number of musculoskeletal defects increases the demand for engineered tendon. Our aim was to find an efficient strategy to produce tendon-like matrix in vitro. To allow efficient differentiation of human adipose stem cells (hASCs) toward tendon tissue, we tested different medium compositions, biomaterials, and scaffold structures in preliminary tests. This is the first study to report that medium supplementation with 50 ng/mL of growth and differentiation factor-5 (GDF-5) and 280 μM l-ascorbic acid are essential for tenogenic differentiation of hASCs. Tenogenic medium (TM) was shown to significantly enhance tendon-like matrix production of hASCs compared to other tested media groups. Cell adhesion, proliferation, and tenogenic differentiation of hASCs were supported on braided poly(l/d)lactide (PLA) 96l/4d copolymer filament scaffolds in TM condition compared to foamed poly(l-lactide-co-ε-caprolactone) (PLCL) 70L/30CL scaffolds. A uniform cell layer formed on braided PLA 96/4 scaffolds when hASCs were cultured in TM compared to maintenance medium (MM) condition after 14 days of culture. Furthermore, total collagen content and gene expression of tenogenic marker genes were significantly higher in TM condition after 2 weeks of culture. The elastic modulus of PLA 96/4 scaffold was more similar to the elastic modulus reported for native Achilles tendon. Our study showed that the optimized TM is needed for efficient and rapid in vitro tenogenic extracellular matrix production of hASCs. PLA 96/4 scaffolds together with TM significantly stimulated hASCs, thus demonstrating the potential clinical relevance of this novel and emerging approach to tendon injury treatments in the future.
Prosthetic Pacing Device for Unilateral Facial Paralysis

Facial pacing ultimately aims at improving the quality of life of people suffering from unilateral facial paralysis. A device to study facial pacing is presented. It is able to measure electromyography signals from the healthy side of the face and simultaneously activate the corresponding muscles on the paralyzed side with electrical stimulation. Tests with healthy participants are ongoing and clinical studies are to be started soon. Four measurement and four stimulation channels of the device enable studying different electrode configurations and stimulation patterns for recognizing and reanimating symmetrical facial expressions in the future. Preliminary testing with ten healthy volunteers showed average partial activation threshold of 2.50 mA (± 0.47 mA) and 3.00 mA (± 0.67 mA) for orbicularis oculi and orbicularis oris muscles, respectively, and full eye closure threshold of 4.45 mA (± 0.69 mA).

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Organisations: Department of Automation Science and Engineering, Research area: Microsystems, Research area: Measurement Technology and Process Control
Quantifying the effect of electric current on cell adhesion studied by single-cell force spectroscopy

This study presents the effect of external electric current on the cell adhesive and mechanical properties of the C2C12 mouse myoblast cell line. Changes in cell morphology, viability, cytoskeleton, and focal adhesion structure were studied by standard staining protocols, while single-cell force spectroscopy based on the fluidic force microscopy technology provided a rapid, serial quantification and detailed analysis of cell adhesion and its dynamics. The setup allowed measurements of adhesion forces up to the μN range, and total detachment distances over 40 μm. Force-distance curves have been fitted with a simple elastic model including a cell detachment protocol in order to estimate the Young's modulus of the cells, as well as to reveal changes in the dynamic properties as functions of the applied current dose. While the cell spreading area decreased monotonously with increasing current doses, small current doses resulted only in differences related to cell elasticity. Current doses above 11 As/m(2), however, initiated more drastic changes in cell morphology, viability, cellular structure, as well as in properties related to cell adhesion. The observed differences, eventually leading to cell death toward higher doses, might originate from both the decrease in pH and the generation of reactive oxygen species. (C) 2016 American Vacuum Society.
At cellular level, changes in the cardiac action potential (AP) duration (APD) are relevant proarrhythmic markers. The assessment of single current contributions to APD changes allows the investigation of the complex interplay of ionic mechanisms underlying such repolarization changes. In this paper, we present a new method to quantify the contributions of each membrane current to APD changes due to a perturbation from the basal to a different condition. To achieve our goal, we used a piecewise linear approximation of the AP. We tested our method on the O'Hara-Rudy model in case of rate adaptation: from the basal condition (pacing at 60 bpm), two different pacing rates are used as perturbations: 30 bpm, which prolongs APD by 21 ms, and 120 bpm, which shortens APD by -37 ms. At steady state, the most significant current contributions (30 bpm/120 bpm) are: INaK (68/-73 ms), ICaL (-58/51 ms), INaCa (-10/25 ms), IKs (13/-7 ms) and INaL (7/-23 ms). Our method allows also quantifying the dynamic adaptation to rate changes from the perturbation until the steady state. In conclusion, our method enables the quantification of the adaptive and compensatory mechanisms implemented by the (in silico model of) cell in response to a perturbation, such as the pacing rate change.

Texture descriptors ensembles enable image-based classification of maturation of human stem cell-derived retinal pigmented epithelium

Aims A fast, non-invasive and observer-independent method to analyze the homogeneity and maturity of human pluripotent stem cell (hPSC) derived retinal pigment epithelial (RPE) cells is warranted to assess the suitability of hPSC-RPE cells for implantation or in vitro use. The aim of this work was to develop and validate methods to create ensembles of state-off-the-art texture descriptors and to provide a robust classification tool to separate three different maturation stages of RPE cells by using phase contrast microscopy images. The same methods were also validated on a wide variety of biological image classification problems, such as histological or virus image classification. Methods For image classification we used different texture descriptors, descriptor ensembles and preprocessing techniques. Also, three new methods were tested. The first approach was an ensemble of preprocessing methods, to create an additional set of
images. The second was the region-based approach, where saliency detection and wavelet decomposition divide each image in two different regions, from which features were extracted through different descriptors. The third method was an ensemble of Binarized Statistical Image Features, based on different sizes and thresholds. A Support Vector Machine (SVM) was trained for each descriptor histogram and the set of SVMs combined by sum rule. The accuracy of the computer vision tool was verified in classifying the hPSC-RPE cell maturation level. Dataset and Results The RPE dataset contains 1862 subwindows from 195 phase contrast images. The final descriptor ensemble outperformed the most recent stand-alone texture descriptors, obtaining, for the RPE dataset, an area under ROC curve (AUC) of 86.49% with the 10-fold cross validation and 91.98% with the leave-one-image-out protocol. The generality of the three proposed approaches was ascertained with 10 more biological image datasets, obtaining an average AUC greater than 97%. Conclusions Here we showed that the developed ensembles of texture descriptors are able to classify the RPE cell maturation stage. Moreover, we proved that preprocessing and region-based decomposition improves many descriptors' accuracy in biological dataset classification. Finally, we built the first public dataset of stem cell-derived RPE cells, which is publicly available to the scientific community for classification studies.

General information
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Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Computational Biophysics and Imaging Group, Department of Information Engineering, Universita degli Studi di Padova, Italy, BioMediTech
Authors: Nanni, L., Paci, M., Dos Santos, F. L. C., Skottman, H., Juuti-Uusitalo, K., Hyttinen, J.
Publication date: 1 Feb 2016
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Scopus rating (2015): SJR 1.414 SNIP 1.131 CiteScore 3.32
Scopus rating (2014): SJR 1.545 SNIP 1.141 CiteScore 3.54
Scopus rating (2013): SJR 1.74 SNIP 1.147 CiteScore 3.94
Scopus rating (2012): SJR 1.945 SNIP 1.142 CiteScore 4.15
Scopus rating (2011): SJR 2.369 SNIP 1.23 CiteScore 4.58
Scopus rating (2010): SJR 2.631 SNIP 1.161
Scopus rating (2009): SJR 2.473 SNIP 0.985
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Scopus rating (2007): SJR 1.289 SNIP 0.525
Original language: English
ASJC Scopus subject areas: Agricultural and Biological Sciences(all), Biochemistry, Genetics and Molecular Biology(all), Medicine(all)
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Research output: Scientific - peer-review » Article

Recurrence network analysis of EEG signals: A Geometric Approach
Understanding the neuronal dynamics of dynamical diseases like epilepsy is of fundamental importance. For instance, establishing the presence of deterministic chaos can open up possibilities that can lead to potential medical applications, including timely prevention of seizures. Additionally, understanding the dynamics of interictal activity can greatly aid the localization of epileptic foci without the need for recording seizures. Recurrences, a fundamental property of dynamical systems, are useful for characterizing nonlinear systems. Recurrence networks, which are obtained by reinterpretting the recurrence matrix as an adjacency matrix of a complex network, are useful in characterizing the structural or geometric properties of the underlying system. Recurrence network analysis has established itself as a versatile tool in the field of nonlinear time series analysis and its applicability in investigating neural dynamics remains unexplored. Certain recurrence network measures are particularly sensitive to the presence of unstable periodic orbits (UPOs), which are important for
detecting determinism and are the backbone of chaotic attractors.

In this thesis, we introduce recurrence network analysis as a tool for nonlinear time series analysis of epileptic electroencephalographic (EEG) signals. We present novel results based on the application of recurrence network analysis combined with surrogate testing to intracranial and extracranial epileptic EEG signals. In addition, using paradigmatic examples of dynamical systems, we present theoretical results exploring the effect of increasing noise levels on recurrence network measures.

Using paradigmatic model systems, we first demonstrate that recurrence network measures can distinguish between deterministic (chaos) and stochastic processes, even at short data lengths (≈ 200 samples). In particular, our results from theoretical simulations show that recurrence network measures, particularly transitivity, local clustering coefficient, assortativity, and betweenness centrality can successfully distinguish between deterministic chaotic and stochastic processes (after additional embedding) due to their sensitivity to the presence of UPOs. Our results also show that recurrence network measures like transitivity and average path length are robust against noise and perform better than the Complexity-Entropy plane method at short data lengths. Furthermore, our results show that the effect of noise on the recurrence network measures can be minimized by increasing the recurrence rate.

For the analysis of real-world data such as EEG signals, we combined the recurrence network approach with surrogate data to test for the structural complexity in healthy and epileptic EEG signals. Here our results point to an increasing complexity of EEG recordings when moving from healthy to epileptic conditions. Furthermore, we used both univariate network measure and bivariate cross-network measure to distinguish between the structural properties of interictal EEG signals recorded from epileptic and nonepileptic brain areas. Here, our results clearly demonstrated that interictal EEG signals recorded from epileptic areas are more deterministic and interdependent compared to interictal activity recorded from nonepileptic areas. Finally, we show that recurrence network analysis can be applied to uncover the dynamical transitions in neural signals using short segments of data (≈ 150 to 500 samples). To demonstrate this, we used two kinds of neural data - epileptic EEG data and local field potential (LFP) signals recorded during a visuomotor task. We observed that the temporal fluctuations observed in the recurrence network measures are consistent with the dynamical transitions underlying the epileptic and task-based LFP signals.

To conclude, recurrence network analysis can capture the complexity in the organization of EEG data in different dynamical states in a more elaborated fashion compared to other approaches such as nonlinear prediction error or correlation dimension. By means of the recurrence network measures, this difference can be assessed not only qualitatively (as when using as tests for nonlinearity), but also quantitatively. Thus, coupled with its ability to operate on short-window sizes and robustness to noise, recurrence network analysis can be a powerful tool to analyze the dynamics of multi-scale neural signals.
Analysis of Ion Currents Contribution to Repolarization in Human Heart Failure Using Computer Models

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Computational Biophysics and Imaging Group, University of Bologna, Valencia Polytechnical University
Authors: Marotta, F., Paci, M., Severi, S., Trénor, B.
Publication date: 2016

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ISBN (Electronic): 978-84-9048-531-6
Research output: Scientific - peer-review › Conference contribution

Analyzing the feasibility of time correlated spectral entropy for the assessment of neuronal synchrony
In this paper, we study neuronal network analysis based on microelectrode measurements. We search for potential relations between time correlated changes in spectral distributions and synchrony for neuronal network activity. Spectral distribution is quantified by spectral entropy as a measure of uniformity/complexity and this measure is calculated as a function of time for the recorded neuronal signals, i.e., time variant spectral entropy. Time variant correlations in the spectral distributions between different parts of a neuronal network, i.e., of concurrent measurements via different microelectrodes, are calculated to express the relation with a single scalar. We demonstrate these relations with in vivo rat hippocampal recordings, and observe the time courses of the correlations between different regions of hippocampus in three sequential recordings. Additionally, we evaluate the results with a commonly employed causality analysis method to assess the possible correlated findings. Results show that time correlated spectral entropy reveals different levels of interrelations in neuronal networks, which can be interpreted as different levels of neuronal network synchrony.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Pervasive Computing, Department of Electronics and Communications Engineering, Research area: Software engineering, Research group: Computational Biophysics and Imaging Group
Authors: Kapucu, F. E., Mikkonen, J. E., Tanskanen, J. M., Hyttinen, J. A.
Publication date: 2016

Host publication information
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ISBN (Electronic): 978-1-4577-0220-4
DOIs: 10.1109/EMBC.2016.7591017
Research output: Scientific - peer-review › Conference contribution

A novel generic algorithm for robust physiological signal classification
The last decade has witnessed a significant interest in widespread usage of wearable monitoring devices that could provide continuous measurements of physiological parameters. The design and development of these devices has attracted lots of attention in industry and scientific associations. Advanced and miniaturized electronics with signal acquisition technologies provide a possibility for designing only one device for several physiological measurement purposes. Therefore for designing such an automatic system, a simple generic algorithm for physiological signal classification is required. In this paper, a novel generic algorithm for robust physiological signal classification is presented. The architecture of the proposed system includes preprocessing, feature extraction and a neural network method. Our generic algorithm was able to distinguish different physiological signals such as electrocardiogram (ECG), respiratory signal, seismocardiogram (SCG), electromyogram (EMG) and photoplethysmogram with 100% accuracy. The algorithm was also evaluated by noisy signals with 10 and 20 dB levels of added noise and the same results were achieved. The algorithm could be implemented in healthcare monitoring systems and it can provide the possibility of monitoring various physiological signals with only one device.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Physiological Measurement Systems and Methods Group
Authors: Mahdiani, S., Vanhala, J., Viik, J.
A Population of In Silico Models to Face the Variability of Human Induced Pluripotent Stem Cell-derived Cardiomyocytes: the hERG Block Case Study

Human induced pluripotent stem cell-derived cardiomyocytes (hiPSC-CMs) are characterized by an extreme variability, which cannot be reproduced by a single in-silico model. Here we present a population of hiPSC-CM models, calibrated using six different experimental datasets. By sampling the maximum conductances of 11 ionic currents, 10000 parameter sets were obtained. The experimental data-based calibration selected 1355 in silico models to be included in the final population. Such population reproduces the experimental data variability and it is used to assess the different responses to a 90% IKr block. Three different profiles emerged: models still normally beating (562), action potentials with EADs (336) and repolarization failures (457). The models still beating after 800 s since IKr block showed a mean APD90 of 723±12 ms. We observed significant differences among these three classes in the maximum conductances of ICaL, IKr, IKs, IK1, INaCa and INaK, supporting the idea that hiPSC-CM belonging to the same control population can however show dramatically different responses to an external perturbation, due to the physiological variability. This has to be taken in proper consideration in the perspective of using hiPSC-CMs for safety pharmacology assays.

A tool for geometrical measurements of orthognathic surgery changes using cone beam computed tomography

Cone Beam Computed Tomography has become quite popular in craniofacial imaging. Tools for analyzing the volumetric data however have not caught up with the recent industry demands. Most of the analysis in 3D is primarily based on techniques used in 2D format, thus adding some limitations to the post diagnostic capabilities of the imaging modality. We
have developed a technique to measure the geometry of the CBCT volumes and find the changes in the facial structures after the surgery, all in a technically non-intensive and reproducible way.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Research group: Quantative medical imaging, Medical Imaging Center, Tampere University Hospital
Authors: Prakash, M., Peltomäki, T., Eskola, H.
Number of pages: 4
Pages: 430-433
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Source: Scopus
Source-ID: 84968616757
Research output: Scientific - peer-review » Conference contribution

Determination of saturation, heart rate, and respiratory rate at forearm using a NellcorTM forehead SpO2-saturation sensor

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Scopus rating (2015): SJR 0.744 SNIP 0.932 CiteScore 1.56
Scopus rating (2014): SJR 0.704 SNIP 1.013 CiteScore 1.8
Scopus rating (2013): SJR 0.554 SNIP 0.867 CiteScore 1.33
Scopus rating (2012): SJR 0.445 SNIP 0.518 CiteScore 0.78
Scopus rating (2011): SJR 0.453 SNIP 0.812 CiteScore 1.23
Scopus rating (2010): SJR 0.382 SNIP 0.615
Scopus rating (2009): SJR 0.428 SNIP 0.743
Scopus rating (2008): SJR 0.297 SNIP 0.517
Scopus rating (2007): SJR 0.424 SNIP 0.79
Fluorimetric Oxygen Sensor for in Vitro Cell Models

A phase fluorimetric sensor targeted for the monitoring of dissolved oxygen concentration in microfluidic in vitro cell models is presented. The sensing surface of the sensor consists of oxygen sensitive fluorescent dyes (PtOEPK) embedded in a thin polystyrene film. The simulated fluorescence emission characteristics show highly anisotropic distribution, and an efficient optical read-out based on a parabolic lens is presented. Experimental results show that the applied sensing scheme allows one to use thin films (<500 nm), dilute dye-polymer ratios (0.025%), low power LED excitation (<1 mW), a simple phase locked photodiode read-out and yet achieve over 40 dB signal-to-noise ratio at 10 Hz data rate at physiologically relevant oxygen concentrations. These features are important in in vitro cell studies, as the potential cytotoxicity of the dyes and the sensing method (i.e. production of singlet oxygen) are reduced with low dye content and excitation power. In addition, thin and dilute polystyrene films are highly transparent and facilitate optical microscopy.
Impedance pneumography for ambulatory assessment of obstructive respiratory diseases
Obstructive respiratory diseases such as asthma feature time-variation in presence of symptoms. For example in asthma there is typically a decline in lung function during night. Due to methodological limitations of current lung function measurement methods this fundamental variation has been difficult to quantify, especially in young children and infants. In this chapter, a recently proposed wearable lung function assessment method based on impedance pneumography is presented. The physiological and technical theoretical background, and technical advancements and clinical studies are discussed. In light of current clinical information, the proposed solution may have clinical value for assessment of obstructive respiratory diseases, especially because it enables assessing lung function in a continuous real-life setting.

General information
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Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Electronics and Communications Engineering, Research group: Computational Biophysics and Imaging Group, Research group: Physiological Measurement Systems and Methods Group
Authors: Seppä, V., Hyttinen, J., Viik, J.
Pages: 45-62
Publication date: 2016

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Research output: Scientific - peer-review › Chapter

Increased Cardiac Workload in the Upright Posture in Men: Noninvasive Hemodynamics in Men Versus Women
Background Men and women differ in the risk of cardiovascular disease, but the underlying mechanisms are not completely understood. We examined possible sex-related differences in supine and upright cardiovascular regulation. Methods and Results Hemodynamics were recorded from 167 men and 167 women of matching age (≈45 years) and body mass index (≈26.5) during passive head-up tilt. None had diabetes mellitus or cardiovascular disease other than hypertension or used antihypertensive medication. Whole-body impedance cardiography, tonometric radial blood pressure, and heart rate variability were analyzed. Results were adjusted for height, smoking, alcohol intake, mean arterial pressure, plasma lipids, and glucose. Supine hemodynamic differences were minor: Men had lower heart rate (−4%) and higher stroke index (+7.5%) than women (P<0.05 for both). Upright systemic vascular resistance was lower (−10%), but stroke index (+15%), cardiac index (+16%), and left cardiac work were clearly higher (+20%) in men than in women (P<0.001 for all). Corresponding results were observed in a subgroup of men and postmenopausal women (n=76, aged >55 years). Heart rate variability analyses showed higher low:high frequency ratios in supine (P<0.001) and upright (P=0.003) positions in men. Conclusions The foremost difference in cardiovascular regulation between sexes was higher upright hemodynamic workload for the heart in men, a finding not explained by known cardiovascular risk factors or hormonal differences before menopause. Heart rate variability analyses indicated higher sympathovagal balance in men regardless of body position. The deviations in upright hemodynamics could play a role in the differences in cardiovascular risk between men and women.

General information
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Research output: Scientific - peer-review › Article

ISPA 2015: 9th International Symposium on Image and Signal Processing and Analysis

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DOIs:
10.1109/ISPA.2015.7306018

Bibliographical note
JUFOID=57665
Research output: Scientific - peer-review › Anthology

Mimetic Interfaces: Facial Surface EMG Dataset 2015 (Data and software)
Mimetic Interfaces: Facial Surface EMG Dataset 2015 (c) by Ville Rantanen, Mirja Ilves, Antti Vehkaoja, Anton Kontunen, Jani Lylykangas, Eeva Mäkelä, Markus Rautiainen, Veikko Surakka, and Jukka Lekkala

Mimetic Interfaces: Facial Surface EMG Dataset 2015 is licensed under a Creative Commons Attribution 4.0 International License.

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The dataset includes Matlab script and functions for processing the data. These are licenced under the MIT license.

Data Description
The data consists of facial surface EMG signals from the muscles corrugator supercilii, zygomaticus major, orbicularis oris, orbicularis oculi, and masseter.

Fifteen participants (8 females, 7 males) participated in the experiments for data collection. Their age was between 26 and 57 years (mean 40.7, standard deviation 9.6). They all had normal or corrected-to-normal vision and normal hearing by their own report.

The experiments were conducted in two phases. In the A phase, the participant performed voluntary smile, lip pucker, and frown movement tasks while EMG signals from zygomaticus major, orbicularis oris, orbicularis oculi, and corrugator
supercilii were measured from the right side of the face. B phase included the measurement of zygomaticus major, orbicularis oris, orbicularis oculi, and masseter from the right side of the face while the participant performed smile and pucker movement tasks while chewing a gum. Both phases had resting tasks between the movement tasks. The resting task was a neutral expression in the first phase, but included chewing in the second one. Phases started with a 1-minute-long resting task. Then 10 repetitions of each movement tasks were performed in randomized order. Each task lasted for 6 seconds. The movements were instructed to be performed as naturally as possible for the time that an on-screen instruction was visible. Instructions regarding movement intensities were not given, and the participants were not informed that their eye blinks will be monitored to avoid causing abnormal blinking.

The used experimental software was E-Prime [1] stimulation software. The facial surface EMG signals were measured with a NeXus-10 physiological monitoring device by Mind Media BV. The sampling rate was 2048 Hz. Filtering was not set from the measurement software but the hardware is to be expected to have antialiasing filters. The measurements were bipolar using pre-gelled, sintered Ag–AgCl electrodes. A separate grounding electrode was used on the forehead, and the electrodes were placed according to the guidelines of Fridlund and Cacioppo [2] as shown in the images accompanied with the dataset. Corrugator supercilii was left out from the second phase of the experiments because the measurement device only had 4 channels, and the muscle is not as important in facial pacing as the others are.

The experiments were recorded with a digital video camera at HD quality at 25 fps. The recordings are not published due to privacy issues. They were visually inspected to find out the onset and termination of each eye blink. The beginning each movement task was also determined from the video where the instructions shown to the participant were visible. Screenshots of the videos are included to illustrate the experimental setup. Eye blinks were classified to three categories: ones with a small eyelid movement where the pupil wasn't fully covered, ones where the pupil was fully covered and once where the eye lids was fully closed. Some participants performed multipart blinks where the previous one hadn't ended before the second one started. These are annotated separately in the data.


The log files from E-Prime are not published in raw form but they have been read to Matlab and saved as mat-files along with metadata and data from the visual inspection. The log files are named according to the scheme 01A.mat where the number (01-15) is the number of the participant and the letter (A/B) is the experimental phase.

The dataset is accompanied with a Matlab script and functions needed to produce the results for a publication titled "A Survey on the Feasibility of Surface EMG in Facial Pacing" that is to be published at IEEE Engineering in Medicine and Biology Society's EMBC '16 conference.

The included files are:
- Data/*.mat - Matlab data files
- Results/* - Result figures and table as LaTeX tabular
- Screenshots/*.jpg - Images from the experiments
- helper_functions/* - Helper functions for Matlab
- CHANGELOG.txt - Change log to document possible updates
- LICENSE.txt - License files for data, metadata, and the Matlab scripts (software)
- README.txt - This document
- Participants.csv - Table with the participants' ages and genders
- dataprocessing.m - The Matlab script for the data processing and outputting the results
- metadata.mat - Metadata with some variables used in the Matlab script

General information
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Ministry of Education publication type: I2 ICT software
Organisations: Department of Automation Science and Engineering, Research area: Microsystems, Research area: Measurement Technology and Process Control, University of Tampere, Pirkanmaa Hospital District
Authors: Rantanen, V., Ilves, M., Vehkaoja, A., Kontunen, A., Lylykangas, J., Mäkelä, E., Rautiainen, M., Surakka, V., Lekkala, J.
Publication date: 2016
Links:
http://avaa.tdata.fi/openida/dl.jsp?pid=urn:nbn:fi:csc-ida-9x201605192015015521963s
http://urn.fi/urn:nbn:fi:csc-kata20160519233254366793
Research output: Scientific > Software
Occupational exposure to electric and magnetic fields during tasks at ground or floor level at 110 kV substations in Finland

The aim was to investigate occupational exposure to electric and magnetic fields during tasks at ground or floor level at 110 kV substations in Finland and to compare the measured values to Directive 2013/35/EU. Altogether, 347 electric field measurements and 100 magnetic field measurements were performed. The average value of all electric fields was 2.3 kV/m (maximum 6.4 kV/m) and that of magnetic fields was 5.8 µT (maximum 51.0 µT). It can be concluded that the electric and magnetic field exposure at ground or floor level is typically below the low action levels of Directive 2013/35/EU. The transposition of the directive will not create new needs to modify the work practice of the evaluated tasks, which can continue to be performed as before. However, for workers with medical implants, the exposure may be high enough to cause interference.

General information
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Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Environmental Health, Työterveyslaitos
Authors: Korpinen, L., Pääkkönen, R.
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Scopus rating (2015): SJR 0.284 SNIP 0.729 CiteScore 0.65
Scopus rating (2014): SJR 0.23 SNIP 0.62 CiteScore 0.56
Scopus rating (2013): SJR 0.232 SNIP 0.853 CiteScore 0.65
Scopus rating (2012): SJR 0.344 SNIP 0.732 CiteScore 0.77
Scopus rating (2011): SJR 0.286 SNIP 0.578 CiteScore 0.39
Scopus rating (2010): SJR 0.221 SNIP 0.341
Scopus rating (2009): SJR 0.272 SNIP 0.673
Scopus rating (2008): SJR 0.369 SNIP 0.488
Scopus rating (2007): SJR 0.431 SNIP 0.618
Scopus rating (2006): SJR 0.205 SNIP 0.427
Scopus rating (2005): SJR 0.216 SNIP 0.257
Scopus rating (2004): SJR 0.224 SNIP 0.45
Scopus rating (2003): SJR 0.19 SNIP 0.344
Scopus rating (2002): SJR 0.205 SNIP 0.403
Scopus rating (2001): SJR 0.141 SNIP 0.333
Scopus rating (2000): SJR 0.136 SNIP 0.264
Scopus rating (1999): SJR 0.197 SNIP 0.372
Original language: English
Keywords: electric fields, exposure, magnetic fields, substations
ASJC Scopus subject areas: Public Health, Environmental and Occupational Health, Safety, Risk, Reliability and Quality, Safety Research
DOIs:
10.1080/10803548.2016.1153858
Source: Scopus
Source-ID: 84965075914
Research output: Scientific - peer-review › Article

Optimal short distance electrode locations for impedance pneumography measurement from the frontal thoracic area

Electrical impedance pneumography signal is a valuable tool in qualifying better the person’s health condition. It can be used in monitoring of respiration rate, rhythm and tidal volume. Impedance pneumography has also the potential in ambulatory physiological monitoring systems that are increasingly often implemented using plaster-like on-body devices. In such cases, the area of electrode substrate may be limited and therefore, the electrode configuration, which is able to provide both a clinically valuable electrocardiogram signal and accurate pulmonary information, is an issue. EAS is a useful small area electrode configuration that can be used for electrocardiogram measurements. In this work, different
two-electrode bipolar pairs of EAS system are tested for impedance pneumography measurements. Two additional electrodes are also considered in these tests. Our results show that the electrode pair S-A provides the most accurate respiration cycle length and is least affected by movement artifact. Additionally, the results show that this electrode pair produces the signals with highest amplitude.

Possible Influences of spark discharges on cardiac pacemakers
Exposure to spark discharges may occur beneath high voltage transmission lines when contact is initiated with a conductive object (such as a motor vehicle) with the spark discharge mediated by the ambient electric field from the line. The objective of this study was to assess whether such exposures could interfere with the normal functioning of implanted cardiac pacemakers (PMs). The experiment consisted of PMs implanted in a humansized phantom and then exposed to spark discharge through an upper extremity. A circuit was designed that produced spark discharges between two spherical electrodes fed to the phantom’s left hand. The circuit was set to deliver a single discharge per half cycle (every 10 ms) about 10 ms in duration with a peak current of 1.2-1.3 A, thus simulating conditions under a 400kV power line operating at 50 Hz. Of 29 PMs acquired, all were tested in unipolar configuration and 20 in bipolar configuration with exposure consisting of 2 min of continuous exposure (one unit was exposed for 1 min). No interference was observed in bipolar configuration. One unit in unipolar configuration incorrectly identified ventricular extra systoles (more than 400 beats min⁻¹) for 2 s. The use of unipolar configuration in new implants is extremely rare, thus further minimizing the risk of interference with the passage of time. Replication of this study and, if safety for human subjects can be assured, future testing of human subjects is also advisable.
Printed epidermal electronic system

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Review on Texture Descriptors for Image Classification

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Semi-automatic Method for Ca²⁺ Imaging Data Analysis of Maturing Human Embryonic Stem Cells-Derived Retinal Pigment Epithelium

Ca²⁺ is a second messenger controlling vital cellular processes, including cell maturation. Changes in Ca²⁺ signaling during maturation of human embryonic stem cell-derived retinal pigment epithelial cells (hESC-RPE) have not been assessed previously. The aim of this study was to investigate maturation-dependent changes in transient intracellular Ca²⁺ ([Ca²⁺]i) increases in hESC-RPE. For this, we developed image analysis tools to evaluate cell-specific Ca²⁺ signals from the entire field of view. Spontaneous and mechanically induced transient [Ca²⁺] increases (STIs and MITIs) were analyzed in hESC-RPEs cultured for 9 or 28 days, altogether from more than 80,000 cells. Both cultures showed STIs: the longer culture time resulted in twofold increase of amount of cells with STIs. Mechanical stimulation induced intercellular Ca²⁺ waves in cells from both time points, but longer culture time reduced Ca²⁺ wave spreading. Depletion of intracellular Ca²⁺ stores decreased cell fraction with STIs and MITIs at both time points, and absence of extracellular Ca²⁺ had similar effect on cells with STIs. To conclude, hESC-RPE cells undergo significant Ca²⁺ signaling re-arrangements during a short maturation period increasing cell fraction with STIs, while decreasing coordinated cell response to mechanical stimulation. This knowledge and proposed analysis tools can be used for assessment of hESC-RPE maturation in vitro.

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Scopus rating (2005): SJR 0.802 SNIP 1.111
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Subjective symptoms in Magnetic Resonance Imaging operators: prevalence, short-term evolution and possible related factors

Background: The number of Magnetic Resonance Imaging (MRI) operators is rapidly increasing. In these workers, a high prevalence of certain subjective symptoms has been described but until now scant research is available on this topic.

Objectives: To assess the prevalence and the evolution of symptoms over time in a group of operators recently engaged in MRI, also considering the possible role played by factors such as age, gender and occupational stress. Methods: In 17 physicians exclusively engaged in MRI - 6 working with 1.5 T scanners only and 11 with both 1.5 and 3T - subjective symptoms were evaluated at the beginning of MRI activity and after 2 months by using an ad hoc questionnaire. The questionnaire also included items on occupational stress. Results: At the start of MRI activity, 81% of the subjects reported at least one of the investigated symptoms; after 2 months, 85% of the symptomatic operators reported the regression of one or more symptoms. In operators with high exposure (1.5 and 3 T scanners), the mean number of symptoms tended to be higher compared with those with lower exposure (1.5 T only), and the reduction after 2 months was significantly greater. In the whole group, occupational stress was significantly correlated with the total number of symptoms and to some of the symptoms more specifically. As stress did not differ between highly- and lowly-exposed, there is no reason to assume an influence on the observed differences in the prevalence and reduction of symptoms. Conclusions: Our data suggest that MRI operators may experience various symptoms at the beginning of activity, rapidly reversible in a few weeks. The trend over longer periods deserves further study. Occupational stress may play a role in symptoms. The duration of previous MRI work (particularly short-term) as well as work-related stress should be adequately addressed in future studies on subjective symptoms in operators.
The biomechanical overload of the upper limb: a neglected occupational hazard in animal facility operators

Data on biomechanical overload of the upper limb in animal facility operators are currently scanty. We decided to study this risk in a university animal facility. Eleven different tasks performed by operators were identified. For each of them, the biomechanical overload of the upper limb was evaluated by applying 4 different methods frequently used, hypothesising a task duration of 4 and 8 h. Then two ‘typical’ real working days of the examined facility were reconstructed, and the risk for operators was calculated using the OCRA Index, Checklist and Mini-Checklist. Considering the specific tasks, the results show some difference among methods, but the overall results show an acceptable/slight risk of biomechanical overload of the upper limb in animal facility operators during typical working days. Practitioner Summary: Upper limb biomechanical overload (UL-BO) is a neglected risk in animal facilities. In a university facility, 11 different tasks were identified, and 2 typical working days were analysed. Even if some task at increased risk may exist, during typical working days, the overall results show that the risk of UL-BO in operators can be considered usually acceptable or, at worst, slight.
Uniform and electrically conductive biopolymer-doped polypyrrole coating for fibrous PLA

Three-dimensional, fibrous scaffolds can be easily fabricated from polylactide (PLA) using melt spinning and textile techniques. However, the surface properties of PLA scaffolds are not ideal for tissue engineering purposes. Furthermore, electrically conducting scaffolds are required to deliver electrical stimulation to cells. In this study, uniform, electrically conducting polypyrrole (PPy) coatings were fabricated on biodegradable PLA fibers. Biopolymer dopants-hyaluronic acid (HA) and chondroitin sulfate (CS)-were compared, and a PPy/CS composition was analyzed further. The effect of the oxidative polymerization conditions on the PLA fibers and CS counterion was studied. Furthermore, the initial molecular weight of CS and its degree of polymerization were determined. Our experiments showed that the molecular weight of CS decreases under oxidizing conditions but that the decay is not significant with the short polymerization process we used. The coating process was transferred to nonwoven PLA fabrics, and the stability of PPy/CS coating was studied during in vitro incubation in phosphate buffer solution at physiological temperature. The conductivity and surface roughness of the coating decayed during the 20-day incubation. The mechanical strength, however, remained at the initial level. Thus, the fabricated structures are suitable for short-term electrical stimulation adequate to promote cell functions in specific cases.

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X-ray microtomography of collagen and polylactide samples in liquids
Methods to image and assess the microstructure of polymer based biomaterials in liquid phase, for example cell culture medium, are well warranted. X-ray microtomography could provide a mean to visualize and analyze such structures. However, the density of such polymers is close to that of water and hence the inherent X-ray contrast is poor. The material can provide good contrast when dry, however, if the materials contain cells and are dried, the cell morphology may be distorted. Moreover the entire structure of these water containing materials are deformed in the drying process. In this paper we tested phosphotungstic acid (PTA) staining to improve the contrast. We imaged collagen and PLA samples, as well as collagen-PLA composites with μCT in air, water and alcohol. The methods were compared visually and with contrast to noise ratio calculated from the images. Our results demonstrate that with alcohol the PLA can be imaged also in liquid phase. PTA staining seems to be a good method to increase the contrast for collagen in μCT imaging.
Which wavelength is the best for arterial pulse waveform extraction using laser speckle imaging?

A multi-wavelengths analysis for pulse waveform extraction using laser speckle is conducted. The proposed system consists of three coherent light sources (532 nm, 635 nm, 850 nm). A bench-test composed of a moving skin-like phantom (silicone membrane) is used to compare the results obtained from different wavelengths. The system is able to identify a skin-like phantom vibration frequency, within physiological values, with a minimum error of 0.5 mHz for the 635 nm and 850 nm wavelengths and a minimum error of 1.3 mHz for the 532 nm light wavelength using a FFT-based algorithm. The phantom velocity profile is estimated with an error ranging from 27% to 9% using a bidimensional correlation coefficient-based algorithm. An in vivo trial is also conducted, using the 532 nm and 635 nm laser sources. The 850 nm light source has not been able to extract the pulse waveform. The heart rate is identified with a minimum error of 0.48 beats per minute for the 532 nm light source and a minimal error of 1.15 beats per minute for the 635 nm light source. Our work reveals that a laser speckle-based system with a 532 nm wavelength is able to give arterial pulse waveform with better results than those given with a 635 nm laser.
Device for Studying Reanimation of Unilateral Facial Paralysis

A device for studying facial pacing for people who suffer from unilateral facial paralysis is presented. The device is able to measure electromyographic (EMG) signals from the healthy side of the face and simultaneously activate the paralysed side with electrical stimulation.

Electronics designed for the device are integrated to a single tabletop unit together with a myRIO embedded hardware device by National Instruments (NI). The presented device is designed to fulfill the safety requirements of the Council Directive 93/42/EEC of the European Union concerning medical devices and IEC 60601 standards. The device is powered by a commercial medical grade power source. The custom electronics include isolated measurement and stimulation amplifiers that feed the signals to and from the myRIO. Complex real-time processing can be carried out in the myRIO's FPGA circuit for detecting muscle activations and producing appropriate stimulation signals. The functionality is programmed with NI LabVIEW. The device is controlled wirelessly via a computer interface, and the measured data is logged to the computer.

Clinical study with the device is about to be started at the Tampere University Hospital. First trials will determine and compare the required stimulation signal waveform parameters for transcutaneous activation of facial muscles of healthy participants and patients suffering from unilateral facial paralysis. Four measurement and four stimulation channels of the device enable studying different electrode configurations and stimulation patterns for recognizing and reanimating symmetrical facial expressions in the future.

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A new algorithm to improve assessment of cortical bone geometry in pQCT

High-resolution peripheral quantitative computed tomography (HR-pQCT) is now considered the leading imaging modality in bone research. However, access to HR-pQCT is limited and image acquisition is mainly constrained only for the distal third of appendicular bones. Hence, the conventional pQCT is still commonly used despite inaccurate threshold-based segmentation of cortical bone that can compromise the assessment of whole bone strength. Therefore, this study addressed whether the use of an advanced image processing algorithm, called OBS, can enhance the cortical bone analysis in pQCT images and provide similar information to HR-pQCT when the same volumes of interest are analyzed.
Using pQCT images of European Forearm Phantom (EFP), and pQCT and HR-pQCT images of the distal tibia from 15 cadavers, we compared the results from the OBS algorithm with those obtained from common pQCT analyses, HR-pQCT manual analysis (considered as a gold standard) and common HR-pQCT analysis dual threshold technique. We found that the use of OBS segmentation method for pQCT image analysis of EFP data did not result in any improvement but reached similar performance in cortical bone delineation as did HR-pQCT image analyses. The assessments of cortical cross-sectional bone area and thickness by OBS algorithm were overestimated by less than 4% while area moments of inertia were overestimated by ~5-10%, depending on reference HR-pQCT analysis method. In conclusion, this study showed that the OBS algorithm performed reasonably well and it offers a promising practical tool to enhance the assessment of cortical bone geometry in pQCT.

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Maintaining a proper pH level is crucial for successful cell culturing. Mammalian cells are commonly cultured in incubators, where the cell culture medium is saturated with a mixture of air and 5% carbon dioxide (CO\textsubscript{2}). Therefore, to keep cell culture medium pH in an acceptable level outside these incubators, a suitable CO\textsubscript{2} concentration must be dissolved in the medium. However, it can be very difficult to control and measure precisely local concentration levels. Furthermore, possible undesired concentration gradients generated during long-term cell culturing are almost impossible to detect. Therefore, we have developed a computational model to estimate CO\textsubscript{2} transport in silicone-based microfluidic devices. An extensive set of experiments was used to validate the finite element model. The model parameters were obtained using suitable measurement set-ups and the model was validated using a fully functional cell cultivation device. The predictions obtained by the simulations show very good responses to experiments. It is shown in this paper how the model helps to understand the dynamics of CO\textsubscript{2} transport in silicone-based cell culturing devices possessing different geometries, thus providing cost-effective means for studying different device designs under a variety of experimental conditions without the need of actual testing. Finally, based on the results from the computational model, an alternative strategy for feeding CO\textsubscript{2} is proposed to accelerate the system performance such that a faster and more uniform CO\textsubscript{2} concentration response is achieved in the area of interest.
LTCC-Based Multi-Electrode Arrays for 3D in Vitro Cell Cultures

Current technologies to monitor neuronal cultures in vitro are based on 2-dimensional (2D) multi-electrode arrays and cell cultures. The complexity of actual high-level neurobiological systems requires 3-dimensional (3D) cultures and 3D electrode arrays to improve our understanding of such systems. The realization calls for smart multilayer and packaging technology. Our approach uses low-temperature cofired ceramics (LTCC) for the design of a 3-dimensional multi-electrode array (3D MEA). An LTCC multilayer board with gold electrodes forms the basis of the system. The layout of the 3D MEA is designed to fit into widely used measurement adapters for 2D signal recordings, enabling data processing identical to that of established chips. Design and manufacturing of the new 3D device as a basic tool for the investigation of 3D cell cultures are described. Features of thick-film gold electrodes are characterized by means of microscopic and spectroscopic tools complemented with complex impedance measurements. Possible biological applications for in vitro electrophysiological measurements were evaluated based on cell cultures of primary neurons, seeded directly to the chip surface. It was shown that activity can be measured over six months.
Polypyrrole coating on poly-(lactide/glycolide)-β-tricalcium phosphate screws enhances new bone formation in rabbits

Polypyrrole (PPy) has gained interest as an implant material due to its multifunctional properties and its high compatibility with several cell and tissue types. For the first time, the biocompatibility and osteointegration of PPy coating, incorporated with chondroitin sulfate (CS), were studied in vivo by implanting PPy-coated bioabsorbable bone fixation composite screws of poly-(lactide/glycolide) copolymer (PLGA) and β-tricalcium phosphate (TCP) into New Zealand white rabbits. Uncoated bioabsorbable polymer composite screws and commercially available stainless steel cortical screws were used as reference implants. The rabbits were euthanized 12 and 26 weeks after the implantation. The systemic effects were evaluated from food and water consumption, body weight, body temperature, clinical signs, blood samples, internal organ weights, and histological examination. Local effects were studied from bone tissue and surrounding soft tissue histology. New bone formation was evaluated by micro-computed tomography, tetracycline labeling and torsion tests. Torsion tests were performed in order to capture the peak value of the torsion force during the course of the screw's loosening. The coated screws induced significantly more bone formation than the uncoated screws. In addition, none of the implants induced any systemic or local toxicity. The results suggest that PPy is biocompatible with bone tissue and is a potential coating for enhancing osteointegration in orthopedic implants.

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Authors: Zhao, M. D., Björninen, M., Cao, L., Wang, H. R., Pelto, J., Li, X. Q., Hyttinen, J., Jiang, Y. Q., Kellomäki, M., Miettinen, S., Sándor, G. K., Seppänen, R., Haimi, S., Dong, J.
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Scopus rating (2012): SJR 0.652 SNIP 0.742 CiteScore 1.95
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Scopus rating (2010): SJR 0.383 SNIP 0.776
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Scopus rating (2005): SJR 0.101
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Scopus rating (2001): SJR 0.101 SNIP 0
Signatures of chaotic and stochastic dynamics uncovered with epsilon-recurrence networks
An old and important problem in the field of nonlinear time-series analysis entails the distinction between chaotic and stochastic dynamics. Recently, e-recurrence networks have been proposed as a tool to analyse the structural properties of a time series. In this paper, we propose the applicability of local and global e-recurrence network measures to distinguish between chaotic and stochastic dynamics using paradigmatic model systems such as the Lorenz system, and the chaotic and hyper-chaotic Rossler system. We also demonstrate the effect of increasing levels of noise on these network measures and provide a real-world application of analysing electroencephalographic data comprising epileptic seizures. Our results show that both local and global e-recurrence network measures are sensitive to the presence of unstable periodic orbits and other structural features associated with chaotic dynamics that are otherwise absent in stochastic dynamics. These network measures are still robust at high noise levels and short data lengths. Furthermore, e-recurrence network analysis of the real-world epileptic data revealed the capability of these network measures in capturing dynamical transitions using short window sizes. e-recurrence network analysis is a powerful method in uncovering the signatures of chaotic and stochastic dynamics based on the geometrical properties of time series.

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Scopus rating (2009): SJR 1.001 SNIP 1.571
Scopus rating (2008): SJR 1.071 SNIP 1.415
Scopus rating (2007): SJR 1.139 SNIP 1.532
Scopus rating (2006): SJR 1.041 SNIP 1.456
Scopus rating (2005): SJR 1.14 SNIP 1.419
Scopus rating (2004): SJR 1.068 SNIP 1.339
Scopus rating (2003): SJR 1.146 SNIP 1.438
Scopus rating (2002): SJR 1.119 SNIP 1.414
Scopus rating (2001): SJR 1.126 SNIP 1.329
Biotelemetric wireless intracranial pressure monitoring: an in vitro study

Assessment of intracranial pressure (ICP) is of great importance in management of traumatic brain injuries (TBIs). The existing clinically established ICP measurement methods require catheter insertion in the cranial cavity. This increases the risk of infection and hemorrhage. Thus, noninvasive but accurate techniques are attractive. In this paper, we present two wireless, battery-less and minimally invasive implantable sensors for continuous ICP monitoring. The implants comprise ultra-thin (50 µm) flexible spiral coils connected in parallel to a capacitive microelectromechanical systems (MEMS) pressure sensor. The implantable sensors are inductively coupled to an external on-body reader antenna. The ICP variation can be detected wirelessly through measuring the reader antenna’s input impedance. This paper also proposes a novel implant placement to improve the efficiency of the inductive link. In this study, the performance of the proposed telemetry system was evaluated in a hydrostatic pressure measurement setup. The impact of the human tissues on the inductive link was simulated using a 5-mm layer of pig skin. The results from the in vitro measurement proved the capability of our developed sensors to detect ICP variations ranging from 0 to 70 mmHg at 2.5-mmHg intervals.
750 nm 1.5 W frequency-doubled semiconductor disk laser with a 44 nm tuning range

We demonstrate 1.5 W of output power at the wavelength of 750 nm by intracavity frequency doubling a wafer-fused semiconductor disk laser diode-pumped at 980 nm. An optical-to-optical efficiency of 8.3% was achieved using a bismuth borate crystal. The wavelength of the doubled emission could be tuned from 720 to 764 nm with an intracavity birefringent plate. The beam quality parameter M2 of the laser output was measured to be below 1.5 at all pump powers. The laser is a promising tool for biomedical applications that can take advantage of the large penetration depth of light in tissue in the 700–800 nm spectral range.
Analytic Hierarchy Process for assessing e-health technologies for elderly indoor mobility analysis

Accidental falls and reduced mobility are major risk factors in later life. Changes in a person’s mobility patterns can be related with personal well-being and with the frequency of memory lapses and can be used as risk detectors of incipient neuro-degenerative diseases. Thus, developing technologies for fall detection and indoor localization and novel methods for mobility pattern analysis is of utmost importance in e-health. Choosing the right technology is not only a matter of cost and performance, but also a matter of user acceptability and the perceived ease-of-use by the end user. In this paper, we employ an Analytic Hierarchy Process (AHP) to assess the best fit-to-purpose technology for fall detection and user mobility estimation. Our multi-criteria decision making process is based on the survey results collected from 153 elderly volunteers from 5 EU countries and on 10 emerging e-health technologies for fall detection and indoor mobility pattern estimation. Our analysis points out towards a Bluetooth Low Energy wearable solution as the most suitable solution.

Strontium- and calcium-containing, titanium-stabilised phosphate-based glasses with prolonged degradation for orthopaedic tissue engineering

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**Authors:** Lohan, E., Cramariuc, O., Malicki, L., Samar Brencic, N., Cramariuc, B.

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**Organisations:** Department of Electronics and Communications Engineering, Research group: Biomaterials and Tissue Engineering Group, BioMediTech, Integrated Technologies for Tissue Engineering Research (ITTE), BioMediTech - Institute of Biosciences and Medical Technology, Adult Stem Cell Group, CREST - University College London, Division of
Response patterns in finger and central body skin temperatures under mild whole body cooling in an elderly and in a young male - a pre-study

General information
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Organisations: Department of Electronics and Communications Engineering, Research group: Physiological Measurement Systems and Methods Group
Authors: Kuklane, K., Vanggaard, L., Smolander, J., Halder, A., Lundgren, K., Gao, C., Viik, J., Alametsä, J.
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Methods for Doppler Radar Monitoring of Physiological Signals

Unobtrusive health monitoring includes advantages such as long-term monitoring of rarely occurring conditions or of slow changes in health, at reasonable costs. In addition, the preparation of electrodes or other sensors is not needed. Currently, the main limitation of remote patient monitoring is not in the existing communication infrastructure but the lack of reliable, easy-to-use, and well-studied sensors.

The aim of this thesis was to develop methods for monitoring cardiac and respiratory activity with microwave continuous wave (CW) Doppler radar. When considering cardiac and respiration monitoring, the heart and respiration rates are often the first monitored parameters. The motivation of this thesis, however, is to measure not only rate-related parameters but also the cardiac and respiratory waveforms, including the chest wall displacement information.

This dissertation thoroughly explores the signal processing methods for accurate chest wall displacement measurement with a radar sensor. The sensor prototype and measurement setup choices are reported. The contributions of this dissertation encompass an I/Q imbalance estimation method and a nonlinear demodulation method for a quadrature radar sensor. Unlike the previous imbalance estimation methods, the proposed method does not require the use of laboratory equipment. The proposed nonlinear demodulation method, on the other hand, is shown to be more accurate than other methods in low-noise cases. In addition, the separation of the cardiac and respiratory components with independent component analysis (ICA) is discussed. The developed methods were validated with simulations and with simplified measurement setups in an office environment. The performance of the nonlinear demodulation method was also studied with three patients for sleep-time respiration monitoring. This is the first time that whole-night measurements have been analyzed with the method in an uncontrolled environment. Data synchronization between the radar sensor and a commercial polysomnographic (PSG) device was assured with a developed infrared (IR) link, which is reported as a side result.

The developed methods enable the extraction of more useful information from a radar sensor and extend its application. This brings Doppler radar sensors one step closer to large-scale commercial use for a wide range of applications, including home health monitoring, sleep-time respiration monitoring, and measuring gating signals for medical imaging.

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Authors: Zakrzewski, M.
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Detection and Assessment of Sleep-Disordered Breathing with Special Interest of Prolonged Partial Obstruction

Sleep-disordered breathing (SDB) has become more common and puts more strain on public health services than ever before. Obstructive sleep apnea (OSA) and its health consequences such as different cardiovascular diseases are nowadays well recognized. In addition to OSA, attention has recently been paid to another SDB; prolonged partial obstruction. However, it is often undiagnosed and easily left untreated because of the low number of respiratory events during polysomnography recording. This patient group has found to present with more atypical subjective symptoms than OSA patients.

Polysomnography (PSG) is considered to be the gold standard in reference methods in SDB diagnostics. PSG is a demanding and laborious multichannel recording method and often requires subjects to spend one night in a sleep laboratory. There is long tradition in Finland to use mattress sensors in SDB diagnostics. Recently, smaller electromechanical film transducer (Emfit) mattresses have replaced the old Static Charge-Sensitive Bed (SCSB) mattresses. However, a proper clinical validation of Emfit mattresses in SDB diagnostics has not been carried out.

In this work, the use of Emfit recording in the detection of sleep apneas, hypopneas, and prolonged partial obstruction with increased respiratory effort was evaluated. The general aim of the thesis is to develop and improve the diagnostic methods for sleep-related breathing disorders.

Comparisons with both PSG with nasal pressure recording and transesophageal pressure were made. Special attention was paid to the existence of the spiking phenomenon in the Emfit mattress in relation to changes in negative intrathoracic pressure in estimating increased respiratory effort. This entails monitoring the esophageal pressure as a part of nocturnal polysomnography. The recording method is demanding and uncomfortable and is usually not used with ordinary sleep laboratory patients. Thus, reliable and easy indirect quantification methods for respiratory effort are needed in clinical work. According to the results presented in this work, the Emfit signal reveals increased respiratory effort as well as apneas/hypopneas.

To find out the prevalence and consequences of prolonged partial obstruction among sleep laboratory patients was another aim of this thesis. This was done by retrospective analyses of sleep laboratory patients from one year. The prevalence of patients with prolonged partial obstruction was 11%. They were as sleepy as OSA patients, but their life quality was worse, as assessed by a survey. These results, along with the findings of the heart rate variation evaluation carried out in this thesis, suggest that prolonged partial obstruction and OSA should be considered as different entities of SDB.

With the Emfit mattress sensor, the SDB types can be differentiated, which is expected to enhance the accuracy of diagnostics. However, there is increasing need for easy and cheap screening methods to evaluate nocturnal breathing. In this respect, the usability of compressed tracheal sound signal scoring in SDB screening was estimated. The method reveals apneas and hypopneas but, according to the present findings, it can also be used in the detection of prolonged partial obstruction. The findings encourage the use of compressed tracheal sound analysis in screening different SDB.

The analysis of sleep recordings is still based on a doctor’s subjective and visual estimation. To date, no generally accepted and sufficiently reliable automatic analysis method exists. Robust, automatic quantification methods with easier techniques for non-invasive sleep recording would enable the analysis methods to be also used for screening purposes. In this technology-orientated world, people could take much more responsibility and take care of themselves better by following their own biosignals and by changing their health habits earlier. The need for good sleep as a necessity for good life and health is widely recognized.
Distinct electrophysiological and mechanical beating phenotypes of long QT syndrome type 1-specific cardiomyocytes carrying different mutations

Background: Long QT syndrome (LQTS) is associated with increased risk of ventricular arrhythmias and cardiac arrest. LQTS type 1 (LQT1), the most prevalent subtype of LQTS, is caused by defects of slow delayed rectifier potassium current (I<sub>Ks</sub>) that lead to abnormal cardiac repolarization. Here we used pluripotent stem cell (iPSC)-technology to investigate both the electrophysiological and also for the first time the mechanical beating behavior of genetically defined, LQT1 specific cardiomyocytes (CMs) carrying different mutations. Methods: We established in vitro models for LQT1 caused by two mutations (G589D or ivs7-2A>G). LQT1 specific CMs were derived from patient specific iPSCs and characterized for their electrophysiology using a current clamp and Ca<sup>2+</sup>-imaging. Their mechanical beating characteristics were analyzed with video-image analysis method. Results and conclusions: Both LQT1-CM-types showed prolonged repolarization, but only those with G589D presented early after-depolarizations at baseline. Increased amounts of abnormal Ca<sup>2+</sup> transients were detected in both types of LQT1-CMs. Surprisingly, also the mechanical beating behavior demonstrated clear abnormalities and additionally the abnormalities were different with the two mutations: prolonged contraction was seen in G589D-CMs while impaired relaxation was observed in ivs7-2A>G-CMs. The CMs carrying two different LQT1 specific mutations (G589D or ivs7-2A>G) presented clear differences in their electrical properties as well as in their mechanical beating behavior. Results from different methods correlated well with each other suggesting that simply mechanical beating behavior of CMs could be used for screening of diseased CMs and possibly for diagnostic purposes in the future.
Comparison of Bispectral Index and Entropy values with electroencephalogram during surgical anaesthesia with sevoflurane

Background Concomitantly recorded Bispectral Index® (BIS) and Entropy™ values sometimes show discordant trends during general anaesthesia. Previously, no attempt had been made to discover which EEG characteristics cause discrepancies between BIS and Entropy. We compared BIS and Entropy values, and analysed the changes in the raw EEG signal during surgical anaesthesia with sevoflurane. Methods In this prospective, open-label study, 65 patients receiving general anaesthesia with sevoflurane were enrolled. BIS, Entropy and multichannel digital EEG were recorded. Concurrent BIS and State Entropy (SE) values were selected. Whenever BIS and SE values showed ≥10-unit disagreement for ≥60 s, the raw EEG signal was analysed both in time and frequency domain. Results A ≥10-unit disagreement ≥60 s was detected 428 times in 51 patients. These 428 episodes accounted for 5158 (11%) out of 45 918 analysed index pairs. During EEG burst suppression, SE was higher than BIS in 35 out of 49 episodes. During delta-theta dominance, BIS was higher than SE in 141 out of 157 episodes. During alpha or beta activity, SE was higher than BIS in all 49 episodes. During electrocautery, both BIS and SE changed, sometimes in the opposite direction, but returned to baseline values after electrocautery. Electromyography caused index disagreement four times (BIS > SE). Conclusions Certain specific EEG patterns, and artifacts, are associated with discrepancies between BIS and SE. Time and frequency domain analyses of the original EEG improve the interpretation of studies involving BIS, Entropy and other EEG-based indices. Clinical trial registration.ClinicalTrials.gov:identifier NCT01077674.

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Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Department of Anaesthesia, Hospital for Joint Replacement, Tampere University Hospital, Seinäjoki Central Hospital, Department of Clinical Neurophysiology, Osaka University Graduate School of Medicine, University of Tampere
Authors: Aho, A. J., Kamata, K., Jäntti, V., Kulkas, A., Hagihira, S., Huhtala, H., Yli-Hankala, A.
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Scopus rating (2014): SJR 2.181 SNIP 2.386 CiteScore 3.35
Scopus rating (2013): SJR 2.088 SNIP 2.395 CiteScore 3.22
Scopus rating (2012): SJR 2.376 SNIP 2.207 CiteScore 3.12
Scopus rating (2011): SJR 2.075 SNIP 2.448 CiteScore 3.32
Scopus rating (2010): SJR 1.952 SNIP 2.05
Scopus rating (2009): SJR 1.72 SNIP 1.985
Scopus rating (2008): SJR 1.615 SNIP 1.837
Scopus rating (2007): SJR 1.423 SNIP 1.792
Scopus rating (2006): SJR 1.332 SNIP 1.677
Scopus rating (2005): SJR 1.317 SNIP 1.667
Scopus rating (2004): SJR 1.179 SNIP 1.62
Scopus rating (2003): SJR 1.231 SNIP 1.483
Scopus rating (2002): SJR 1.12 SNIP 1.332
Scopus rating (2001): SJR 1.178 SNIP 1.212
Scopus rating (2000): SJR 1.169 SNIP 1.223
Scopus rating (1999): SJR 1.14 SNIP 1.525
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Evaluation of the different sleep-disordered breathing patterns of the compressed tracheal sound

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Organisations: Department of Electronics and Communications Engineering, BioMediTech, Tampere University Hospital, Medical Imaging Centre, Department of Clinical Neurophysiology, Medical Imaging Centre and Hospital Pharmacy
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Scopus rating (2014): SJR 1.405 SNIP 1.363 CiteScore 2.61
Scopus rating (2013): SJR 1.523 SNIP 1.468 CiteScore 3
Scopus rating (2012): SJR 1.553 SNIP 1.403 CiteScore 3.03
Scopus rating (2011): SJR 1.713 SNIP 1.678 CiteScore 3.35
Scopus rating (2010): SJR 1.511 SNIP 1.481
Scopus rating (2009): SJR 1.601 SNIP 1.467
Scopus rating (2008): SJR 1.374 SNIP 1.293
Scopus rating (2007): SJR 1.369 SNIP 1.441
Scopus rating (2006): SJR 1.385 SNIP 1.483
Scopus rating (2005): SJR 1.343 SNIP 1.474
Scopus rating (2004): SJR 1.256 SNIP 1.435
Scopus rating (2003): SJR 1.293 SNIP 1.32
Scopus rating (2002): SJR 1.129 SNIP 1.088
Scopus rating (2001): SJR 0.791 SNIP 1.169
Scopus rating (2000): SJR 0.594 SNIP 1.009
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X-ray microtomographic confirmation of the reliability of CBCT in identifying the scalar location of cochlear implant electrode after round window insertion
Cone-beam computed tomography (CBCT) plays a key role in cochlear implantation in both planning implantation before surgery and quality control during surgery due to the high spatial resolution and convenience of application in the operation theater. We recently designed a novel, highresolution cone-beam acquisition system that has been tested in temporal bones with cochlear implantation to identify the scalar localization of the electrode arrays. The current study
aimed to verify the reliability of the experimental CBCT set-up using high-resolution invitro X-ray microtomography (μCT) imaging as a reference. Nine human temporal bones were studied by inserting a straight electrode of a cochlear implant using the round window approach followed by sequential imaging using experimental CBCT and μCT with and without 1% iodine as the contrast agent. In the CBCT images, the electrodes were located in the scala tympani and near the lateral wall in all temporal bones. In the μCT images, the cochlear fine structures, including Reissner's membrane, stria vascularis, spiral ligament, basilar membrane, spiral limbus, osseous spiral lamina, and Rosenthal's canal that hosts the spiral ganglion cells, were clearly delineated; the electrode array avoided the lateral wall of the scala tympani in the hook region and then ran along the lateral wall of the scala tympani without any exception, a feature that was also detected in a temporal bone with ruptures in the basilar and Reissner's membranes. In conclusion, the current invitro μCT imaging system produced high-quality images that could demonstrate the fine cochlear structures faithfully and verify the reliability of a novel experimental CBCT set-up aimed for clinical application in identifying the scalar localization of the electrode array. The straight electrode is safe for cochlear structures with low risk of translocation and is suitable for atraumatic implantation, although a large gap between the contacts and the modiolus exists.

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Scopus rating (2014): SJR 1.719 SNIP 1.36 CiteScore 3.11
Scopus rating (2013): SJR 1.512 SNIP 1.488 CiteScore 2.86
Scopus rating (2012): SJR 1.648 SNIP 1.192 CiteScore 2.81
Scopus rating (2011): SJR 1.363 SNIP 1.231 CiteScore 2.73
Scopus rating (2010): SJR 1.485 SNIP 1.137
Scopus rating (2009): SJR 1.31 SNIP 1.105
Scopus rating (2008): SJR 1.521 SNIP 0.997
Scopus rating (2007): SJR 1.165 SNIP 1.061
Scopus rating (2006): SJR 0.981 SNIP 0.927
Scopus rating (2005): SJR 1.023 SNIP 0.956
Scopus rating (2004): SJR 1 SNIP 0.911
Scopus rating (2003): SJR 1.199 SNIP 0.959
Scopus rating (2002): SJR 1.074 SNIP 0.981
Scopus rating (2001): SJR 1.014 SNIP 0.916
Scopus rating (2000): SJR 0.919 SNIP 0.999
Scopus rating (1999): SJR 1.175 SNIP 0.945
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ASJC Scopus subject areas: Sensory Systems
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Research output: Scientific - peer-review › Article

615 nm GainNAs VECSEL with output power above 10 W
A high-power optically-pumped vertical-external-cavity surface-emitting laser (VECSEL) generating 10.5 W of cw output power at 615 nm is reported. The gain mirror incorporated 10 GainNAs quantum wells and was designed to have an emission peak in the 1230 nm range. The fundamental emission was frequency doubled to the red spectral range by using
an intra-cavity nonlinear LBO crystal. The maximum optical-to-optical conversion efficiency was 17.5%. The VECSEL was also operated in pulsed mode by directly modulating the pump laser to produce light pulses with duration of ~1.5 µs. The maximum peak power for pulsed operation (pump limited) was 13.8 W. This corresponded to an optical-to-optical conversion efficiency of 20.4%.

**General information**
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Authors: Kantola, E., Leinonen, T., Penttinen, J., Korpijärvi, V., Guina, M.
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Scopus rating (2012): SJR 2.587 SNIP 2.145 CiteScore 3.85
Scopus rating (2011): SJR 2.579 SNIP 2.606 CiteScore 4.04
Scopus rating (2010): SJR 2.943 SNIP 2.466
Scopus rating (2009): SJR 3.092 SNIP 2.669
Scopus rating (2008): SJR 3.195 SNIP 2.393
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Scopus rating (2005): SJR 3.334 SNIP 2.379
Scopus rating (2004): SJR 2.833 SNIP 2.499
Scopus rating (2003): SJR 2.688 SNIP 2.193
Scopus rating (2002): SJR 1.547 SNIP 1.673
Scopus rating (2001): SJR 1.442 SNIP 1.39
Scopus rating (2000): SJR 1.246 SNIP 0.714
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**Improved dimensional stability with bioactive glass fibre skeleton in poly(lactide-co-glycolide) porous scaffolds for tissue engineering**
Abstract Bone tissue engineering requires highly porous three-dimensional (3D) scaffolds with preferable osteoconductive properties, controlled degradation, and good dimensional stability. In this study, highly porous 3D poly(d,l-lactide-co-glycolide) (PLGA) - bioactive glass (BG) composites (PLGA/BG) were manufactured by combining highly porous 3D fibrous BG mesh skeleton with porous PLGA in a freeze-drying process. The 3D structure of the scaffolds was investigated as well as in vitro hydrolytic degradation for 10 weeks. The effect of BG on the dimensional stability, scaffold composition, pore structure, and degradation behaviour of the scaffolds was evaluated. The composites showed superior pore structure as the BG fibres inhibited shrinkage of the scaffolds. The BG was also shown to buffer the acidic degradation products of PLGA. These results demonstrate the potential of these PLGA/BG composites for bone tissue engineering, but the ability of this kind of PLGA/BG composites to promote bone regeneration will be studied in forthcoming in vivo studies.

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Stabilization of Pluronic Gels by Hydrophobically Modified Hydroxyethylcellulose

Hydrophobically modified hydroxyethylcellulose (HM-HEC) of different hydrophobicity has been used to stabilize pluronic gels against dissolution in an aqueous environment. While pluronic by itself dissolves within 1-2 days, the addition of HM-HEC can stabilize part of the gels from dissolving for a period of at least six months. A larger fraction of the gel remains undissolved when utilizing high HM-HEC concentrations and when the degree of hydrophobic modification is increased. The stabilization against fast dissolution makes these systems interesting for drug delivery purposes. The effect of HM-HEC addition on rheological properties of pluronic gels has also been examined. For a low pluronic concentration, the addition of HM-HEC increases the viscosity of the sample, shifts the gel transition to a lower temperature, and reduces the deviscosification of the pluronic gels at high temperatures. When the pluronic concentration is increased, the addition of HM-HEC only affects the sample viscosity at low temperatures.

General information

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Organisations: Department of Electronics and Communications Engineering
Authors: Kjoniksen, A., Calejo, M. T., Zhu, K., Nyström, B., Sande, S. A.
Number of pages: 8
Bioactive glass ions as strong enhancers of osteogenic differentiation in human adipose stem cells

Bioactive glasses are known for their ability to induce osteogenic differentiation of stem cells. To elucidate the mechanism of the osteoinductivity in more detail, we studied whether ionic extracts prepared from a commercial glass S53P4 and from three experimental glasses (2-06, 1-06 and 3-06) are alone sufficient to induce osteogenic differentiation of human adipose stem cells. Cells were cultured using basic medium or osteogenic medium as extract basis. Our results indicate that cells stay viable in all the glass extracts for the whole culturing period, 14 days. At 14 days the mineralization in osteogenic medium extracts was excessive compared to the control. Parallel to the increased mineralization we observed a decrease in the cell amount. Raman and Laser Induced Breakdown Spectroscopy analyses confirmed that the mineral consisted of calcium phosphates. Consistently, the osteogenic medium extracts also increased osteocalcin production and collagen Type-I accumulation in the extracellular matrix at 13 days. Of the four osteogenic medium extracts, 2-06 and 3-06 induced the best responses of osteogenesis. However, regardless of the enhanced mineral formation, alkaline phosphatase activity was not promoted by the extracts. The osteogenic medium extracts could potentially provide a fast and effective way to differentiate human adipose stem cells in vitro.
BACKGROUND: Advances in rapid-prototyping and 3D printing technologies have enhanced the possibilities in preparing designed architectures for tissue engineering applications. A major advantage in custom designing is the ability to create structures with desired mechanical properties. While the behaviour of a designed scaffold can be simulated using bulk material properties, it is important to verify the behaviour of a printed scaffold at the microstructure level. OBJECTIVE: In this study we present an effective method in validating the mechanical behaviour of designed scaffolds using a CT with an in-situ mechanical deformation device. METHODS: The scaffolds were prepared from biodegradable poly(trimethylene carbonate) (PTMC) by stereolithography and images obtained using a high-resolution CT with 12.25 m isometric voxels. The data was processed (filtering, segmentation) and analysed (surface generation, registration) to extract relevant deformation features. RESULTS: The computed local deformation fields, calculated at sub-pore resolutions, displayed expected linear behaviour within the scaffold along the compression axis. On planes perpendicular to this axis, the deformations varied by 150-200 m. CONCLUSIONS: μCT based imaging with in-situ deformation provides a vital tool in validating the design parameters of printed scaffolds. Deformation fields obtained from micro-tomographic image volumes can serve to corroborate the simulated ideal design with the realized product.
Molecular Communication Modeling of Antibody-Mediated Drug Delivery Systems

Antibody-mediated Drug Delivery Systems (ADDS) are emerging as one of the most encouraging therapeutic solutions for treating several diseases such as human cancers. ADDS use small molecules (antibodies) that propagate in the body and bind selectively to their corresponding receptors (antigens) expressed at the surface of the diseased cells. In this paper, the Molecular Communication (MC) paradigm, where information is conveyed through the concentration of molecules, is advocated for the engineering of ADDS and modeling their complex behavior, to provide a realistic model without the over-complication of system biology models, and the limitations of experimental approaches. The peculiarities of antibodies, including their anisotropic transport and complex electrochemical structure, are taken into account to develop an analytical model of the ADDS transport and antigen-binding kinetics. The end-to-end response of ADDS, from the drug injection to the drug absorption, is mathematically derived based on the geometry of the antibody molecule, the electrochemical structure of the antibody-antigen complex, and the physiology of the patient. The accuracy of the MC model is validated by finite-element (COMSOL) simulations. The implications of the complex interplay between the transport and kinetics parameters on the performance of ADDS are effectively captured by the proposed MC model. The MC model of ADDS will enable the discovery and optimization of drugs in a versatile, cost-efficient, and reliable manner.

General information

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Organisations: Department of Electronics and Communications Engineering, Research group: Emerging Technologies for Nano-Bio-Info-Cogno, Wireless Communications and Positioning (WICO), Georgia Institute of Technology
Authors: Chahibi, Y., Akyildiz, I. F., Balasubramaniam, S., Koucheryavy, Y.
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Scopus rating (2014): SJR 0.84 SNIP 1.973 CiteScore 3.34
Scopus rating (2013): SJR 1.081 SNIP 2.073 CiteScore 3.53
Scopus rating (2012): SJR 0.816 SNIP 1.706 CiteScore 3
Scopus rating (2011): SJR 0.7 SNIP 1.715 CiteScore 3.04
Scopus rating (2010): SJR 0.686 SNIP 1.637
Scopus rating (2009): SJR 0.81 SNIP 1.94
Scopus rating (2008): SJR 0.826 SNIP 1.719
MRI Texture Analysis and Diffusion Tensor Imaging in Chronic Right Hemisphere Ischemic Stroke

BACKGROUND AND PURPOSE: Diffusion tensor imaging (DTI) is shown to reveal changes caused by cerebral infarction. The aim of this study is to reveal those changes also in the conventional magnetic resonance (MR) images using a quantitative image analysis method, texture analysis (TA). METHODs: Thirty patients who had suffered their first ever infarction located on the right hemisphere underwent DTI and conventional MRI studies in the chronic phase. DTI parameters fractional anisotropy and mean diffusivity, as well as four second-order texture parameters were calculated. Interhemispheric differences and correlations between DTI and TA parameters were evaluated. RESULTS: Our DTI findings supported earlier studies as fractional anisotropy values were lowered and mean diffusivity values elevated in the lesion site, and ipsilateral cerebral peduncle, thalamus, and centrum semiovale compared to the unaffected side. Textural homogeneity parameters showed lower and complexity parameters higher values in the lesion site and ipsilateral centrum semiovale compared to the contralateral hemisphere. Correlation between the two methods was found in ipsilateral mesencephalon. CONCLUSIONS: In addition to DTI method, TA could assist in revealing the changes caused by infarction, also outside the lesion site. Damaged areas were found more heterogeneous and random in texture compared to unaffected sites.
Scopus rating (2007): SJR 1.193 SNIP 1.048
Scopus rating (2006): SJR 0.807 SNIP 0.879
Scopus rating (2005): SJR 0.696 SNIP 0.793
Scopus rating (2004): SJR 0.525 SNIP 0.658
Scopus rating (2003): SJR 0.475 SNIP 0.658
Scopus rating (2002): SJR 0.414 SNIP 0.564
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Keywords: Chronic infarction, Diffusion tensor imaging, Magnetic resonance imaging, Texture analysis
DOIs:
10.1111/jon.12185

Bibliographical note
EXT="Dastidar, Prasun"
Source: Scopus
Source-ID: 84937031387
Research output: Scientific - peer-review › Article

On the threshold based neuronal spike detection, and an objective criterion for setting the threshold
In this paper, we investigate the workings of threshold (TH) based spike detection for neuronal extracellular field potential spikes. Thresholding is the most used spike detection method. In general, it is employed by setting the TH as per convention and without considering either the undetected or spurious spikes. In this paper, we provide insight in to the workings of thresholding, and proposed a new objective way to set the TH based on spike count histogram analysis. We illustrate the method with 2D and 3D simulations and analysis of measured data.

General information
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Recurrence network analysis of wide band oscillations of local field potentials from the primary motor cortex reveals rich dynamics.
Aggregate signals that reflect activities of a large number of neurons in the cerebral cortex, local field potentials (LFPs) have been observed to mediate gross functional activities of a relatively small volume of the brain tissues. There are several bands of the oscillations frequencies in LFPs that have been observed across multiple brain areas. The signature oscillation band of the LFPs in the primary motor cortex (MI) is over β range and it has been consistently observed both in human and non-human primates around the time of visual cues and movement onsets. However, its dynamical behavior has not been well characterized. Furthermore, dynamics of β oscillations has been documented based on the phase locking of β oscillations, but not in terms of the inherent dynamics of the oscillations themselves. Here, we used the complexity measure derived from cluster coefficients of a recurrence network and analyzed a pair of wide-band signals, one including β band of the LFPs and the other ranging the low γ band in MI recorded from a non-human primate. We show rather unique temporal profiles of the evoked responses using complexity of the dynamical behavior in both bands of the oscillation, either of which is not simply resembling either the power of the oscillation or the phase locking of β oscillations. Therefore, the current method can reveal a new type of dynamics of the underlying network complexity during
the task simply based on event evoked potentials of wide-band oscillatory signals.

Hemispheric asymmetry measured by texture analysis and diffusion tensor imaging in two multiple sclerosis subtypes

Background: This paper addresses two subtypes of multiple sclerosis (MS), primary progressive multiple sclerosis (PPMS) and relapsing-remitting multiple sclerosis (RRMS). The separation of PPMS and RRMS is challenging in certain cases.

Purpose: To quantitatively determine MS subtypes using texture analysis (TA) and diffusion tensor imaging (DTI).

Material and Methods: T1-weighted (T1W) magnetic resonance imaging (MRI) and DTI of the left and right brain hemispheres of 17 patients with PPMS and 19 patients with RRMS were studied. Areas of the caudate nucleus and thalamus were investigated as normal appearing gray matter (NAGM), and areas of the cerebral peduncle and centrum semiovale were investigated as normal appearing white matter (NAWM). The described locations were symmetrical and were accurately marked. TA was performed on the T1W images, and the fractional anisotropy and apparent diffusion coefficient were determined from the DTI data.

Results: Hemispherical differences were found with both TA and DTI. Several texture and diffusion tensor parameter values calculated for the left and right hemispheres of the patients showed statistically significant differences. The patients with RRMS had greater significant differences (P

Conclusion: TA can be helpful when distinguishing between PPMS and RRMS, while DTI appears to reveal the hemispherical asymmetry of RRMS patients.
A Quantitative Method for Monitoring Wound Healing

Assessment and monitoring of chronic wounds is primarily based on visual inspection by medical professionals. The method is subjective and its reliability depends on the assessment criteria of the evaluator. This may cause problems in particular at home care where caretakers are not usually wound care specialists. Wound dressings have to be removed for each assessment which disturbs the wound healing process. Additionally this increases both workload and cost, as the wound dressings are often changed without medical necessity. Our research group has developed a quantitative method for evaluation and monitoring of the wound healing process. The method is based on differences in electrical conductivity of tissue types and is addressed using the bioimpedance measurement. The results indicate that the method is a potential tool for evaluating the status of a wound.

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Optimising polylactide melt spinning using real-time monitoring

Polylactide (PLA) is a synthetic biodegradable polyester and it is usually processed into fibres by two-step melt spinning, which comprises of (i) melting the raw material and pushing the melt through small orifices and (ii) stretching and heat treating the fibre to increase its mechanical properties. However, processing biodegradable polymers is challenging because the polymer degrades thermally which narrows the choice of the processing parameters. Real-time monitoring allows monitoring of the key properties of the material during the production of the fibre.

There were two objectives for this work: (i) upscaling the production of 4-filament PLA fibre with an updated set-up with real-time monitoring and (ii) studying the hydrolytic degradation of PLA fibres manufactured with the conventional set-up. The updated set-up comprised of high-speed spinning plants and a twin-screw extruder equipped with a slit die for later real-time monitoring of parameters related to thermal degradation of the polymer. The processing conditions of polylactide melt spinning were optimised by two sets of trials; initial trials with a packaging grade PLA and a second set of trials with GMP grade poly(L/D)lactide with an L/D ratio of 96/4.

The obtained fibres were characterised by tensile testing and the temperature-induced chain scission was evaluated by inherent viscosity (i.v.) measurements. Goal values were established to enable the post-processing of the fibres. Mechanically adequate fibre was produced in the initial trials regarding the material used and the filament diameters fulfilled the requirements. The packaging grade PLA did not degrade during extrusion but the i.v. of the GMP grade PLA was decreased by one third. The filament diameter and the strain values were at an acceptable level in half of the spools produced in the GMP grade trials. In the initial trials there was a problem with the fluctuation of the filament diameters but it was largely solved by a change of the feeding equipment in the GMP grade trials. There is a need for further optimisation of the mechanical properties. This should be done by increasing the draw ratio. However, the ultimate tensile strength of the fibre was close to the required value.

In addition a 48-week hydrolysis study was conducted on the fibre produced with the conventional set-up. The molecular, rheological, thermal and mechanical properties of gamma irradiated and non-irradiated fibres were measured. The molecular weights and inherent viscosities of both fibres decreased steadily, but the irradiated fibre degraded more prominently. The mechanical performance of the non-irradiated fibre showed no changes but the irradiated fibre could no longer be tested after 28 weeks. In conclusion, the results of the hydrolytic degradation studies were mainly in line with earlier studies. These results can be used as a reference for the future hydrolytic degradation studies for the fibre manufactured with the upgraded set-up.

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Authors: Lyyra, I.
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Chitosan membranes in a rat model of full-thickness cutaneous wounds: Healing and IL-4 levels

Objective: The aim of this study was to examine the effect of chitosan membrane on wound healing. Method: The effect of chitosan membranes was evaluated in an experimental rat model. On day 0, circular full-thickness skin sections were excised from the scalps of rats. The wounds were then measured and the surrounding area tattooed. Rats were sacrificed either immediately after excision, or randomised into control and chitosan groups and followed up on day 3, 7, 14 or 21. Control group wounds were covered with Aquacel (wound dressing). Chitosan group wounds were covered with chitosan membranes and the wound dressing. Wounds and the distances between the tattooed marks were measured on follow-up, the wound sites were harvested and histologically examined, and serum interleukin (IL-4) levels were analysed.

Results: A total of 54 rats were examined and all time points included 6 control and 6 chitosan treated animals, except for day 0 which consisted of control animals only. On day 3, wounds in the chitosan group were significantly (p<0.05) smaller (60 ± 6% versus 78 ± 19% of the original wound area) than in the control group. Chitosan membranes were found to degrade at the wound sites between days 7 and 14. Leukocyte counts were lower in the chitosan group than in the control group on day seven (p<0.05). IL-4 levels were significantly higher on day 7 (p<0.001) and 14 (p<0.001) in the chitosan group. Conclusion: According to our results chitosan membrane may promote early wound healing, reduce inflammation and affect the IL-4 pathway, however, the membrane degrades at the wound site after day 7.

General information
Signal analysis and classification methods for the calcium transient data of stem cell-derived cardiomyocytes

Calcium cycling is crucial in the excitation-contraction coupling of cardiomyocytes, and therefore has a key role in cardiac functionality. Cardiac disorders and different drugs alter the calcium transients of cardiomyocytes and can cause serious dysfunction of the heart. New insights into this biochemical phenomena can be achieved by studying and analyzing calcium transients. Calcium transients of spontaneously beating human induced pluripotent stem cell-derived cardiomyocytes were recorded for a data set of 280 signals. Our objective was to develop and program procedures: (1) to automatically detect cycling peaks from signals and to classify the peaks of signals as either normal or abnormal, and (2) on the basis of the preceding peak detection results, to classify the entire signals into either a normal class or an abnormal class. We obtained a classification accuracy of approximately 80% compared to class decisions made separately by an experienced researcher, which is promising for the further development of an automatic classification approach. Automated classification software would be beneficial in the future for analyzing cardiomyocyte functionality on a large scale when screening for the adverse cardiac effects of new potential compounds, and also in future clinical applications.

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Technologies for Ambient Assisted Living: Ambient Communication and Indoor Positioning

In all industrialised countries, the population is aging rapidly as the average life expectancy continues to rise and the number of younger age groups grows smaller. Hence, due to economical and practical reasons, the elders of the near future will likely live longer in their own apartments, particularly because institutionalization is significantly expensive and there is not room for the entire elderly population in currently existing nursing homes. Even more important, nearly all people would choose to live independently as long as possible before moving into an assisted-living facility.

A longer period of independent living for elders can be enabled by technical solutions. In this work, two technology areas for assisted living are studied. First, the prevention of feelings of loneliness in elders living alone is studied, and a solution for social inclusion and remote presence is presented. The results of long-lasting field trials are presented and analysed. Secondly, as information regarding the location of the inhabitant in the apartment can be used to provide several assistive services, indoor positioning systems are also studied in this work. Several technologies for indoor positioning are presented and compared. Furthermore, a new system based on capacitive measurement and the results of testing of the system are introduced.

Technologies and systems developed here have been implemented into actual systems, and real end users have tested them over long periods of time. Thus, these technologies can be developed into commercial products with reasonable effort. Moreover, in this work it has been proven that the systems developed can actually be used to support the independent living of elders.
Investigating the possible effect of electrode support structure on motion artifact in wearable bioelectric signal monitoring

Background: With advances in technology and increasing demand, wearable biosignal monitoring is developing and new applications are emerging. One of the main challenges facing the widespread use of wearable monitoring systems is the motion artifact. The sources of the motion artifact lie in the skin-electrode interface. Reducing the motion and deformation at this interface should have positive effects on signal quality. In this study, we aim to investigate whether the structure supporting the electrode can be designed to reduce the motion artifact with the hypothesis that this can be achieved by stabilizing the skin deformations around the electrode.

Methods: We compare four textile electrodes with different support structure designs: a soft padding larger than the electrode area, a soft padding larger than the electrode area with a novel skin deformation restricting design, a soft padding the same size as the electrode area, and a rigid support the same size as the electrode. With five subjects and two electrode locations placed over different kinds of tissue at various mounting forces, we simultaneously measured the motion artifact, a motion affected ECG, and the real-time skin-electrode impedance during the application of controlled motion to the electrodes.

Results: The design of the electrode support structure has an effect on the generated motion artifact; good design with a skin stabilizing structure makes the electrodes physically more motion artifact resilient, directly affecting signal quality. Increasing the applied mounting force shows a positive effect up to 1,000 gr applied force. The properties of tissue under the electrode are an important factor in the generation of the motion artifact and the functioning of the electrodes. The relationship of motion artifact amplitude to the electrode movement magnitude is seen to be linear for smaller movements. For larger movements, the increase of motion generated a disproportionally larger artifact. The motion artifact and the induced impedance change were caused by the electrode motion and contained the same frequency components as the applied electrode motion pattern.

Conclusion: We found that stabilizing the skin around the electrode using an electrode structure that manages to successfully distribute the force and movement to an area beyond the borders of the electrical contact area reduces the motion artifact when compared to structures that are the same size as the electrode area.
Age-related circulatory responses to whole body cooling: observations by heart rate variability

The purpose was to study potential age-related changes in the circulatory system via heart rate variability (HRV) by gradually lowering ambient temperature (0.2°C/min) from thermoneutral (32°C) towards cold (18°C). ECG was recorded from a young (31 years) and from an older subject (78 years), both males. During the tests, brachium blood pressure (BP) was recorded.

During the cooling, BP increased in both subjects (young from 95/69 to 132/75 mmHg, old from 125/68 to 176/101 mmHg), the latter exhibiting a prominent rise in diastolic values after cooling. HRV parameters increased in both subjects during the cold exposure being modest in the younger subject as compared to the older one. Also, recovery from the cold in terms of HRV was faster in the younger subject. The present preliminary observations indicate that older age is coupled with altered HRV response to a mild whole-body skin cooling.

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Highly Porous Freeze-Dried Composite Scaffolds for Cartilage and Osteochondral Tissue Engineering

Cartilage lesions are known to heal poorly and their tissue engineering with optimal scaffolds are widely studied. If the cartilage lesion is deep, there is a need to also repair the underlying bone (i.e. subchondral bone) and the lesion is called an osteochondral lesion. There are several methods used for osteochondral tissue engineering and various scaffold compositions are being studied. The studied scaffold compositions include the one scaffold method, where only one scaffold is used for the osteochondral lesion, or independent structures for cartilage and bone. These two scaffolds could be combined during processing, before surgery or in surgery to obtain osteochondral solutions for cartilage repair. In this thesis, freeze-drying was used to manufacture highly porous scaffolds with an interconnected pore structure. Natural polymer-based scaffolds often lack the required mechanical stability. Therefore, natural polymer-based hybrids with improved stiffness were manufactured for cartilage tissue engineering scaffolds. Synthetic polymer-based composites with improved osteoconductivity were manufactured for bone or osteochondral tissue engineering scaffolds. The scaffolds were studied to determine the structure of the scaffolds, the effect of the fibrous filler mesh or filler particles on the characteristics of the hybrids or composites, and the suitability of the hybrids for cartilage tissue engineering and the composites for bone or osteochondral tissue engineering. The majority of the studied scaffolds were also cultured with cells in vitro to define the suitability of the scaffolds for tissue engineering. The results show the freeze-drying method to be useful for manufacturing highly porous hybrid and composite scaffolds with improved properties compared with plain polymer scaffolds. Also, all the studied scaffolds had an interconnected porous structure. Improved wettability characteristics showed the method of cross-linking collagen post freeze-drying to be more effective way of cross-linking collagen compared to crosslinking collagen prior to freeze-drying. Synthetic polymer-based composites with an inhomogeneous scaffold structure with β-tricalcium phosphate (TCP) or bioactive glass (BG) filler particles showed improved osteoconductivity. TCP was found to improve the cell proliferation and alkaline phosphatase (ALP) activity of adipose stem cells (ASCs) over plain poly(L/D,L)-lactide 70/30 (PLA70) scaffolds or PLA70+BG composites. A porous polymer matrix with a highly porous fibrous filler was successfully combined into highly porous freeze-dried hybrids with a natural polymer matrix (collagen/ chitosan and poly(L/D)-lactide 96/4 fibres (PLA96)) and composites with a synthetic polymer matrix (poly(D,L-lactide-co-glycolide)70/30 (PLGA)) with bioactive glass fibres (BGf). The PLA96 fibrous mesh improved the penetration of the chondrocytes into the hybrids compared with plain natural polymer scaffolds. The manufactured scaffolds were found to be applicable for cartilage, bone and osteochondral tissue engineering applications. Based on the structures developed in this thesis, more optimal scaffold structures are currently being studied.
A prospective biopsychosocial study of the persistent post-concussion symptoms following mild traumatic brain injury

This study examined multiple biopsychosocial factors relating to post-concussion symptom (PCS) reporting in patients with mild traumatic brain injuries (mTBI), including structural (computed tomography and magnetic resonance imaging [MRI]) and microstructural neuroimaging (diffusion tensor imaging [DTI]). Patients with mTBIs completed several questionnaires and cognitive testing at approximately one month (n=126) and one year (n=103) post-injury. At approximately three weeks post-injury, DTI was undertaken using a Siemens 3T scanner in a subgroup (n=71). Measures of fractional anisotropy were calculated for 16 regions of interest (ROIs) and measures of apparent diffusion coefficient were calculated for 10 ROIs. Patients were compared with healthy control subjects. Using International Classification of Diseases, Tenth Revision (ICD-10) PCS criteria and mild or greater symptom reporting, 59% of the mTBI sample met criteria at one month and 38% met criteria at one year. However, 31% of the healthy control sample also met criteria for the syndrome - illustrating a high false-positive rate. Significant predictors of ICD-10 PCS at one month were pre-injury mental health problems and the presence of extra-cranial bodily injuries. Being symptomatic at one month was a significant predictor of being symptomatic at one year, and depression was significantly related to PCS at both one month and one year. Intracranial abnormalities visible on MRI were present in 12.1% of this sample, and multifocal areas of unusual white matter as measured by DTI were present in 50.7% (compared with 12.4% of controls). Structural MRI abnormalities and microstructural white matter findings were not significantly associated with greater post-concussion symptom reporting. The personal experience and reporting of post-concussion symptoms is likely individualized, representing the cumulative effect of multiple variables, such as genetics, mental health history, current life stress, medical problems, chronic pain, depression, personality factors, and other psychosocial and environmental factors. The extent to which damage to the structure of the brain contributes to the persistence of post-concussion symptoms remains unclear.

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Scopus rating (2009): SJR 1.645 SNIP 1.415
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Scopus rating (2006): SJR 1.32 SNIP 1.194
Scopus rating (2005): SJR 1.278 SNIP 1
Longitudinal assessment of clinically isolated syndrome with diffusion tensor imaging and volumetric MRI

The potential of diffusion tensor imaging (DTI) indices and volumes of focal lesions on conventional magnetic resonance imaging to predict conversion to multiple sclerosis (MS) was analyzed in subjects with clinically isolated syndrome (CIS) over 4 years. Twenty patients with CIS and 10 healthy controls were included in the study. The data showed an association between the volumes of T1 and fluid-attenuated inversion recovery (FLAIR) lesions and conversion to MS (T1: P= .02; FLAIR: P= .02). The worsening of DTI indices (mean diffusivity and fractional anisotropy) was primarily seen in patients progressing to MS, but clear-cut association with conversion could not be detected.
Dynamics of intracranial electroencephalographic recordings from epilepsy patients using univariate and bivariate recurrence networks

Recently Andrezejak et al. combined the randomness and nonlinear independence test with iterative amplitude adjusted Fourier transform (iAAFT) surrogates to distinguish between the dynamics of seizure-free intracranial electroencephalographic (EEG) signals recorded from epileptogenic (focal) and nonepileptogenic (nonfocal) brain areas of epileptic patients. However, stationarity is a part of the null hypothesis for iAAFT surrogates and thus nonstationarity can violate the null hypothesis. In this work we first propose the application of the randomness and nonlinear independence test based on recurrence network measures to distinguish between the dynamics of focal and nonfocal EEG signals. Furthermore, we combine these tests with both iAAFT and truncated Fourier transform (TFT) surrogate methods, which also preserves the nonstationarity of the original data in the surrogates along with its linear structure. Our results indicate that focal EEG signals exhibit an increased degree of structural complexity and interdependency compared to nonfocal EEG signals. In general, we find higher rejections for randomness and nonlinear independence tests for focal EEG signals compared to nonfocal EEG signals. In particular, the univariate recurrence network measures, the average clustering coefficient C and assortativity R, and the bivariate recurrence network measure, the average cross-clustering coefficient Ccross, can successfully distinguish between the focal and nonfocal EEG signals, even when the analysis is restricted to nonstationary signals, irrespective of the type of surrogates used. On the other hand, we find that the univariate recurrence network measures, the average path length L, and the average betweenness centrality BC fail to distinguish between the focal and nonfocal EEG signals when iAAFT surrogates are used. However, these two measures can distinguish between focal and nonfocal EEG signals when TFT surrogates are used for nonstationary signals. We also report an improvement in the performance of nonlinear prediction error N and nonlinear interdependence measure L used by Andrezejak et al., when TFT surrogates are used for nonstationary EEG signals. We also find that the outcome of the nonlinear independence test based on the average clustering coefficient Ccross is independent of the outcome of the randomness test based on the average clustering coefficient C. Thus, the univariate and bivariate recurrence network measures provide independent information regarding the dynamics of the focal and nonfocal EEG signals. In conclusion, recurrence network analysis combined with nonstationary surrogates can be applied to derive reliable biomarkers to distinguish between epileptogenic and nonepileptogenic brain areas using EEG signals.
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Unobtrusive Monitoring of Heart Rate and Respiration Rate during Sleep
Sleep deprivation has various adverse psychological and physiological effects. The effects range from decreased vigilance causing an increased risk of e.g. traffic accidents to a decreased immune response causing an increased risk of falling ill. Prevalence of the most common sleep disorder, insomnia can be, depending on the study, as high as 30 % in adult population. Physiological information measured unobtrusively during sleep can be used to assess the quantity and the quality of sleep by detecting sleeping patterns and possible sleep disorders. The parameters derived from the signals measured with unobtrusive sensors may include all or some of the following: heartbeat intervals, respiration cycle lengths, and movements. The information can be used in wellness applications that include self-monitoring of the sleep quality or it can also be used for the screening of sleep disorders and in following-up of the effect of a medical treatment. Unobtrusive sensors do not cause excessive discomfort or inconvenience to the user and are thus suitable for long-term monitoring. Even though the monitoring itself does not solve the sleeping problems, it can encourage the users to pay more attention on their sleep. While unobtrusive sensors are convenient to use, their common drawback is that the quality of the signals they produce is not as good as with conventional measurement methods. Movement artifacts, for example, can make the detection of the heartbeat intervals and respiration impossible. The accuracy and the availability of the physiological information extracted from the signals however depend on the measurement principle and the signal analysis methods used. Three different measurement systems were constructed in the studies included in the thesis and signal processing methods were developed for detecting heartbeat intervals and respiration cycle lengths from the measured signals. The performance of the measurement systems and the signal analysis methods were evaluated separately for each system with healthy young adult subjects. The detection of physiological information with the three systems was based on the measurement of ballistocardiographic and respiration movement signals with force sensors placed under the bedposts, the measurement of electrocardiographic (ECG) signal with textile electrodes attached to the bed sheet, and the measurement of the ECG signal with non-contact capacitive electrodes. Combining the information produced by different measurement methods for improving the detection performance was also tested. From the evaluated methods, the most accurate heartbeat interval information was obtained with contact electrodes attached to the bed sheet. The same method also provided the highest heart rate detection coverage. This monitoring method, however, has a limitation that it requires a naked upper body, which is not necessarily acceptable for everyone. For respiration cycle length detection, better results were achieved by using signals recorded with force sensors placed under a bedpost than when extracting the respiration information from the ECG signal recorded with textile bed sheet electrodes. From the data quality point of view, an ideal night-time physiological monitoring system would include a contact ECG measurement for the heart rate monitoring and force sensors for the respiration monitoring. The force sensor signals could also be used for movement detection.

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Authors: Vehkaoja, A.
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Publication information
Thermal transport characteristics of human skin measured in vivo using ultrathin conformal arrays of thermal sensors and actuators

Measurements of the thermal transport properties of the skin can reveal changes in physical and chemical states of relevance to dermatological health, skin structure and activity, thermoregulation and other aspects of human physiology. Existing methods for in vivo evaluations demand complex systems for laser heating and infrared thermography, or they require rigid, invasive probes; neither can apply to arbitrary regions of the body, offers modes for rapid spatial mapping, or enables continuous monitoring outside of laboratory settings. Here we describe human clinical studies using mechanically soft arrays of thermal actuators and sensors that laminate onto the skin to provide rapid, quantitative in vivo determination of both the thermal conductivity and thermal diffusivity, in a completely non-invasive manner. Comprehensive analysis of measurements on six different body locations of each of twenty-five human subjects reveal systematic variations and directional anisotropies in the characteristics, with correlations to the thicknesses of the epidermis (EP) and stratum corneum (SC) determined by optical coherence tomography, and to the water content assessed by electrical impedance based measurements. Multivariate statistical analysis establishes four distinct locations across the body that exhibit different physical properties: heel, cheek, palm, and wrist/volar forearm/dorsal forearm. The data also demonstrate that thermal transport correlates negatively with SC and EP thickness and positively with water content, with a strength of correlation that varies from region to region, e.g., stronger in the palmar than in the follicular regions.
Integrated in vitro-in silico screening strategy for the discovery of antibacterial compounds

Multidrug-resistant bacterial infections are an increasing source of healthcare problems, and the research for new antibiotics is currently unable to respond to this challenge. In this work, we present a screening strategy that integrates cell-based high-throughput screening (HTS) with in silico analogue search for antimicrobial small-molecule drug discovery. We performed an HTS on a diverse chemical library by using an assay based on a bioluminescent Escherichia coli K-12 (pTetLux1) strain. The HTS yielded eight hit compounds with >50% inhibition. These hits were then used for structural similarity-based virtual screening, and of the 29 analogues selected for in vitro testing, four compounds displayed potential activity in the pTetLux1 assay. The 11 most active compounds from combined HTS and analogue search were further assessed for antimicrobial activity against clinically important strains of E. coli and Staphylococcus aureus and for in vitro cytotoxicity against human cells. Three of the compounds displayed antibacterial activity and low human cell cytotoxicity. Additionally, two compounds of the set fully inhibited S. aureus growth after 24 h, but also exhibited human cell cytotoxicity in vitro.

General information

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Scopus rating (2012): SJR 0.828 SNIP 0.651 CiteScore 1.07
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Scopus rating (2007): SJR 0.777 SNIP 0.577
Scopus rating (2006): SJR 1.015 SNIP 0.78
Passive pumping using gravity-driven flow is a fascinating approach for microfluidic systems. When designing a passive pumping system, generated flow rates should be known precisely. While reported models used to estimate the flow rates do not usually consider capillary forces, this paper shows that their exclusion is unrealistic in typical gravity-driven systems. Therefore, we propose a new analytical model to estimate the generated flow rates. An extensive set of measurements is used to verify that the proposed model provides a remarkably more precise approximation of the real flow rates compared to the previous models. It is suggested that the developed model should be used when designing a gravity-driven pumping system.
Micro CT visualization of silver nanoparticles in the middle and inner ear of rat and transportation pathway after transtympanic injection

Background: Silver nanoparticles (Ag NPs) displayed strong activities in anti-bacterial, anti-viral, and anti-fungal studies and were reportedly efficient in treating otitis media. Information on distribution of AgNPs in different compartments of the ear is lacking.

Objective: To detect distribution of Ag NPs in the middle and inner ear and transportation pathways after transtympanic injection.

Methods: Contrast effect of Ag NPs in the micro CT imaging was assessed in a phantom. AgNPs at various concentrations (1.85 mM, 37.1 mM, and 370.7 mM) were administered to rat middle ear using transtympanic injection and cadaver heads were imaged using micro CT at several time points.

Results: The lowest concentration of Ag NPs that could be visualized using micro CT was 37.1 mM. No difference was observed between the solvents, deionized H2O and saline. Ag NPs at 37.1 mM were visible in the middle ear on 7 d post-administration. Ag NPs at 370.7 mM generated signals in the middle ear, ossicular chain, round window membrane, oval window, scala tympani, and Eustachian tube for both 4 h and 24 h time points. A gradient distribution of Ag NPs from the middle ear to the inner ear was detected. The pathways for Ag NPs to be transported from the middle ear into the inner ear are round and oval windows.

Conclusion: This study provided the imaging evidence that Ag NPs are able to access the inner ear in a dose-dependent manner after intratympanic administration, which is relevant to design the delivery concentration in the future clinic application in order to avoid adverse inner ear effect.
Scopus rating (2009): SJR 1.478 SNIP 1.289
Scopus rating (2008): SJR 1.364 SNIP 1.181
Scopus rating (2007): SJR 1.455 SNIP 1.868
Scopus rating (2006): SJR 1.065 SNIP 1.509
Scopus rating (2005): SJR 0.696 SNIP 0.816
Scopus rating (2004): SJR 0.446 SNIP 0.555
Original language: English
Keywords: Silver nanoparticles, Micro CT, Ear, Animal, Pathway, CHRONIC OTITIS-MEDIA, SENSORINEURAL HEARING-LOSS, BACTERIAL BIOFILMS, TOMOGRAPHY, GADOLINIUM, CHILDREN
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Source: WOS
Source-ID: 000351128900001
Research output: Scientific - peer-review › Article

Classification of iPSC colony images using hierarchical strategies with support vector machines
In this preliminary research we examine the suitability of hierarchical strategies of multi-class support vector machines for classification of induced pluripotent stem cell (iPSC) colony images. The iPSC technology gives incredible possibilities for safe and patient specific drug therapy without any ethical problems. However, growing of iPSCs is a sensitive process and abnormalities may occur during the growing process. These abnormalities need to be recognized and the problem returns to image classification. We have a collection of 80 iPSC colony images where each one of the images is prelabeled by an expert to class bad, good or semigood. We use intensity histograms as features for classification and we evaluate histograms from the whole image and the colony area only having two datasets. We perform two feature reduction procedures for both datasets. In classification we examine how different hierarchical constructions effect the classification. We perform thorough evaluation and the best accuracy was around 54% obtained with the linear kernel function. Between different hierarchical structures, in many cases there are no significant changes in results. As a result, intensity histograms are a good baseline for the classification of iPSC colony images but more sophisticated feature extraction and reduction methods together with other classification methods need to be researched in future.

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Organisations: Department of Electronics and Communications Engineering, Research group: Computational Biophysics and Imaging Group, BioMediTech, Augmented Human Activities (AHA), Integrated Technologies for Tissue Engineering Research (ITTE), University of Tampere
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Research output: Scientific - peer-review › Conference contribution

A motion artifact generation and assessment system for the rapid testing of surface biopotential electrodes
Dry electrodes can reduce cost while increasing the usability and comfort of wearable monitoring systems. They are, however, susceptible to motion artifacts. The present electrode testing methods lack reliability and do not separate the factors that affect the motion artifact. In this paper, we introduce a first generation motion artifact generation and assessment system that generates the speed, amplitude, and pattern-wise programmable movement of the electrode. The system simultaneously measures electrode-skin impedance, the motion artifact, and one channel of an electrocardiogram that contains the motion artifact and monitors the mounting force applied to the electrode. We demonstrate the system by comparing the applied movement and the measured signals for electrode movements up to 6 mm and movement frequencies from 0.4 Hz to 4 Hz. Results show that the impedance change and surface potential are visually clearly related to the applied motion, with average correlations of 0.89 and 0.64, respectively. The applied force, electrode
location, and electrode structure all affect the motion artifact. The setup enables the motion of the electrode to be accurately controlled. The system can be used as a precursor to the testing of integrated systems because it enables thorough, repeatable, and robust motion artifact studies. The system allows a deeper insight into motion artifacts and the interplay of the various factors that affect them.

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Authors: Cömert, A., Hyttinen, J.  
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Scopus rating (2013): SJR 0.751 SNIP 1.678 CiteScore 2.25  
Scopus rating (2012): SJR 0.576 SNIP 1.285 CiteScore 2  
Scopus rating (2011): SJR 0.654 SNIP 1.252 CiteScore 2.19  
Scopus rating (2010): SJR 0.619 SNIP 1.544  
Scopus rating (2009): SJR 0.622 SNIP 1.445  
Scopus rating (2008): SJR 0.675 SNIP 1.342  
Scopus rating (2007): SJR 0.892 SNIP 1.402  
Scopus rating (2006): SJR 0.797 SNIP 1.3  
Scopus rating (2005): SJR 0.59 SNIP 1.13  
Scopus rating (2004): SJR 0.501 SNIP 1.047  
Scopus rating (2003): SJR 0.591 SNIP 0.958  
Scopus rating (2002): SJR 0.592 SNIP 0.975  
Scopus rating (2001): SJR 0.36 SNIP 1.016  
Scopus rating (2000): SJR 0.355 SNIP 0.882  
Scopus rating (1999): SJR 0.428 SNIP 0.901  
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ASJC Scopus subject areas: Biophysics, Physiology, Physiology (medical)  
DOIs:  
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Source: Scopus  
Source-ID: 84918511064  
Research output: Scientific - peer-review › Article

**Fatigue behaviour of nickel- and cobalt-based laser cladded coatings on steel bars**

Laser cladding allows the manufacturing of thick, dense and fusion bonded low diluted coatings, permitting its application in industry fields that require wear and corrosion protection. On the other hand, large residual stresses on the coating layer and noticeable changes in the substrate material may affect mechanical properties and fatigue strength. In this study, high load four-point bending fatigue tests were conducted, comparing the results to those of the substrate material alone and post-weld heat treated components. The fatigue test results were displayed with Wöhler curves. Two different substrate/coating couples are studied in this work: mild steel S355-J2 coated with Stellite21cobalt based hard-facing alloy, and low-alloy steel 42CrMo4 coated with Inconel625 nickel based super alloy. In order to better define how the features of the materials change with the cladding direction and the post weld heat treatment, the specimens were analysed by SEM/EDS; verifying the presence of defects, and how dilution changes along the cladding direction. Chemical etched samples were observed by optical microscope to assess the effect of the laser treatment on materials microstructures.
Hardness measurements and depth sensing nanoindentations are performed to evaluate mechanical properties of coatings, HAZ and substrate. After fatigue failure, every fractured surface was separated from the fatigue specimen and analysed by stereo microscope, SEM and EDS in order to identify the reasons and the mechanisms of the failure.

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Organisations: Department of Materials Science, Research group: Surface Engineering
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**Bibliographical note**
Research output: Scientific - peer-review › Conference contribution

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1180 nm CW VECSEL emitting 50 W

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Research output: Scientific - peer-review › Conference contribution

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A fast stimulability screening protocol for neuronal cultures on microelectrode arrays

Microelectrode arrays (MEAs) are used to study the electrical activity in brain slices and neuronal cultures. MEA experiments for the analysis of electrical stimulation responses require the tissue or culture to be prone to stimulation. For brain slices, potential stimulation sites may be directly visible in microscope, in which case the determination of stimulability at those locations is sufficient. In unstructured neuronal cultures, potential stimulation sites may not be known a priori, and spatial stimulability screening should be performed. Considering, e.g., 59 microelectrode sites, each to be stimulated several times, may result in long screening times, unacceptable with a MEA system without an integrated CO2 incubator, or in high stimulation effects on the networks. Here, we describe an implementation of a fast stimulation protocol employing pseudorandom stimulation site switching aiming at alleviating the network effects of the stimulability screening. In this paper, we show the usability of the proposed protocol by first detecting stimulable locations and subsequently apply repeated stimulation on the identified potentially stimulable locations to observe an exemplary neuronal pathway.

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Authors: Kapucu, F. E., Tanskanen, J. M., Yuan, Y., Hyttinen, J. A.
Number of pages: 4
Pages: 3440-3443
Publication date: 2015
Age dependence of arterial pulse wave parameters extracted from dynamic blood pressure and blood volume pulse waves

Atherosclerosis is a significant cause of mortality in the aged population, and it affects arterial wall properties causing differences in measured arterial pulse wave (PW). In this study, both dynamic arterial blood pressure PWs and blood volume PWs are analyzed. The PWs are recorded noninvasively from multiple measurement points from the upper and lower limbs from 52 healthy (22-90-year-old) volunteers without known cardiovascular diseases. For each signal, various parameters earlier proposed in the literature are computed, and 25 different novel parameters are formed by combining these parameters. The results are evaluated in terms of age and heart rate (HR) dependence of the parameters. In general, the results show that 14 out of 25 tested combined parameters have stronger age dependence than any of the individual parameters. The highest obtained linear correlation coefficients between the age and combined parameter and individual parameter equal to 0.85 (p < 10-4) and 0.79 (p < 10-4), respectively. Most of the combined parameters have also improved discrimination capability when classifying the test subjects into different age groups. This is a promising result for further studies, but indicate that the age dependence of the parameters must be taken into account in further studies with atherosclerotic patients.
Comparison of HRV parameters derived from photoplethysmography and electrocardiography signals

Heart rate variability (HRV) has become a useful tool in analysis of cardiovascular system in both research and clinical fields. HRV has been also used in other applications such as stress level estimation in wearable devices. HRV is normally obtained from ECG as the time interval of two successive R waves. Recently PPG has been proposed as an alternative for ECG in HRV analysis to overcome some difficulties in measurement of ECG. In addition, PPG-HRV is also used in some commercial devices such as modern optical wrist-worn heart rate monitors. However, some researches have shown that PPG is not a surrogate for heart rate variability analysis. In this work, HRV analysis was applied on beat-to-beat intervals obtained from ECG and PPG in 19 healthy male subjects. Some important HRV parameters were calculated from PPG-HRV and ECG-HRV. Maximum of PPG and its second derivative were considered as two methods for obtaining the beat-to-beat signals from PPG and the results were compared with those achieved from ECG-HRV. Our results show that the smallest error happens in SDNN and SD2 with relative error of 2.46% and 2%, respectively. The most affected parameter is pNN50 with relative error of 29.89%. In addition, in our trial, using the maximum of PPG gave better results than its second derivative.
Computer vision for virus image classification

In this paper we present a new ensemble of descriptors for the classification of transmission electron microscopy images of viruses that is based on texture analysis. A set of six well-assessed texture descriptors, namely Local Binary Pattern (LBP), Local Ternary Pattern (LTP), Dense LBP (DLBP), Rotation Invariant co-occurrence among LBP (RI), Local Phase Quantization (LPQ), and LBP Histogram Fourier (LHF), are combined with innovative approaches to improve their performances in virus classification. To generate new variants of the aforementioned descriptors, different approaches are applied: (i) the Edge approach (ED), which extracts the textural information from specific regions of the image instead of from the original image; (ii) the Bag of Features (BOF) scheme, which is used to build vocabularies of the most representative patterns; and (iii) Multi-Quinary coding (MQ). Moreover, to demonstrate the generalizability and applicability of ED and BOF, they are tested on additional datasets containing subcellular parts and tissues. We observe that ED improves the performance of the single standard descriptors, while BOF is particularly effective in fusion by sum rule with the standard application of texture descriptors (i.e., when they are extracted from the entire image). In contrast, the combination of MQ with LHF, DLBP, and RI does not improve virus classification. Using these results, we suggest a new ensemble of descriptors called NewF, which is based on the best methods investigated in this paper, as well as on some other state-of-the-art descriptors. NewF accuracy in virus classification is 85.7%, outperforming previous methods proposed in the literature for the same task (i.e., virus classification using the object scale dataset). The MATLAB code for our methods and NewF descriptor are available at https://www.dei.unipd.it/node/2357.
Controlling cell migration and adhesion into a scaffold by external electric currents

Fabrication of more complex tissue-engineered structures, resembling the tissues and organs in vivo requires combining more than one cell type within the same construct. This can be achieved by designing and fabricating complex scaffolds with asymmetric properties but controlled arrangement of cells within the scaffold could also be realized by using electric current. External electric currents are able to modify cell adhesion, orientation and migration and this can be used for influencing cell location within a scaffold. In this paper we studied the effect of an electric current on cell migration and adhesion into a three-dimensional scaffold through a conductive mesh.
Data Correction for Seven Activity Trackers based on Regression Models

Using an activity tracker for measuring activity-related parameters, e.g. steps and energy expenditure (EE), can be very helpful in assisting a person’s fitness improvement. Unlike the measuring of number of steps, an accurate EE estimation requires additional personal information as well as accurate velocity of movement which is hard to achieve due to inaccuracy of sensors. In this paper, we have evaluated regression-based models to improve the precision for both steps and EE estimation. For this purpose, data of seven activity trackers and two reference devices was collected from 20 young adult volunteers wearing all devices at once in three different tests, namely 60-minute office work, 6-hour overall activity and 60-minute walking. Reference data is used to create regression models for each device and relative percentage errors of adjusted values are then statistically compared to that of original values. The effectiveness of regression models are determined based on the result of a statistical test. During a walking period, EE measurement was improved in all devices. The step measurement was also improved in five of them. The results show that improvement of EE estimation is possible only with low-cost implementation of fitting model over the collected data e.g. in the app or in corresponding service back-end.

Detection of exercise load-associated differences in hip muscles by texture analysis

We examined whether specific physical exercise loading is associated with texture parameters from hip muscles scanned with magnetic resonance imaging (MRI). Ninety-one female athletes representing five distinct exercise-loading groups (high-impact, odd-impact, low-impact, nonimpact and high-magnitude) and 20 nonathletic female controls underwent MRI of the hip. Texture parameters were computed from the MRI images of four hip muscles (gluteus maximus, gluteus medius, iliopsoas and obturator internus). Differences in muscle texture between the athlete groups and the controls were evaluated using Mann-Whitney U-test. Significant (P<0.05) textural differences were found between the high-impact (triple and high jumpers) and the control group in gluteus medius, iliopsoas and obturator internus. Differences in muscle texture between the athlete groups and the controls were evaluated using Mann-Whitney U-test. Significant (P<0.05) textural differences were found between the high-impact (triple and high jumpers) and the control group in gluteus medius, iliopsoas and obturator internus muscles. Texture of the gluteus maximus, gluteus medius and obturator internus muscles differed significantly between the odd impact (soccer and squash players) and the control group. Textures of all studied muscles differed significantly between the low impact (endurance runners) and the controls. Only the gluteus medius muscle differed significantly between the nonimpact (swimmers) and the controls. No significant difference in muscle texture was found between the high-magnitude (powerlifters) and the control group. In conclusion, MRI texture analysis provides a quantitative method capable of detecting textural differences in hip muscles that are associated with specific types of long-term exercise loadings.
Effects of sensor type and sensor location on signal quality in bed mounted ballistocardiographic heart rate and respiration monitoring

Sleeping is a crucial part of our circadian rhythm and the quality of sleep has substantial impact on the quality of life in general and the overall well-being of a person. That is why sleep related physiological measurements have been in the focus of many scientific studies along the years, and why a large number of different measurement methods have been developed for this purpose. The ability to monitor heart rate respiration without any sensors or electrodes being directly attached to the body is extremely useful especially in long-term monitoring and it allows automated daily measurements without any medical staff present. This is the reason why ballistocardiographic force sensors and accelerometers have been introduced alongside electrocardiography (ECG) and thermistors or respiration belts as a means to monitor the heart rate and respiration during sleep. While ECG remains as the most reliable and accurate method for heart rate monitoring, the development of unobtrusive monitoring methods has improved to the point where the commercialization of such sleep monitoring systems has been possible. In this paper, the signals of five sensors and sensor placement combinations for measuring physiological parameters from a sleeping person are evaluated and compared in terms of their measurement sensitivities and waveform quality. The sensors are accelerometer and film type force sensors made of PVDF and EMFi material placed under the mattress topper and PVDF and EMFi sensors placed under the bed posts.
Human induced pluripotent stem cell-derived versus adult cardiomyocytes: an in silico electrophysiological study on ionic current block effects

Background and purpose.

Two new technologies hold the promise to revolutionize cardiac safety and drug development: in vitro experiments on human induced pluripotent stem cell-derived cardiomyocytes (hiPSC-CMs) and in silico human adult ventricular cardiomyocyte (hAdultV-CM) models. Their combination was recently proposed as a potential replacement for the present hERG-based QT study in safety pharmacology assessment. Here, we systematically compare in silico the effects of selective ionic current block on hiPSC-CM and hAdultV-CM action potentials (APs), to identify similarities/differences and to illustrate the potential of computational models as supportive tools for evaluating new in vitro technologies.

Experimental approach.

In silico AP models of ventricular-like and atrial-like hiPSC-CMs and hAdultV-CM are used to simulate the main effects of four degrees of block of the main cardiac transmembrane currents.

Key results.

Qualitatively, hiPSC-CM and hAdultV-CM APs show similar responses to current block, consistent with experiments. However, quantitatively, hiPSC-CMs display stronger sensitivities to block of (i) L-type Ca^2+ current due to the overexpression of the Na^+-Ca^2+ exchanger (leading to shorter APs) and (ii) inward rectifier K^+ current due to reduced repolarization reserve (inducing diastolic potential depolarization and repolarization failure).

Conclusions and Implications.

In silico hiPSC-CMs and hAdultV-CMs exhibit similar response to selective current blocks. However, overall hiPSC-CMs show greater sensitivity to block, which may facilitate in vitro identification of drug-induced effects. Extrapolation of drug effects from hiPSC-CM to hAdultV-CM and pro-arrhythmic risk assessment can be facilitated by in silico predictions using biophysically-based computational models.

Keywords

hiPSC-derived cardiomyocytes, in silico models, action potential, cardiotoxicity assessment.
Impedanssipneumografia pienten lasten alahengitytiesoireiden selvityyssä

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Authors: Seppä, V., Pelkonen, A. S., Kotaniemi-Syrjänen, A., Viik, J., Mäkelä, M. J., Malmberg, P.
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Infant respiration and heart rate monitoring with EMFi sensor

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Research output: Scientific - peer-review › Conference contribution

Integration of microfluidic sample delivery system on silicon nanowire-based biosensor

Silicon nanowire-based (SiNW) biosensors have gained a lot of attention during recent years. However, studies often totally neglect, or only briefly describe, the incorporation of microfluidic channel into the sensor architecture, although it is a crucial step towards a real lab-on-chip device. This paper proposes a process that can be applied to integration of microfluidic sample delivery system onto different SiNW biosensors. The sample delivery system includes a hydrophilic channel that enables the use of capillary action in delivering sample directly onto the sensor array, which leads to reduced sample loss, faster detection process, and frees from the use of external pumps. In addition, the microfluidic channel system protects the fragile SiNWs from mechanical shocks, chemical spatters, and dust. The sample delivery system was fabricated of surface treated polydimethylsiloxane (PDMS), using a four-step approach, as follows: (1) master molds for soft lithography were etched onto Si. (2) PDMS replicas of the molds were fabricated and (3) bonded onto example sensor
(4) Oxygen plasma treatment also enabled the attachment of polyvinylpyrrolidone (PVP) to the sample channel surfaces to synthesize hydrophilic polymer coating. A contact angle for the PVP treated PDMS was 21° after 17 days, indicating the formation of a long-term hydrophilic PDMS surface. Finally, the example SiNW sensor is modified to allow direct real-time detection of thyroid-stimulating hormone (TSH). The sensor was able to detect as low TSH concentration values as 0.5 mIU/L, which indicates a successfully integrated sample delivery system.

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Scopus rating (2009): SJR 0.535 SNIP 0.988
Scopus rating (2008): SJR 0.557 SNIP 1.085
Scopus rating (2007): SJR 0.59 SNIP 0.905
Scopus rating (2006): SJR 0.443 SNIP 0.733
Scopus rating (2005): SJR 0.465 SNIP 1.009
Scopus rating (2004): SJR 0.39 SNIP 0.812
Scopus rating (2003): SJR 0.362 SNIP 1.022
Scopus rating (2002): SJR 0.255 SNIP 0.762
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Research output: Scientific - peer-review › Article

Is 50 Hz high enough ECG sampling frequency for accurate HRV analysis?
With the worldwide growth of mobile wireless technologies, healthcare services can be provided at anytime and anywhere. Usage of wearable wireless physiological monitoring system has been extensively increasing during the last decade. These mobile devices can continuously measure e.g. the heart activity and wirelessly transfer the data to the mobile phone of the patient. One of the significant restrictions for these devices is usage of energy, which leads to requiring low sampling rate. This article is presented in order to investigate the lowest adequate sampling frequency of ECG signal, for achieving accurate enough time domain heart rate variability (HRV) parameters. For this purpose the ECG signals originally measured with high 5 kHz sampling rate were down-sampled to simulate the measurement with lower sampling rate. Down-sampling loses information, decreases temporal accuracy, which was then restored by interpolating the signals to their original sampling rates. The HRV parameters obtained from the ECG signals with lower sampling rates were compared. The results represent that even when the sampling rate of ECG signal is equal to 50 Hz, the HRV parameters...
are almost accurate with a reasonable error.

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**Bibliographical note**
AUX=orc,"Jeyhani, Vala"
AUX=orc,"Mahdiani, Shadi"
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Source-ID: urn:AE3F93F9C20623036AB8EBBC01FEB932
Research output: Scientific - peer-review › Conference contribution

**Joint analysis of extracellular spike waveforms and neuronal network bursts**
Background: Neuronal networks are routinely assessed based on extracellular electrophysiological micro electrode array (MEA) measurements by spike sorting, and spike and burst statistics. We propose to jointly analyze sorted spikes and detected bursts, and hypothesize that the obtained spike type compositions of the bursts can provide new information on the functional networks.

New method: Spikes are detected and sorted to obtain spike types and bursts are detected. In the proposed joint analysis, each burst spike is associated with a spike type, and the spike type compositions of the bursts are assessed.

Results: The proposed method was tested with simulations and MEA measurements of in vitro human stem cell derived neuronal networks under different pharmacological treatments. The results show that the treatments altered the spike type compositions of the bursts. For example, 6-cyano-7-nitroquinoxaline-2,3-dione almost completely abolished two types of spikes which had composed the bursts in the baseline, while bursts of spikes of two other types appeared more frequently. This phenomenon was not observable by spike sorting or burst analysis alone, but was revealed by the proposed joint analysis.

Comparison with existing methods: The existing methods do not provide the information obtainable with the proposed method: for the first time, the spike type compositions of bursts are analyzed.

Conclusions: We showed that the proposed method provides useful and novel information, including the possible changes in the spike type compositions of the bursts due to external factors. Our method can be employed on any data exhibiting sortable action potential waveforms and detectable bursts. (C) 2015 Elsevier B.V. All rights reserved.

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Peer-reviewed: Yes
Methods for in vitro functional analysis of iPSC derived cardiomyocytes — Special focus on analyzing the mechanical beating behavior

Abstract A rapidly increasing number of papers describing novel iPSC models for cardiac diseases are being published. To be able to understand the disease mechanisms in more detail, we should also take the full advantage of the various methods for analyzing these cell models. The traditionally and commonly used electrophysiological analysis methods have been recently accompanied by novel approaches for analyzing the mechanical beating behavior of the cardiomyocytes. In this review, we provide first a concise overview on the methodology for cardiomyocyte functional analysis and then concentrate on the video microscopy, which provides a promise for a new faster yet reliable method for cardiomyocyte functional analysis. We also show how analysis conditions may affect the results. Development of the methodology not only serves the basic research on the disease models, but could also provide the much needed efficient early phase screening method for cardiac safety toxicology. This article is part of a Special Issue entitled: Cardiomyocyte Biology: Integration of Developmental and Environmental Cues in the Heart edited by Marcus Schaub and Hughes Abriel.
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Research output: Scientific - peer-review › Article

Microcomputed Tomography–Based Assessment of Retrieved Dental Implants

General information
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Organisations: Department of Electronics and Communications Engineering, Research group: Computational Biophysics and Imaging Group
Authors: Narra, N., Antalainen, A., Zipprich, H., Sándor, G. K., Wolff, J.
Number of pages: 7
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Scopus rating (2014): SJR 1.405 SNIP 0.91 CiteScore 1.57
Scopus rating (2013): SJR 1.157 SNIP 1.218 CiteScore 1.6
Scopus rating (2012): SJR 2.163 SNIP 1.629 CiteScore 2.49
Scopus rating (2011): SJR 1.389 SNIP 1.278 CiteScore 1.76
Scopus rating (2010): SJR 1.586 SNIP 1.322
Scopus rating (2009): SJR 1.534 SNIP 1.485
Scopus rating (2008): SJR 1.949 SNIP 1.639
Scopus rating (2007): SJR 1.601 SNIP 1.424
Scopus rating (2006): SJR 1.533 SNIP 1.391
Scopus rating (2005): SJR 1.536 SNIP 1.258
Scopus rating (2004): SJR 1.449 SNIP 1.478
MR image texture in Parkinson's disease: A longitudinal study

Background: Few of the structural changes caused by Parkinson's disease (PD) are visible in magnetic resonance imaging (MRI) with visual inspection but there is a need for a method capable of observing the changes beyond the human eye. Texture analysis offers a technique that enables the quantification of the image gray-level patterns. Purpose: To investigate the value of quantitative image texture analysis method in diagnosis and follow-up of PD patients. Material and Methods: Twenty-six PD patients underwent MRI at baseline and after 2 years of follow-up. Four co-occurrence matrix-based texture parameters, describing the image homogeneity and complexity, were calculated within clinically interesting areas of the brain. In addition, correlations with clinical characteristics (Unified Parkinson's Disease Rating Scales I-III and Mini-Mental State Examination score) along with a comparison to healthy controls were evaluated. Results: Patients at baseline and healthy volunteers differed in their brain MR image textures mostly in the areas of substantia nigra pars compacta, dentate nucleus, and basilar pons. During the 2-year follow-up of the patients, textural differences appeared mainly in thalamus and corona radiata. Texture parameters in all the above mentioned areas were also found to be significantly related to clinical scores describing the severity of PD. Conclusion: Texture analysis offers a quantitative method for detecting structural changes in brain MR images. However, the protocol and repeatability of the method must be enhanced before possible clinical use.
Piezoelectric sensitivity measurements of cellulose nanofibril sensors

Piezoelectric sensitivity of cellulose nanofibril (CNF) film sensors was measured using a mechanical shaker and charge amplifier setup. In-house fabricated CNF film sensors showed 5-7 pC/N sensitivity in ambient conditions. The CNF film used here contained randomly oriented fibrils, and the piezoelectric response is expected to increase remarkably after film polarization and fibril alignment. The results obtained in this study suggest that nanocellulose film is a suitable sensor material for applications in various fields such as material sciences, electronics and biomedical diagnostics.

General information
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Ministry of Education publication type: A4 Article in a conference publication
Authors: Rajala, S., Vuoriluoto, M., Rojas, O., Franssila, S., Tuukkanen, S.
Number of pages: 5
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Bibliographical note
xoa ei tarkistettu
Research output: Scientific - peer-review › Conference contribution

Printed hybrid systems for healthcare

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Electronics and Communications Engineering, Research group: Laboratory for Future Electronics
Authors: Mäntysalo, M., Vuorinen, T., Nurmentaus, S.
Number of pages: 2
Pages: 8-9
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Publication information
Journal: OPE Journal
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Original language: English
Research output: Professional › Article
Quantification of the ionic current contributions to alterations in the action potential repolarization by means of piecewise-linear approximation

General information
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Organisations: Research group: Computational Biophysics and Imaging Group, Department of Electronics and Communications Engineering, BioMediTech
Authors: Paci, M., Hyttinen, J., Severi, S.
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Research output: Scientific - peer-review › Conference contribution

Quantification and automatized adaptive detection of in vivo and in vitro neuronal bursts based on signal complexity
In this paper, we propose employing entropy values to quantify action potential bursts in electrophysiological measurements from the brain and neuronal cultures. Conventionally in the electrophysiological signal analysis, bursts are quantified by means of conventional measures such as their durations, and number of spikes in bursts. Here our main aim is to device metrics for burst quantification to provide for enhanced burst characterization. Entropy is a widely employed measure to quantify regularity/complexity of time series. Specifically, we investigate the applicability and differences of spectral entropy and sample entropy in the quantification of bursts in in vivo rat hippocampal measurements and in in vitro dissociated rat cortical cell culture measurement done with microelectrode arrays. For the task, an automatized and adaptive burst detection method is also utilized. Whereas the employed metrics are known from other applications, they are rarely employed in the assessment of burst in electrophysiological field potential measurements. Our results show that the proposed metrics are potential for the task at hand.

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research group: Computational Biophysics and Imaging Group, Department of Electronics and Communications Engineering, BioMediTech, Integrated Technologies for Tissue Engineering Research (ITTE), Univ Jyvaskyla, University of Jyvaskyla, Dept Psychol
Authors: Kapucu, F. E., Mikkonen, J. E., Tanskanen, J. M. A., Hyttinen, J. A. K.
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DOIs: 10.1109/EMBC.2015.7319450
Source: RIS
Source-ID: urn:7F73D35386ED553E8FEC5AAACC8CC7DE
Research output: Scientific - peer-review › Conference contribution

Recurrence network analysis of multiple local field potential bands from the orofacial portion of primary motor cortex
Local field potentials (LFPs), which have been considered as aggregate signals that reflect activities of a large number of neurons in the cerebral cortex, have been observed to mediate gross functional activities of a relatively small volume of the brain tissues. Historically there have been several frequency bands observed and defined across various brain areas.
However, detailed analysis, either spectral analysis or any dynamical analysis of LFPs particularly in the orofacial part of the primary motor cortex (MIo) has not been done before. Here, we recorded LFPs from MIo using an electrode array from a non-human primate during feeding behavior. Then we performed spectral analysis during the whole feeding sequences and to characterize temporal evolution of spectrum around the time of swallow cycles. The spectrogram over the β range showed dynamical change in its power around the swallow cycle onsets. We then characterized dynamical behaviors of LFPs over multiple bands, α, β, low γ, and high γ using two measures from the recurrence network (RN) method, network transitivity, T and average path length L. Temporal profile of T in α and β indicated that there was a sudden change in the dynamical properties around the swallow cycle onsets, while temporal profile of L indicated that a range of ~200 to ~150 ms and 200ms to the swallow cycle onsets exhibited large changes both in α and β ranges. Therefore, to further understand the involvement of cortical oscillation to behavior, particularly swallowing, the combination of traditional spectral methods and various dynamical methods such as RN method would be essential.

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Organisations: Department of Electronics and Communications Engineering, Research group: Computational Biophysics and Imaging Group, BioMediTech, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Subramaniyam, N. P., Hyttinen, J., Hatsopoulos, N. G., Ross, C. F., Takahashi, K.
Number of pages: 4
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DOIs: 10.1109/EMBC.2015.7319598
Source: RIS
Source-ID: urn:F7D2827B40D79243F0D448865482E3AA
Research output: Scientific - peer-review » Conference contribution

Regional impedance pneumography heterogeneity during airway opening pressure chirp oscillations

General information
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Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Physiological Measurement Systems and Methods Group, Tampere University of Technology
Authors: Garcia, J., Seppä, V., Viik, J.
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ASJC Scopus subject areas: Biomedical Engineering
Links:
Research output: Scientific - peer-review » Article

Some aspects of molecular physics in measuring tissue samples using enose for disease diagnostics

eNose technologies can be used for disease diagnostics. One technology is based on ionized molecules and their drifting speed in an electric field. Ionized molecules can be measured with ion mobility spectrometry and with electrical mobility measurements. Depending on the size scale of these molecules, different physical effects are relevant. We studied the relevance of size scale dependent physics for disease diagnostics.
Structural and mechanical implications of PMMA implant shape and interface geometry in cranioplasty – a finite element study

This computational study investigates the effect of shape (defect contour curvature) and bone-implant interface (osteotomy angle) on the stress distribution within PMMA skull implants. Using finite element methodology, 15 configurations - combinations of simplified synthetic geometric shapes (circular, square, triangular, irregular) and interface angulations - were simulated under 50N static loads. Furthermore, the implant fixation devices were modelled and analysed in detail. Negative osteotomy configurations demonstrated the largest stresses in the implant (275 MPa), fixation devices (1258 MPa) and bone strains (0.04). The circular implant with zero and positive osteotomy performed well with maximum observed magnitudes of - implant stress (1.2 MPa and 1.2 MPa), fixation device stress (11.2 MPa and 2.2 MPa), bone strain (0.218e-3 and 0.750e-4). The results suggest that the preparation of defect sites is a critical procedure. Of the greatest importance is the angle at which the edges of the defect are sawed. If under an external load, the implant has no support from the interface and the stresses are transferred to the fixation devices. This can endanger their material integrity and lead to unphysiological strains in the adjacent bone, potentially compromising the bone morphology required for anchoring. These factors can ultimately weaken the stability of the entire implant assembly. (C) 2015 European Association for Cranio-Maxillo-Facial Surgery. Published by Elsevier Ltd. All rights reserved.
The Combination of Electric Current and Copper Promotes Neuronal Differentiation of Adipose-Derived Stem Cells

Damage to the nervous system can be caused by several types of insults, and it always has a great effect on the life of an individual. Due to the limited availability of neural transplants, alternative approaches for neural regeneration must be developed. Stem cells have a great potential to support neuronal regeneration. Human adipose-derived stem cells (hADSCs) have gained increasing interest in the fields of regenerative medicine due to their multilineage potential and easy harvest compared to other stem cells. In this study, we present a growth factor-free method for the differentiation of hADSCs toward neuron-like cells. We investigated the effect of electric current and copper on neuronal differentiation. We analyzed the morphological changes, the mRNA and protein expression levels in the stimulated cells and showed that the combination of current and copper induces stem cell differentiation toward the neuronal lineage with elongation of the cells and the upregulation of neuron-specific genes and proteins. The induction of the neuronal differentiation of hADSCs by electric field and copper may offer a novel approach for stem cell differentiation and may be a useful tool for safe stem cell-based therapeutic applications.

General information
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Authors: Jaatinen, L., Salemi, S., Miettinen, S., Hyttinen, J., Eberli, D.
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Scopus rating (2015): SJR 1.179 SNIP 1.355 CiteScore 3.21
Scopus rating (2014): SJR 1.095 SNIP 1.521 CiteScore 3.29
Scopus rating (2013): SJR 1.257 SNIP 1.451 CiteScore 3.38
Scopus rating (2012): SJR 0.926 SNIP 1.242 CiteScore 2.77
Scopus rating (2011): SJR 0.863 SNIP 1.135 CiteScore 2.54
Scopus rating (2010): SJR 0.812 SNIP 1.266
Scopus rating (2009): SJR 0.892 SNIP 1.337
Scopus rating (2008): SJR 1.003 SNIP 1.268
Scopus rating (2007): SJR 1.073 SNIP 1.322
Scopus rating (2006): SJR 1.049 SNIP 1.283
Scopus rating (2005): SJR 0.802 SNIP 1.111
Scopus rating (2004): SJR 0.694 SNIP 1.214
Scopus rating (2003): SJR 0.355 SNIP 1.069
Scopus rating (2002): SJR 0.295 SNIP 0.911
Scopus rating (2001): SJR 0.282 SNIP 1.276
Scopus rating (2000): SJR 0.663 SNIP 0.956
Ultrathin Polyimide Membrane as Cell Carrier for Subretinal Transplantation of Human Embryonic Stem Cell Derived Retinal Pigment Epithelium

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Scopus rating (2015): SJR 1.414 SNIP 1.131 CiteScore 3.32
Scopus rating (2014): SJR 1.545 SNIP 1.141 CiteScore 3.54
Scopus rating (2013): SJR 1.74 SNIP 1.147 CiteScore 3.94
Scopus rating (2012): SJR 1.945 SNIP 1.142 CiteScore 4.15
Scopus rating (2011): SJR 2.369 SNIP 1.23 CiteScore 4.58
Scopus rating (2010): SJR 2.631 SNIP 1.161
Scopus rating (2009): SJR 2.473 SNIP 0.985
Scopus rating (2008): SJR 2.323 SNIP 0.96
Scopus rating (2007): SJR 1.289 SNIP 0.525
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VECSELs: Innovative light sources for PDT
Photodynamic therapy (PDT) with porphyrins and red light (610–630 nm) is finding increasing clinical application for both the eradication of relatively small tumors and the palliation of inoperable or obstructive tumors. PDT also shows some promise for the sterilization of the tumor bed after surgical removal of neoplastic masses. Optically pumped vertical external-cavity surface-emitting lasers (VECSELs) appear to be a very innovative and efficient technology in this specific wavelength range. Furthermore, VECSELs are power scalable and wavelength tunable, and are an appealing light source for PDT.

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Organisations: Optoelectronics Research Centre, Research group: Semiconductor Technology and Applications
Authors: Kantola, E. L., Leinonen, T. P., Penttinen, J., Korpipää, V., Mordon, S. R., Guina, M.
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W2E - Wellness Warehouse Engine for Semantic Interoperability of Consumer Health Data

Novel health monitoring devices and applications allow consumers easy and ubiquitous ways to monitor their health status. However, technologies from different providers lack both technical and semantic interoperability and hence the resulting health data is often deeply tied to a specific service, which is limiting its re-usability and utilization in different services. We have designed a Wellness Warehouse Engine (W2E) that bridges this gap and enables seamless exchange of data between different services. W2E provides interfaces to various data sources and makes data available via unified Representational State Transfer Application Programming Interface (REST API) to other services. Importantly, it includes Unifier – an engine that allows transforming input data into generic units re-usable by other services, and Analyzer – an engine that allows advanced analysis of input data, such as combining different data sources into new output parameters.

In this paper, we describe the architecture of W2E and demonstrate its applicability by using it for unifying data from four consumer activity trackers, using a test base of 20 subjects each carrying out three different tracking sessions. Finally, we discuss challenges of building a scalable Unifier engine for the ever-enlarging number of new devices.
Development and clinical application of impedance pneumography technique

Assessment of the lung function is essential in the diagnosis and management of respiratory disease such as asthma. However, conventional spirometry requires difficult manoeuvres from the subject and is thus unsuitable for young children and infants. This renders the diagnosis of childhood asthma often qualitative, time-consuming and clinically challenging. However, information relating to the lung function can be derived from restful tidal breathing (TB) as well. Traditionally TB has been recorded in short intervals in laboratory conditions with obtrusive instrumentation using a face mask or a mouth piece. The principal aim of this thesis was to develop a noninvasive and convenient, yet highly accurate method for recording TB over extended time periods for clinical purposes, especially in young children. The measurement methodology developed within this thesis is based on impedance pneumography (IP), where breathing is recorded through the respiratory variations of the electrical impedance of the thorax. This is established by placing four skin electrodes on the upper body and connecting them to a recording device. The main focus was in ensuring the accuracy of the IP-derived tidal flow recording as compared to direct measurement from the mouth. This was established by
attenuating the distortive cardiac oscillations (CGO) of the impedance signal and by optimising the locations of the skin electrodes. The complete method was then validated in healthy adults during respiratory loading (n=17) and in preschool children with wheezing disorder (n=20). The CGO attenuation was realised through an ensemble averaging based signal processing algorithm. The algorithm takes into account the respiratory modulation of the CGO waveform thus enabling efficient CGO attenuation while preserving the respiratory component of the signal unchanged. The newly proposed electrode configuration provides consistently more linear impedance to lung volume ratio than those previously established in the literature. The complete method integrating these developments provided highly accurate TB flow signal during normal and altered respiratory mechanics (loading) in adults and during induced bronchoconstriction in young children. It may be concluded that in this thesis significant improvements were realised with the IP technique. These improvements were experimentally validated in two studies and the integrated system was found to consistently provide an accurate respiratory flow signal. The method may have clinical implications for the diagnosis of respiratory diseases especially in non-cooperative subjects, such as young children.

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Organisations: Department of Electronics and Communications Engineering
Authors: Seppä, V.
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Direct laser writing of polymer-ceramic and hydrogel microstructures by two-photon polymerization
Additive manufacturing techniques enable the fabrication of sophisticated micro- and nanostructures through computer controlled deposition of either energy, material or both. By combining these techniques with biomaterials, microstructures suitable for cell culturing and other biomedical applications can be created. Among these approaches, direct laser writing by two-photon polymerization (2PP-DLW) is a highly accurate and flexible technique that can be used for the processing of various synthetic and natural materials. 2PP-DLW is based on nonlinear two-photon absorption, which enables selective photopolymerization and realization complex three-dimensional (3D) microstructures in a single processing step. This thesis focuses on the microfabrication of polymer-ceramic and hydrogel materials by custom built 2PP-DLW laser systems. The main objective was to determine how 2PP-DLW processing parameters affect the quality of microstructures aimed at cell culturing applications. The optimal processing conditions for a commercial polymer-ceramic material Ormocomp® were studied with the Irgacure® 127 photoinitiator and a picosecond laser system. It was found that the achievable Ormocomp® feature size could be reduced from microscale to nanoscale by careful tuning of laser power and exposure time. Within the determined fabrication window, the Ormocomp® microstructure dimensions could be tuned in a wide range by the choice of focusing optics and processing parameters. With help of these findings, Ormocomp® scaffold structures with a variable and defined degree of porosity and interconnectivity were successfully fabricated. The 85% porous scaffolds supported the attachment, viability and growth of human adipose stem cells in a six day culture. Aimed at creating biomimetic microstructures, the 2PP-DLW processing of custom-synthesized poly(amine acid) hydrogels (poly(AA)s) was studied and compared to commercial poly(ethylene glycol) diacrylates (PEGdas). The acryloylated and methacryloylated poly(AA)s combined with the Irgacure® 2959 photoinitiator were found applicable to 2PP-DLW over a relatively wide range of processing parameters. Due to the wider fabrication window, the dimensions of poly(AA) microstructures could be tuned more than PEGda microstructures. Stable poly(AA) microstructures could be fabricated with 80% water content and with improved 3D fabrication performance with increasing acryloylation. In the future, this
work could be expanded to the fabrication of custom scaffolds for different cell types and stem cell lineages. These types of structures could combine areas of different chemical composition and porosity within a single scaffold. The poly(AA) hydrogels could also be combined with cells to fabricate cell-laden 3D microstructures.

Bone structural analysis with pQCT: image preprocessing and cortical bone segmentation

Bone fragility, or conversely, its strength is largely determined by structural properties (e.g., cross-sectional geometry, cortical thickness and trabecular architecture). Accordingly, a proper structural analysis of bones might help identify those individuals who are susceptible to fragility fractures. In this respect, peripheral quantitative computed tomography (pQCT) provides a reasonable option to assess bone cross-sectional geometry and separate it into the trabecular and the cortical compartments. Although the commonly used pQCT systems lack sufficient spatial resolution to capture fine structural traits compared with present high-resolution pQCT (HR-pQCT) systems, they are cheaper and still widely used among bone researchers. Current techniques used for pQCT image analysis (e.g., median filtering, threshold-based segmentation), however, may not be optimally suited for characterizing bone geometry and strength. Therefore, in this work, image preprocessing based on a statistical approach, and a fast and reliable segmentation method were developed with the aim of improving the in vivo precision of pQCT image analyses, in vivo assessment of tibial bone geometry and strength. The segmentation method is based on the outer boundary detection and subsequent shrinking (OBS) procedure. These methods were applied on various phantom and in vivo pQCT image data and their performance was compared with commonly used analysis approaches and, in the case of segmentation, with a more advanced level-set based method. The manual segmentation of cortical bone, done by 3 independent evaluators, was considered as a gold standard. The findings demonstrate that the developed preprocessing method provided the most consistent results and improved the reliability of the analysis of the cortical bone area by approximately 30%. However, the preprocessing failed to improve the assessment of trabecular density. Nevertheless, some coarse structural patterns could be seen in the preprocessed images in contrast to a disperse distribution of density levels in the raw images. Further, the developed OBS method showed nearly 50% less variation in error compared with threshold-based analysis and, in conjunction with the developed preprocessing method, agreed well with the results obtained from manual segmentation. The level-set based segmentation resulted in a consistent ~15% mean overestimation of all geometrical traits with a similar variation of data as that obtained from the OBS method. The results of this research show that the preprocessing method can enhance cortical bone analysis. Further, the OBS method (i) improved assessment of cortical geometry, (ii) enhanced cortical bone analysis of pQCT images and (iii) can, in conjunction with the developed preprocessing, form a simple and applicable pQCT image analysis tool for clinical bone research applications.
Development of chip-surface stimulus electrode array for fully-implantable subretinal prosthesis chip

In this study, we have developed a chip-surface stimulus electrode array for fully-implantable subretinal prosthesis chip. To realize visual restoration with high resolution, stimulus electrodes should be miniaturized and arrayed with high density. When we miniaturize them, however, their electrochemical impedances become higher and their amount of charge injection become smaller. Additionally, as the number of electrodes increases, it becomes difficult to make electrical connection to each pixel of the retinal prosthesis chip and each electrode by electrical wiring. To overcome these problems, we have developed the stimulus electrodes that have low electrochemical impedances and large charge injection capacities, and established a fabrication process of chip-surface stimulus electrode array. We fabricated the stimulus electrodes made of extremely porous platinum which had large-surface-area compared with conventional Pt. We also fabricated the chip-surface stimulus electrodes array on the subretinal prosthesis chip which surface was rough and covered with insulator film.
Development of Si neural probe module with adjustable gain amplifier for neuronal signal recording

In recent years, lots of research on biomedical technologies directly using bio-signals such as BMI (Brain Machine Interface) have been performed intensively. Among bio-signals, ECoG (Electrocorticogram), LFP (Local Field Potential), and AP (Action Potential) are usually recorded especially for diagnosis, treatment, and prevention of brain diseases. These bio-signals have different amplitudes and frequency bandwidths, and the signal intensities vary accordingly with recording electrode conditions and individual variation. Therefore, a multiple bio-signals recording system having adjustable gain and bandwidth is strongly required. In this study, we designed the adjustable gain amplifier appropriate for the system, and fabricated the module composed of the amplifier and a Si neural probe for the multiple bio-signal recording in the deep brain. Additionally, we verified fundamental functions of the module by in vitro experiments.

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Authors: Tani, T., Naganuma, H., Harashima, T., Iwagami, T., Kino, H., Kiyoyama, K., Kellomäki, M., Hyttinen, J., Tanaka, T.
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Peer-reviewed: Yes
Monte Carlo simulations in quality assurance of dosimetry and clinical dose calculations in radiotherapy

The status of radiotherapy as an important treatment modality for cancer is indisputable. In external beam radiotherapy, usually delivered with linear accelerators (linacs), there is a total uncertainty involved in the treatment process, in which the accuracy of the dose calculation is a significant factor. In patient dose calculation, the radiation beam produced by the linac is modelled and delivered to the calculation phantom, which is based on computed tomography (CT) datasets. Most of the clinical dose calculation algorithms implemented in treatment planning systems (TPSs) have been based on analytical or semi-analytical principles, but statistical Monte Carlo (MC) methods have been shown to provide the most accurate representation of dose distributions in the patient and other calculation phantoms. However, long calculation times have prohibited the implementation of full MC methods to clinical patient dose calculation. In this study, the aim was to develop a full MC-based dose calculation tool to serve as a reference method for TPS dose calculation algorithm benchmarking, but also for dosimetry purposes. The MC-based model constructed for both photon and electron beams was first benchmarked against measurements in water. Finally, the value of the absolute dose calibrated MC model was assessed by applying it to specific problems in dosimetry and dose calculations. The performance of the MC model in this study in a water phantom was shown to be equal or better than that reported in other studies. During the stage in which the multileaf collimator (MLC) part of the MC model was benchmarked, the MC-based results were used to assess the performance of various measurement detectors in small aperture dosimetry. Eventually, the MC model was shown to provide reference dose distributions both in virtual and CT-based phantom geometries, where accurate measurements are difficult or impossible to perform. With photon beams, the MC model was used to benchmark the TPS algorithms in cases where large uncertainties have been reported, i.e. in the stereotactic body radiotherapy (SBRT) of the lung and in the presence of high atomic number material as a metallic hip implant. With electron beams, the MC model was applied to assess the accuracy of the TPS algorithms in chest wall radiotherapy. With the described use, in addition to performed TPS configuration data validation, the MC model has the potential to have a positive influence on the total uncertainty involved in radiotherapy. Furthermore, the MC model can be used in the development of new treatment techniques, protocols and detectors for dosimetry and dose calculation algorithms. The time when full MC-based calculations are implemented into clinical treatment planning is yet to come.
Adipose Stem Cells Used to Reconstruct 13 Cases With Cranio-Maxillofacial Hard-Tissue Defects

Although isolated reports of hard-tissue reconstruction in the cranio-maxillofacial skeleton exist, multipatient case series are lacking. This study aimed to review the experience with 13 consecutive cases of cranio-maxillofacial hard-tissue defects at four anatomically different sites, namely frontal sinus (3 cases), cranial bone (5 cases), mandible (3 cases), and nasal septum (2 cases). Autologous adipose tissue was harvested from the anterior abdominal wall, and adipose-derived stem cells were cultured, expanded, and then seeded onto resorbable scaffold materials for subsequent reimplantation into hard-tissue defects. The defects were reconstructed with either bioactive glass or p-tricalcium phosphate scaffolds seeded with adipose-derived stem cells (ASCs), and in some cases with the addition of recombinant human bone morphogenetic protein-2. Production and use of ASCs were done according to good manufacturing practice guidelines. Follow-up time ranged from 12 to 52 months. Successful integration of the construct to the surrounding skeleton was noted in 10 of the 13 cases. Two cranial defect cases in which nonrigid resorbable containment meshes were used sustained bone resorption to the point that they required the procedure to be redone. One septal perforation case failed outright at 1 year because of the postsurgical resumption of the patient’s uncontrolled nasal picking habit.

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Number of pages: 11
Pages: 530-540
Publication date: Apr 2014
Peer-reviewed: Yes

Publication information
Journal: Stem Cells Translational Medicine
Volume: 3
Issue number: 4
ISSN (Print): 2157-6564
Ratings:
Scopus rating (2016): SJR 1.637 SNIP 0.931 CiteScore 4.16
Scopus rating (2015): SJR 2.098 SNIP 1.216 CiteScore 4.89
Scopus rating (2014): SJR 2.291 SNIP 1.61 CiteScore 5.44
Scopus rating (2013): SJR 1.297 SNIP 1.048 CiteScore 3.44
Original language: English
Keywords: Adipose stem cells, Bioactive glass, beta-Tricalcium phosphate, Bone morphogenetic protein, HUMAN OSTEOGENIC PROTEIN-1, VASCULARIZED BONE-GRAFT, DONOR-SITE MORBIDITY, MANDIBULAR RECONSTRUCTION, GROWTH-FACTORS, ENGINEERED BONE, FREE FIBULA, REPAIR, DIFFERENTIATION, SCAFFOLDS
DOIs:
10.5966/sctm.2013-0173

Bibliographical note
INT=elt,"Seppänen, Riitta"
Source: WOS
Source-ID: 000333938200018
Research output: Scientific › peer-review › Article

In vitro Studies of Bioabsorbable and Antibiotic-Releasing Composites for the Treatment of Osteomyelitis

Osteomyelitis is a severe bacterial infection that is considered to be one of the most-difficult-to-treat infections. It causes the destruction of bone tissue and the treatment often includes surgical debridement that creates a defect in the bone. Because there may be bacteria left in the surrounding tissues, long courses of antibiotics are also required. Adequate antibiotic concentrations using oral or intravenous antibiotics may be difficult to achieve because of degenerated blood circulation. Local antibiotic delivery using implanted antibiotic-releasing materials in the defect site provides an efficient way of achieving high local antibiotic concentrations, and also decreases the side-effects that are often associated with oral or intravenous antibiotics. The objective of this thesis was to develop bioabsorbable and antibiotic-releasing (either
rifampicin or ciprofloxacin) composite materials that can be used for the local antibiotic treatment of osteomyelitis and that also include a osteoconductive ceramic component to aid bone healing. Continuous antibiotic delivery for three to six months was requested. The materials developed are to be used together so that the surgeon can decide in which ratio to use them. The materials chosen for the study were medical grade poly(L-lactide-co-ε-caprolactone) as the bioabsorbable polymer matrix, β-tricalcium phosphate (β-TCP) as the osteoconductive ceramic component, and the antibiotics ciprofloxacin and rifampicin that are clinically used as a combination in the treatment of osteomyelitis. All the materials used are approved for clinical use. Ten different composites of these materials plus plain poly(L-lactide-co-ε-caprolactone) were processed using extrusion and cut into pellet shaped samples (diameter approximately 2.5 mm and length 2.5 mm). Four of the composites had no antibiotic component, three composites contained 8 wt-% ciprofloxacin, and three contained 8 wt-% rifampicin. A series of in vitro tests (Sörensen phosphate buffer, pH 7.4, 37 °C) were performed to evaluate the hydrolytic degradation and drug release behavior of the manufactured composites. The most promising antibiotic-releasing composites, showing continuous release, were also tested against two common osteomyelitis-causing model bacteria utilizing genetically engineered bioluminescent bacteria. The antibiotic containing composites with 50 wt-% of β-tricalcium phosphate were the most promising with continuous drug release up to approximately 20 weeks. The antibiotic release occurred in several phases and the release was not similar for the two studied antibiotics. The differences were attributed mainly to different molecular size (ciprofloxacin 331 g/mol and rifampicin 823 g/mol) and differences in water solubility (For rifampicin in water at 30 °C, 1.5-1.7 mg/ml depending on the crystal form (Henwood et al. 2000) and for ciprofloxacin at 37 °C, 0.20 mg/ml at pH 7.8 and 0.22 mg/ml at pH 6.9 (Breda et al. 2009)). The composites containing 50 wt-% β-TCP also showed good effect against the common osteomyelitis-causing bacteria, Staphylococcus epidermidis and Pseudomonas aeruginosa. The hydrolytic degradation of the polymer followed first order kinetics and the molar ratio of the comonomers changed, as the degradation proceeded. These composites have great potential to be used in the treatment of osteomyelitis or other bone related infections. In this work, only in vitro tests were performed, and thus the next step for these composites is preclinical testing.
Acute mild traumatic brain injury is not associated with white matter change on diffusion tensor imaging
A multi-tissue segmentation of the human head for detailed computational models

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Hannula, M., Narra, N., Onnela, N., Dastidar, P., Hyttinen, J.
Number of pages: 4
Pages: 2484-2487
Publication date: 2014

Host publication information
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4244-7929-0
DOIs:
10.1109/EMBC.2014.6944126

An algorithm for computational simulation of mandible bone modeling and remodeling around dental implants

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Marcian, P., Borak, L., Narra, N., Skalka, P., Kaiser, J., Wolff, J.
Number of pages: 4
Pages: 388-391
Publication date: 2014

Host publication information
Title of host publication: 20th International Conference on Engineering Mechanics, 12-15 May 2014, Svratka, Czech Republic
Publisher: Brno University of Technology, Institute of Solid Mechanics, Mechatronics and Biomechanics
ISBN (Print): 978-80-214-4871-1
Links:

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-08-19<br/>Publisher name: Oxford University Press
Source: researchoutputwizard
Source-ID: 537
Research output: Scientific - peer-review › Article

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-10-08<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 410
Research output: Scientific - peer-review › Conference contribution

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-08-18<br/>Publisher name: Brno University of Technology, Institute of Solid Mechanics, Mechatronics and Biomechanics
Source: researchoutputwizard
Source-ID: 1031
Research output: Scientific - peer-review › Conference contribution
Analysis of Virus Textures in Transmission Electron Microscopy Images

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Nanni, L., Paci, M., Santos, F. L. C. D., Brahnam, S., Hyttinen, J.
Number of pages: 9
Pages: 83-91
Publication date: 2014

Host publication information
Publisher: IOS Press

Publication series
Name: Studies in Health Technology and Informatics
Volume: 207
ISSN (Print): 0926-9630
ISSN (Electronic): 1879-8365
DOIs: 10.3233/978-1-61499-474-9-83

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-12-09
Publisher name: IOS Press
Source: researchoutputwizard
Source-ID: 1121
Research output: Scientific - peer-review › Conference contribution

Antibiooteja annosteleva ja elimistössä hajoava materiaali vaikeiden tulehdusten hoitoon

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Electronics and Communications Engineering
Authors: Ahola, N.
Number of pages: 1
Pages: 13-13
Publication date: 2014
Peer-reviewed: Unknown

Publication information
Journal: Tekstiililehti
Volume: 77
Issue number: 3
ISSN (Print): 0040-2370
Original language: Finnish
Links: http://www.tekstiililehti.fi/binary/file/-/id/12/fid/345/

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-06-18
Publisher name: Suomen tekstiiliteknillinen liitto
Source: researchoutputwizard
Source-ID: 65
Research output: Professional › Article

Application of Thermoresponsive PNIPAAm-b-PAMPTMA Diblock Copolymers in siRNA Delivery

General information
State: Published
A Semi-Automatic Segmentation Method for the Structural Analysis of Carotid Atherosclerotic Plaques by Computed Tomography Angiography

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Caetano Santos, F. L., Joutsen, A., Terada, M., Salenius, J., Eskola, H.
Number of pages: 11
Pages: 930-940
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Atherosclerosis and Thrombosis
Volume: 21
Issue number: 9
ISSN (Print): 1340-3478
Ratings:
Scopus rating (2016): SJR 1.051 SNIP 1.08 CiteScore 2.37
Scopus rating (2015): SJR 1.005 SNIP 1.007 CiteScore 2.34
A texture analysis method for MR images of airway dilator muscles: a feasibility study

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA), Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Köhli, P., Järnstedt, J., Sikiö, M., Viik, J., Dastidar, P., Peltomäki, T., Eskola, H.
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Dentomaxillofacial Radiology
Volume: 43
Issue number: 5
Article number: 20130403
ISSN (Print): 0250-832X
Ratings:
Scopus rating (2016): SJR 0.761 SNIP 0.989 CiteScore 1.36
Scopus rating (2015): SJR 0.981 SNIP 1.326 CiteScore 1.73
Scopus rating (2014): SJR 0.893 SNIP 1.261 CiteScore 1.46
Scopus rating (2013): SJR 0.827 SNIP 1.2 CiteScore 1.42
Scopus rating (2012): SJR 0.871 SNIP 1.362 CiteScore 1.61
Scopus rating (2011): SJR 0.982 SNIP 1.412 CiteScore 1.6
Scopus rating (2010): SJR 0.855 SNIP 1.215
Scopus rating (2009): SJR 1.025 SNIP 1.184
Scopus rating (2008): SJR 0.711 SNIP 1.137
Scopus rating (2007): SJR 0.898 SNIP 1.425
Scopus rating (2006): SJR 0.501 SNIP 0.944
Scopus rating (2005): SJR 0.474 SNIP 0.948
Scopus rating (2004): SJR 0.507 SNIP 1.01
Biopsychosocial Outcome after Uncomplicated Mild Traumatic Brain Injury

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Number of pages: 17
Pages: 108-124
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Neurotrauma
Volume: 31
Issue number: 1
ISSN (Print): 0897-7151
Ratings:
Scopus rating (2016): SJR 1.993 SNIP 1.419 CiteScore 4.45
Scopus rating (2015): SJR 2.029 SNIP 1.393 CiteScore 4.24
Scopus rating (2014): SJR 1.958 SNIP 1.41 CiteScore 4.14
Scopus rating (2013): SJR 2.001 SNIP 1.385 CiteScore 4.3
Scopus rating (2012): SJR 1.64 SNIP 1.445 CiteScore 4.49
Scopus rating (2011): SJR 1.447 SNIP 1.359 CiteScore 3.9
Scopus rating (2010): SJR 1.556 SNIP 1.331
Scopus rating (2009): SJR 1.645 SNIP 1.415
Scopus rating (2008): SJR 1.693 SNIP 1.157
Scopus rating (2007): SJR 1.605 SNIP 1.252
Scopus rating (2006): SJR 1.32 SNIP 1.194
Scopus rating (2005): SJR 1.278 SNIP 1
Scopus rating (2004): SJR 1.171 SNIP 1.088
Scopus rating (2003): SJR 1.364 SNIP 1.093
Scopus rating (2002): SJR 1.285 SNIP 0.845
Scopus rating (2001): SJR 1.419 SNIP 1.239
Scopus rating (2000): SJR 1.323 SNIP 0.981
Scopus rating (1999): SJR 1.164 SNIP 0.995
Original language: English
DOIs:
10.1089/neu.2013.2941

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-11-27
Publisher name: Mary Ann Liebert
Source: researchoutputwizard
Bone loss patterns in cortical, subcortical, and trabecular compartments during simulated microgravity

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Cervinka, T., Sievänen, H., Hyttinen, J., Rittweger, J.
Number of pages: 9
Pages: 80-88
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Applied Physiology
Volume: 117
Issue number: 1
ISSN (Print): 8750-7587
Ratings:
Scopus rating (2016): SJR 1.485 SNIP 1.243 CiteScore 2.75
Scopus rating (2015): SJR 1.623 SNIP 1.219 CiteScore 2.6
Scopus rating (2014): SJR 1.594 SNIP 1.304 CiteScore 2.56
Scopus rating (2013): SJR 1.7 SNIP 1.482 CiteScore 2.75
Scopus rating (2012): SJR 1.631 SNIP 1.546 CiteScore 2.81
Scopus rating (2011): SJR 1.662 SNIP 1.593 CiteScore 2.63
Scopus rating (2010): SJR 1.713 SNIP 1.552
Scopus rating (2009): SJR 1.58 SNIP 1.443
Scopus rating (2008): SJR 1.73 SNIP 1.433
Scopus rating (2007): SJR 1.646 SNIP 1.523
Scopus rating (2006): SJR 1.383 SNIP 1.424
Scopus rating (2005): SJR 1.423 SNIP 1.38
Scopus rating (2004): SJR 1.432 SNIP 1.322
Scopus rating (2003): SJR 1.459 SNIP 1.367
Scopus rating (2002): SJR 1.349 SNIP 1.26
Scopus rating (2001): SJR 1.161 SNIP 1.451
Scopus rating (2000): SJR 1.183 SNIP 1.431
Scopus rating (1999): SJR 1.239 SNIP 1.372
Original language: English
DOIs:
10.1152/japplphysiol.00021.2014

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-08-30<br/>Publisher name: American Physiological Society
Source: researchoutputwizard
Source-ID: 212
Research output: Scientific - peer-review › Article

Center of Rotation Function as a General Method for Center of Rotation Detection

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Jesus, D., Soto, A., Lehti, M., Hyttinen, J., Figueiras, E.
Number of pages: 3
Publication date: 2014
Characterization of dynamical systems under noise using recurrence networks: Application to simulated and EEG data

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Puthanmadam Subramaniyam, N., Hyttinen, J.
Number of pages: 11
Pages: 3464-3474
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Physics Letters A
Volume: 378
Issue number: 46
ISSN (Print): 0375-9601
Ratings:
Scopus rating (2016): SJR 0.683 SNIP 1.064 CiteScore 1.69
Scopus rating (2015): SJR 0.713 SNIP 1.159 CiteScore 1.74
Scopus rating (2014): SJR 0.699 SNIP 1.024 CiteScore 1.71
Scopus rating (2013): SJR 0.631 SNIP 1.065 CiteScore 1.77
Scopus rating (2012): SJR 0.797 SNIP 1.167 CiteScore 1.91
Scopus rating (2011): SJR 0.873 SNIP 1.188 CiteScore 1.97
Scopus rating (2010): SJR 0.94 SNIP 1.116
Scopus rating (2009): SJR 0.994 SNIP 1.2
Scopus rating (2008): SJR 1.057 SNIP 1.109
Scopus rating (2007): SJR 0.89 SNIP 0.995
Scopus rating (2006): SJR 0.764 SNIP 0.962
Scopus rating (2005): SJR 0.883 SNIP 1.02
Scopus rating (2004): SJR 0.898 SNIP 0.988
Scopus rating (2003): SJR 0.796 SNIP 0.951
Scopus rating (2002): SJR 0.85 SNIP 1.012
Scopus rating (2001): SJR 0.762 SNIP 0.995
Scopus rating (2000): SJR 0.937 SNIP 0.903
Scopus rating (1999): SJR 1.018 SNIP 0.937
Original language: English
DOIs:
10.1016/j.physleta.2014.10.005

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-10-29<br/>Publisher name: Elsevier BV
Source: researchoutputwizard
Source-ID: 1312
Research output: Scientific - peer-review › Article
Clinical correlates of cerebral diffusion tensor imaging findings in chronic traumatic spinal cord injury

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Koskinen, E., Hakulinen, U., Brander, A., Luoto, T., Ylinen, A., Ohman, J.
Number of pages: 7
Pages: 202-208
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Spinal Cord
Volume: 52
Issue number: 3
ISSN (Print): 1362-4393
Ratings:
Scopus rating (2016): SJR 0.802 SNIP 1.011 CiteScore 1.41
Scopus rating (2015): SJR 1.043 SNIP 1.141 CiteScore 1.62
Scopus rating (2014): SJR 0.928 SNIP 1.11 CiteScore 1.65
Scopus rating (2013): SJR 1.074 SNIP 1.108 CiteScore 1.73
Scopus rating (2012): SJR 1.154 SNIP 1.281 CiteScore 1.98
Scopus rating (2011): SJR 1.151 SNIP 1.248 CiteScore 1.88
Scopus rating (2010): SJR 1.193 SNIP 1.263
Scopus rating (2009): SJR 0.954 SNIP 1.32
Scopus rating (2008): SJR 1.24 SNIP 1.268
Scopus rating (2007): SJR 0.883 SNIP 1.08
Scopus rating (2006): SJR 0.609 SNIP 1.092
Scopus rating (2005): SJR 0.546 SNIP 0.99
Scopus rating (2004): SJR 0.632 SNIP 0.951
Scopus rating (2003): SJR 0.667 SNIP 0.996
Computational Modeling and Structural Improvement of a Pneumatically Actuated Concentric Double-Shell Structure for Cell Stretching

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Zhao, F., Kreutzer, J., Kallio, P.
Number of pages: 6
Pages: 906-911
Publication date: 2014

Host publication information
Title of host publication: Proceedings of 2014 IEEE International Conference on Mechatronics and Automation, ICMA 2014, August 3-6, 2014, Tianjin, China
ISBN (Print): 978-1-4799-3978-7
DOI: 10.1109/ICMA.2014.6885818

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-11-27
Publisher name: Nature Publishing
Source: researchoutputwizard
Source-ID: 791
Research output: Scientific - peer-review › Article

Computational Modeling Supports Induced Pluripotent Stem Cell-derived Cardiomyocytes Reliability as a Model for Human LQT3

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Paci, M., Severi, S., Hyttinen, J.
Number of pages: 4
Pages: 69-72
Publication date: 2014

Host publication information
Title of host publication: Computing in cardiology 2014
Publisher: Computing in Cardiology
ISBN (Print): 978-1-4799-4346-3
ISBN (Electronic): 978-1-4799-4347-0
Links:

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-11-30
Publisher name: Computing in Cardiology
Correlations between Functional Imaging Markers Derived from PET/CT and Diffusion-Weighted MRI in Diffuse Large B-Cell Lymphoma and Follicular Lymphoma

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Wu, X., Pertovaara, H., Korkola, P., Dastidar, P., Järvenpää, R., Eskola, H., Kellokumpu-Lehtinen, P.
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: PLoS One
Volume: 9
Issue number: 1
Article number: e84999
ISSN (Print): 1932-6203
Ratings:
Scopus rating (2016): CiteScore 3.11 SJR 1.201 SNIP 1.092
Scopus rating (2015): SJR 1.414 SNIP 1.131 CiteScore 3.32
Scopus rating (2014): SJR 1.545 SNIP 1.141 CiteScore 3.54
Scopus rating (2013): SJR 1.74 SNIP 1.147 CiteScore 3.94
Scopus rating (2012): SJR 1.945 SNIP 1.142 CiteScore 4.15
Scopus rating (2011): SJR 2.369 SNIP 1.23 CiteScore 4.58
Scopus rating (2010): SJR 2.631 SNIP 1.161
Scopus rating (2009): SJR 2.473 SNIP 0.985
Scopus rating (2008): SJR 2.323 SNIP 0.96
Scopus rating (2007): SJR 1.289 SNIP 0.525
Original language: English
DOIs: 10.1371/journal.pone.0084999

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-04-29<br/>Publisher name: Public Library of Science

Detection of Prostate Cancer by an Electronic Nose; A Proof of Principle Study

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering, Integrated Technologies for Tissue Engineering Research (ITTE), Prostate cancer research center (PCRC)
Number of pages: 6
Pages: 230-235
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Urology
Volume: 192
Issue number: 1
ISSN (Print): 0022-5347
Did Jan Swammerdam Do the First Electric Stimulation over 100 Years before Luigi Galvani?

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Malmivuo, J., Honkonen, J., Wendel, K.
Number of pages: 4
Pages: 13-16
Publication date: 2014

Host publication information
Title of host publication: XIII Mediterranean Conference on Medical and Biological Engineering and Computing 2013, MEDICON 2013, 25-28 September 2013, Seville, Spain. Part II
Publisher: Springer International Publishing
ISBN (Print): 978-3-319-00845-5
ISBN (Electronic): 978-3-319-00846-2

Publication series
Name: International federation for medical and biological engineering proceedings
Volume: 41
ISSN (Print): 1680-0737
DOIs:
10.1007/978-3-319-00846-2_3

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-09-16<br/>Publisher name: Springer International Publishing
Source: researchoutputwizard
Source-ID: 1018
Research output: Scientific - peer-review › Conference contribution
Early interim PET/CT predicts post-treatment response in diffuse large B-cell lymphoma

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Number of pages: 7
Pages: 1093-1099
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Acta Oncologica
Volume: 53
Issue number: 8
ISSN (Print): 0284-186X
Ratings:
Scopus rating (2016): SJR 1.385 SNIP 1.171 CiteScore 2.67
Scopus rating (2015): SJR 1.52 SNIP 1.155 CiteScore 2.85
Scopus rating (2014): SJR 1.234 SNIP 1.055 CiteScore 2.43
Scopus rating (2013): SJR 1.477 SNIP 1.342 CiteScore 2.86
Scopus rating (2012): SJR 1.436 SNIP 1.169 CiteScore 2.59
Scopus rating (2011): SJR 1.347 SNIP 1.224 CiteScore 2.58
Scopus rating (2010): SJR 1.166 SNIP 1.093
Scopus rating (2009): SJR 1.176 SNIP 0.886
Scopus rating (2008): SJR 0.902 SNIP 0.881
Scopus rating (2007): SJR 0.945 SNIP 1.052
Scopus rating (2006): SJR 0.788 SNIP 0.842
Scopus rating (2005): SJR 0.776 SNIP 0.929
Scopus rating (2004): SJR 0.819 SNIP 0.917
Scopus rating (2003): SJR 0.907 SNIP 0.915
Scopus rating (2002): SJR 0.691 SNIP 0.876
Scopus rating (2001): SJR 0.516 SNIP 0.695
Scopus rating (2000): SJR 0.385 SNIP 0.541
Scopus rating (1999): SJR 0.363 SNIP 0.563
Original language: English
DOIs:
10.3109/0284186X.2014.927074

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-08-19<br/>Publisher name: Informa Healthcare
Source: researchoutputwizard
Source-ID: 1807
Research output: Scientific - peer-review › Article

Early Retinal Function Deficit without Prominent Morphological Changes in the R6/2 Mouse Model of Huntington's Disease

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Ragauskas, S., Leinonen, H., Puranen, J., Rönkkö, S., Nymark, S., Gurevicius, K., Lipponen, A., Kontkanen, O., Puoliväli, J., Tanila, H., Kalesnykas, G.
Number of pages: 24
Pages: 1-24
Effect of heart rate correction on pre- and post-exercise heart rate variability to predict risk of mortality—an experimental study on the FINCAVAS cohort

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Pradhapan, P., Tarvainen, M. P., Nieminen, T., Lehtinen, R., Nikus, K., Lehtimäki, T., Kähönen, M., Viik, J.
Publication date: 2014
Peer-reviewed: Yes
Evaluation of decellularization protocols for production of tubular small intestine submucosa scaffolds for use in oesophageal tissue engineering

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Integrated Technologies for Tissue Engineering Research (ITTE), Former organisation of the author
Authors: Syed, O., Walters, N. J., Day, R. M., Kim, H., Knowles, J. C.
Number of pages: 2
Pages: 5043-5054
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Acta Biomaterialia
Volume: 10
Issue number: 12
ISSN (Print): 1742-7061
Ratings:
Scopus rating (2016): CiteScore 6.66 SJR 1.789 SNIP 1.921
Scopus rating (2015): SJR 1.997 SNIP 1.99 CiteScore 6.58
Scopus rating (2014): SJR 1.814 SNIP 2.324 CiteScore 6.53
Scopus rating (2013): SJR 1.963 SNIP 2.269 CiteScore 6.41
Scopus rating (2012): SJR 1.904 SNIP 2.125 CiteScore 5.51
Scopus rating (2011): SJR 1.808 SNIP 1.91 CiteScore 5.15
Scopus rating (2010): SJR 1.794 SNIP 1.964
Scopus rating (2009): SJR 1.399 SNIP 1.662
Scopus rating (2008): SJR 1.404 SNIP 1.981
Scopus rating (2007): SJR 1.199 SNIP 1.493
Scopus rating (2006): SJR 0.837 SNIP 1.131
Original language: English
DOIs:
10.1016/j.actbio.2014.08.024

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-11-14<br/>Publisher name: Elsevier
Source: researchoutputwizard
Source-ID: 1573
Research output: Scientific - peer-review » Article

Evolving insights in cell–matrix interactions: Elucidating how non-soluble properties of the extracellular niche direct stem cell fate

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Integrated Technologies for Tissue Engineering Research (ITTE), Former organisation of the author
Authors: Walters, N. J., Gentleman, E.
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Acta Biomaterialia
ISSN (Print): 1742-7061
Ratings:
Scopus rating (2016): CiteScore 6.66 SJR 1.789 SNIP 1.921
Scopus rating (2015): SJR 1.997 SNIP 1.99 CiteScore 6.58
Scopus rating (2014): SJR 1.814 SNIP 2.324 CiteScore 6.53
Finite element analysis of bone loss around failing implants

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering
Authors: Wolff, J., Narra, N., Antalainen, A., Valasek, J., Kaiser, J., Sandor, G. K., Marcian, P.
Number of pages: 8
Pages: 177-184
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Materials and Design
Volume: 61
ISSN (Print): 0264-1275

Ratings:
Scopus rating (2016): CiteScore 4.9 SJR 1.751 SNIP 2.481
Scopus rating (2015): SJR 1.885 SNIP 2.654 CiteScore 4.51
Scopus rating (2014): SJR 2.418 SNIP 3.474 CiteScore 4.36
Scopus rating (2013): SJR 2.045 SNIP 3.269 CiteScore 3.8
Scopus rating (2012): SJR 1.988 SNIP 3.212 CiteScore 3.31
Scopus rating (2011): SJR 1.406 SNIP 2.521 CiteScore 2.63
Scopus rating (2010): SJR 1.07 SNIP 1.822
Scopus rating (2009): SJR 0.93 SNIP 1.81
Scopus rating (2008): SJR 0.973 SNIP 1.361
Scopus rating (2007): SJR 0.846 SNIP 1.68
Scopus rating (2006): SJR 0.666 SNIP 1.415
Scopus rating (2005): SJR 0.739 SNIP 1.373
Scopus rating (2004): SJR 0.52 SNIP 1.167
Scopus rating (2003): SJR 0.565 SNIP 1.201
Scopus rating (2002): SJR 0.574 SNIP 1.165
Scopus rating (2001): SJR 0.374 SNIP 0.59
Scopus rating (2000): SJR 0.242 SNIP 0.716
Scopus rating (1999): SJR 0.192 SNIP 0.339
Original language: English
DOIs:
10.1016/j.matdes.2014.04.080

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-11-14<br/>Publisher name: Elsevier
Finite element analysis of customized reconstruction plates for mandibular continuity defect therapy

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Narra, N., Valasek, J., Hannula, M., Marcian, P., Sandor, G. K., Hyttinen, J., Wolff, J.
Number of pages: 5
Pages: 264-268
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Biomechanics
Volume: 47
Issue number: 1
ISSN (Print): 0021-9290

Ratings:
Scopus rating (2016): SJR 1.2 SNIP 1.368 CiteScore 2.84
Scopus rating (2015): SJR 1.276 SNIP 1.46 CiteScore 2.76
Scopus rating (2014): SJR 1.233 SNIP 1.718 CiteScore 3.01
Scopus rating (2013): SJR 1.522 SNIP 1.783 CiteScore 3.14
Scopus rating (2012): SJR 1.326 SNIP 1.733 CiteScore 2.99
Scopus rating (2011): SJR 1.269 SNIP 1.615 CiteScore 2.82
Scopus rating (2010): SJR 1.174 SNIP 1.747
Scopus rating (2009): SJR 1.39 SNIP 1.867
Scopus rating (2008): SJR 1.455 SNIP 1.899
Scopus rating (2007): SJR 1.575 SNIP 2.14
Scopus rating (2006): SJR 1.518 SNIP 2.11
Scopus rating (2005): SJR 1.223 SNIP 2.208
Scopus rating (2004): SJR 1.057 SNIP 1.909
Scopus rating (2003): SJR 1.314 SNIP 1.737
Scopus rating (2002): SJR 1.124 SNIP 1.605
Scopus rating (2001): SJR 1.234 SNIP 2.158
Scopus rating (2000): SJR 1.525 SNIP 1.971
Scopus rating (1999): SJR 1.137 SNIP 1.835
Original language: English
DOIs:
10.1016/j.jbiomech.2013.11.016

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-02-15
Source: researchoutputwizard
Source-ID: 1124
Research output: Scientific - peer-review » Article

Fusion of Edge Enhancing Algorithms for Atherosclerotic Carotid Wall Contour Detection in Computed Tomography Angiography

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Santos, F. L. C. D., Joutsen, A., Salenius, J., Eskola, H.
Histogram-based classification of iPSC colony images using machine learning methods

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA), Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Joutsijoki, H., Haponen, M., Baldin, I., Rasku, J., Gizaatdinova, Y., Paci, M., Hyttinen, J., Aalto-Setälä, K., Juhola, M.
Number of pages: 7
Pages: 2641-2647
Publication date: 2014

Host publication information
Title of host publication: 2014 IEEE International Conference on Systems, Man, and Cybernetics, October 5-8, 2014, San Diego, CA, USA
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-3840-7

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-11-30<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 613
Research output: Scientific - peer-review › Conference contribution

Impedance spectroscopy of changes in skin-electrode impedance induced by motion

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Cömert, A., Hyttinen, J.
Number of pages: 19
Pages: 1-19
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Biomedical Engineering Online
Volume: 13
Issue number: 1
Article number: 149
ISSN (Print): 1475-925X
Ratings:
Scopus rating (2016): CiteScore 2.01 SJR 0.487 SNIP 1.048
Scopus rating (2015): SJR 0.521 SNIP 0.84 CiteScore 1.67
Scopus rating (2014): SJR 0.517 SNIP 1.133 CiteScore 2.02
Scopus rating (2013): SJR 0.577 SNIP 1.007 CiteScore 2.14
Scopus rating (2012): SJR 0.443 SNIP 1.059 CiteScore 1.81
Scopus rating (2011): SJR 0.401 SNIP 1.054 CiteScore 1.73
Scopus rating (2010): SJR 0.428 SNIP 1.102
Scopus rating (2009): SJR 0.521 SNIP 1.408
Scopus rating (2008): SJR 0.537 SNIP 0.97
Scopus rating (2007): SJR 0.453 SNIP 1.205
Scopus rating (2006): SJR 0.622 SNIP 1.282
Scopus rating (2005): SJR 0.502 SNIP 0.947
Scopus rating (2004): SJR 0.404 SNIP 1.181
Scopus rating (2003): SJR 0.151 SNIP 0.313
Indirect immunofluorescence image classification using texture descriptors

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Nanni, L., Paci, M., Brahnam, S.
Number of pages: 9
Pages: 2463-2471
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Expert Systems with Applications
Volume: 41
Issue number: 5
ISSN (Print): 0957-4174
Ratings:
Scopus rating (2016): CiteScore 4.7 SJR 1.433 SNIP 2.492
Scopus rating (2015): SJR 1.561 SNIP 2.625 CiteScore 4.11
Scopus rating (2014): SJR 1.578 SNIP 2.632 CiteScore 3.63
Scopus rating (2013): SJR 1.364 SNIP 2.408 CiteScore 3.31
Scopus rating (2012): SJR 1.198 SNIP 2.475 CiteScore 3.38
Scopus rating (2011): SJR 1.153 SNIP 2.574 CiteScore 3.76
Scopus rating (2010): SJR 1.081 SNIP 1.829
Scopus rating (2009): SJR 0.967 SNIP 2.57
Scopus rating (2008): SJR 1.146 SNIP 2.238
Scopus rating (2007): SJR 1.051 SNIP 1.771
Scopus rating (2006): SJR 0.738 SNIP 1.407
Scopus rating (2005): SJR 0.714 SNIP 1.705
Scopus rating (2004): SJR 0.63 SNIP 1.882
Scopus rating (2003): SJR 0.541 SNIP 1.217
Scopus rating (2002): SJR 0.524 SNIP 0.898
Scopus rating (2001): SJR 0.33 SNIP 0.656
Scopus rating (2000): SJR 0.478 SNIP 0.793
Scopus rating (1999): SJR 0.307 SNIP 0.796
Original language: English
DOIs:
10.1016/j.eswa.2013.09.046

Influence of exercise loading on magnetic resonance image texture of thigh soft tissues

General information
Investigating local spatially-enhanced structural and textural descriptors for classification of iPSC colony images

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA), Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Gizatdinova, Y., Rasku, J., Haponen, M., Joutsjoki, H., Baldin, I., Paci, M., Hyttinen, J., Aalto-Setälä, K., Juhola, M.
Number of pages: 5
Pages: 3361-3365
Publication date: 2014

Host publication information
Title of host publication: 2014 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), 26-30 Aug. 2014, Chicago, IL, USA
In vitro bioluminescence used as a method for real-time inhibition zone testing for antibiotic-releasing composites

Aims: This study describes the potential of real-time bioluminescence imaging in evaluating the antibiotic efficiency of two cylinder-shaped bioabsorbable antibiotic-releasing composites by in vitro inhibition zone tests. The bacterial infections of bone tissue can cause extensive hard and soft tissue damage and decrease the efficiency of oral antibiotic therapy due to the poor blood circulation in the infected area. To overcome this problem, new, locally antibiotic-releasing biodegradable composites have been developed. Study Design & Methodology: The two composites evaluated in this study were composed of poly(L-lactide-co-ε-caprolactone) matrix, β-tricalcium phosphate ceramic and either ciprofloxacin or rifampicin antibiotic. The composites were tested with genetically modified model pathogens of osteomyelitis (Pseudomonas aeruginosa and Staphylococcus epidermidis) in vitro in inhibition zone tests using a method of real-time bioluminescence. Results: The first signs of the effect of the released ciprofloxacin or rifampicin became visible after four hours of incubation and were seen as changed bioluminescence around the composite pellet on a culture dish. Both of the composite types showed excellent effects against the sensor bacteria within the diffusion area. Bioluminescence measurements suggested that no survivor bacteria capable of evolving resistant strains were left inside the inhibition zones. The S. epidermidis bacterial strain was an inhibition sensor and P. aeruginosa was a stress sensor. Conclusion: These results highlight the potential of the composite materials against the pathogens of osteomyelitis. The approach allows continuous visual inspection of the efficacy of the antibiotics against the bacteria.
Label-Free and Rapid Electrical Detection of hTSH with CMOS-Compatible Silicon Nanowire Transistor Arrays

Monitoring Arterial Pulse Waves With Synchronous Body Sensor Network
**Publication information**

Journal: IEEE Journal of Biomedical and Health Informatics
Volume: 18
Issue number: 6
ISSN (Print): 2168-2194

**Ratings:**
- Scopus rating (2016): CiteScore 3.68 SJR 0.852 SNIP 1.971
- Scopus rating (2015): SJR 0.823 SNIP 2.297 CiteScore 3.15
- Scopus rating (2014): SJR 0.692 SNIP 2.37 CiteScore 1.93
- Scopus rating (2013): SJR 1.049 SNIP 2.405
- Scopus rating (2012): SJR 0.799 SNIP 2.261
- Scopus rating (2011): SJR 0.681 SNIP 2.042
- Scopus rating (2010): SJR 0.632 SNIP 1.862
- Scopus rating (2009): SJR 0.588 SNIP 1.809
- Scopus rating (2008): SJR 0.605 SNIP 2.01
- Scopus rating (2007): SJR 0.716 SNIP 2.154
- Scopus rating (2006): SJR 0.685 SNIP 2.199
- Scopus rating (2005): SJR 0.596 SNIP 1.843
- Scopus rating (2004): SJR 0.486 SNIP 1.355
- Scopus rating (2003): SJR 0.616 SNIP 1.65
- Scopus rating (2002): SJR 0.491 SNIP 1.309
- Scopus rating (2001): SJR 0.821 SNIP 1.548
- Scopus rating (2000): SJR 0.459 SNIP 1.515
- Scopus rating (1999): SJR 0.367 SNIP 0.952

Original language: English

**DOIs:**
10.1109/JBHI.2014.2328788

**Bibliographical note**
Contribution: organisation=ase,FAC1=1<br/>Portfolio EDEND: 2014-11-21<br/>Publisher name: Institute of Electrical and Electronics Engineers

Source: researchoutputwizard
Source-ID: 1255

Research output: Scientific - peer-review › Article

**Morphological and Texture Features for HEp-2 Cells Classification**

**General information**
State: Published

**Host publication information**
Title of host publication: 2014 1st Workshop on Pattern Recognition Techniques for Indirect Immunofluorescence Images (I3A), 24-24 August 2014, Stockholm, Sweden
Publisher: Institute of Electrical and Electronics Engineers IEEE
Motion Analysis Method for Determining Cardiomyocyte Beating Properties Based on Digital Image Correlation and Templates

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Ahola, A., Pradhapan, P., Laurila, E., Aalto-Setälä, K., Hyttinen, J.
Number of pages: 4
Pages: 1137-1140
Publication date: 2014

Host publication information
Title of host publication: Computing in cardiology 2014
Publisher: Computing in Cardiology
ISSN (Print): 978-1-4799-4346-3
Links:

Optical projection tomography as a tool for 3D imaging of hydrogels

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Number of pages: 7
Pages: 3443-3449
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Biomedical Optics Express
Volume: 5
Issue number: 10
ISSN (Print): 2156-7085
Ratings:
Scopus rating (2016): CiteScore 3.8 SJR 1.315 SNIP 1.526
Scopus rating (2015): SJR 1.432 SNIP 1.647 CiteScore 4.07
Scopus rating (2014): SJR 1.754 SNIP 1.798 CiteScore 3.86
Scopus rating (2013): SJR 1.549 SNIP 1.827 CiteScore 3.98
Scopus rating (2012): SJR 1.301 SNIP 1.662 CiteScore 2.85
Scopus rating (2011): SJR 0.846 SNIP 1.757
Optimal Classification of Epileptic EEG Signals Using Neural Networks and Harmony Search Methods

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Number of pages: 10
Pages: 230-239
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Software
Volume: 9
Issue number: 1
ISSN (Print): 1796-217X
Ratings:
Scopus rating (2016): SJR 0.163 SNIP 0.587
Scopus rating (2015): SJR 0.172 SNIP 0.511
Scopus rating (2014): SJR 0.186 SNIP 0.512
Scopus rating (2013): SJR 0.429 SNIP 1.069
Scopus rating (2012): SJR 0.196 SNIP 0.596
Scopus rating (2011): SJR 0.201 SNIP 0.776
Scopus rating (2010): SJR 0.193 SNIP 0.51
Scopus rating (2009): SJR 0.191 SNIP 0.564
Scopus rating (2008): SJR 0.175 SNIP 0.597
Scopus rating (2007): SJR 0.101 SNIP 0
Original language: English
DOIs:
10.4304/jsw.9.1.230-239

Ormocomp-Modified Glass Increases Collagen Binding and Promotes the Adherence and Maturation of Human Embryonic Stem Cell-Derived Retinal Pigment Epithelial Cells

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Optoelectronics Research Centre, Research group: Surface Science, Frontier Photonics, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Käpylä, E., Sorkio, A., Teymouri, S., Lahtonen, K., Vuori, L., Valden, M., Skottman, H., Kellomäki, M., Juutila-Uusitalo, K.
Number of pages: 11
Pages: 1-11
Prediction of Passive Drug Permeability Across the Blood-Retinal Barrier

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Research group: Computational Biophysics and Imaging Group, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Tervonen, A., Vainio, I., Nymark, S., Hyttinen, J.
Number of pages: 15
Pages: 2297-2311
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Pharmaceutical Research
Volume: 31
Issue number: 9
ISSN (Print): 0724-8741
Ratings:
Scopus rating (2016): CiteScore 3.49 SJR 1.105 SNIP 1.042
Scopus rating (2015): SJR 1.154 SNIP 1.188 CiteScore 3.6
Scopus rating (2014): SJR 1.332 SNIP 1.306 CiteScore 3.93
Scopus rating (2013): SJR 1.553 SNIP 1.432 CiteScore 4.7
Scopus rating (2012): SJR 1.882 SNIP 1.547 CiteScore 5.07
Prognostic capacity of a clinically indicated exercise test for cardiovascular mortality is enhanced by combined analysis of exercise capacity, heart rate recovery and T-wave alternans

Background: Exercise capacity, heart rate recovery and T-wave alternans are independent predictors of cardiovascular mortality. We tested whether these parameters contain supplementary prognostic information. Methods: A total of 3609 consecutive patients (2157 men) referred for a routine, clinically indicated bicycle exercise test were enrolled in the Finnish Cardiovascular Study (FINCAVAS). Exercise capacity was measured in metabolic equivalents, heart rate recovery as the decrease in heart rate from maximum to one minute post-exercise, and T-wave alternans by time-domain Modified Moving Average method. Results: During 57-month median follow-up (interquartile range 35-78 months), 96 patients died of cardiovascular causes (primary endpoint) and 233 from any cause. All three parameters were independent predictors of cardiovascular mortality when analysed as continuous variables. Adding metabolic equivalents (p < 0.001), heart rate recovery (p = 0.002) or T-wave alternans (p = 0.01) to the linear model improved its predictive power for cardiovascular mortality. The combination of low exercise capacity (<6 metabolic equivalents), reduced heart rate recovery (≤12 beats/min) and elevated T-wave alternans (≥60μV) yielded the highest hazard ratio for cardiovascular mortality of 16.5 (95% confidence interval 4.0-67.7, p < 0.001). Harrells C index was 0.719 (confidence interval 0.665-0.772) for cardiovascular mortality with previously defined cutpoints (<8 units for metabolic equivalents≤18 beats/min for heart rate recovery and≥60μV for T-wave alternans). Conclusion: The prognostic capacity of the clinical exercise test is enhanced by combined analysis of exercise capacity, heart rate recovery and T-wave alternans.
Rapid and Accurate Detection of Urinary Pathogens by Mobile IMS-Based Electronic Nose: A Proof-of-Principle Study

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering, Integrated Technologies for Tissue Engineering (ITTE), Prostate cancer research center (PCRC)
Number of pages: 11
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: PLoS One
ISSN (Print): 1932-6203
Ratings:
Scopus rating (2016): CiteScore 3.11 SJR 1.201 SNIP 1.092
Scopus rating (2015): SJR 1.414 SNIP 1.131 CiteScore 3.32
Scopus rating (2014): SJR 1.545 SNIP 1.141 CiteScore 3.54
Scopus rating (2013): SJR 1.74 SNIP 1.147 CiteScore 3.94
Scopus rating (2012): SJR 1.945 SNIP 1.142 CiteScore 4.15
Scopus rating (2011): SJR 2.369 SNIP 1.23 CiteScore 4.58
Scopus rating (2010): SJR 2.631 SNIP 1.161
Scopus rating (2009): SJR 2.473 SNIP 0.985
Scopus rating (2008): SJR 2.323 SNIP 0.96
Scopus rating (2007): SJR 1.289 SNIP 0.525
Original language: English
DOIs:
10.1371/journal.pone.0114279

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2014-11-30
Publisher name: Sage Publications
Source: researchoutputwizard
Source-ID: 1086
Research output: Scientific - peer-review > Article
Releasing tool-adhered natural fibrous microscale objects with vacuum system

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Department of Automation Science and Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Lai, Y., Cervinka, T., Kallio, P.
Number of pages: 6
Pages: 378-383
Publication date: 2014

Host publication information
Title of host publication: 2014 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM), 8-11 July 2014, Besacon
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4799-5736-1
DOIs:
10.1109/AIM.2014.6878108

Bibliographical note
Contribution: organisation=ase,FACT1=0.7<br/>Contribution: organisation=elt,FACT2=0.3<br/>Portfolio EDEND: 2014-09-16<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 1394
Research output: Scientific - peer-review » Article

Simulation of hPSC Derived Neuronal Networks with Short and Long Reaching Axons

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Department of Electronics and Communications Engineering
Authors: Lenk, K., Ylä-Outinen, L., Tietz, L., Narkilahti, S., Hyttinen, J.
Pages: 218-219
Publication date: 2014

Host publication information
Title of host publication: MEA Meeting 2014. July 1 - July 4, 2014, Reutlingen, Germany. 9th International Meeting on Substrate-Integrated Microelectrode Arrays
Links:

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-10-20
Source: researchoutputwizard
Source-ID: 869
Research output: Scientific » Conference contribution

Stimuli-Responsive Structures from Cationic Polymers for Biomedical Applications

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Electronics and Communications Engineering
Authors: Calejo, M. T., Hasirci, N., Bagherifam, S., Lund, R., Nyström, B.
Number of pages: 29
Pages: 149-177
Publication date: 2014
Sympathetic activity-associated periodic repolarization dynamics predict mortality following myocardial infarction

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Number of pages: 11
Pages: 1770-1780
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Journal of Clinical Investigation
Volume: 124
Issue number: 4
ISSN (Print): 0021-9738
Ratings:
Unconstrained Night-Time Heart Rate Monitoring with Capacitive Electrodes

**General information**
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Integrated Technologies for Tissue Engineering (ITTE)
Authors: Vehkaoja, A., Salo, A., Peltokangas, M., Verho, J., Salpavaara, T., Lekkala, J.
Number of pages: 4
Pages: 1511-1514
Publication date: 2014

**Host publication information**
Title of host publication: XIII Mediterranean Conference on Medical and Biological Engineering and Computing 2013, MEDICON 2013, 25 - 28 September 2013, Seville, Spain. IFMB Proceedings Volume 41
Place of publication: Berlin
Publisher: Springer
Editor: Roa Romero, L. M.
ISBN (Print): 978-3-319-00845-5
ISBN (Electronic): 978-3-319-00846-2

**Publication series**
Name: IFMBE Proceedings
ISSN (Print): 1680-0737
ASJC Scopus subject areas: Biomedical Engineering

**Bibliographical note**
siirretään Portfolio14
Video image-based analysis of single human induced pluripotent stem cell derived cardiomyocyte beating dynamics using digital image correlation

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Number of pages: 18
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Biomedical Engineering Online
Volume: 13
Issue number: 1
Article number: 39
ISSN (Print): 1475-925X
Ratings:
Scopus rating (2016): CiteScore 2.01 SJR 0.487 SNIP 1.048
Scopus rating (2015): SJR 0.521 SNIP 0.84 CiteScore 1.67
Scopus rating (2014): SJR 0.517 SNIP 1.133 CiteScore 2.02
Scopus rating (2013): SJR 0.577 SNIP 1.007 CiteScore 2.14
Scopus rating (2012): SJR 0.443 SNIP 1.059 CiteScore 1.81
Scopus rating (2011): SJR 0.401 SNIP 1.054 CiteScore 1.73
Scopus rating (2010): SJR 0.428 SNIP 1.102
Scopus rating (2009): SJR 0.521 SNIP 1.408
Scopus rating (2008): SJR 0.537 SNIP 0.97
Scopus rating (2007): SJR 0.453 SNIP 1.205
Scopus rating (2006): SJR 0.622 SNIP 1.282
Scopus rating (2005): SJR 0.502 SNIP 0.947
Scopus rating (2004): SJR 0.404 SNIP 1.181
Scopus rating (2003): SJR 0.151 SNIP 0.313
Original language: English
DOIs:
10.1186/1475-925X-13-39

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2014-05-13<br/>Publisher name: BioMed Central
Source: researchoutputwizard
Source-ID: 63
Research output: Scientific - peer-review › Article

3D Texture Analysis Reveals Imperceptible MRI Textural Alterations in the Thalamus and Putamen in Progressive Myoclonic Epilepsy Type 1, EPM1

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Suoranta, S., Holli-Helenius, K., Koskenkorva, P., Niskanen, E., Könönen, M., Äikiä, M., Eskola, H., Kälviäinen, R., Vanninen, R.
Number of pages: 9
Publication date: 2013
Peer-reviewed: Yes
ADC measurements in diffuse large B-cell lymphoma and follicular lymphoma: a DWI and cellular study

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Number of pages: 7
Pages: e158-e164
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: European Journal of Radiology
Volume: 82
Issue number: 4
ISSN (Print): 0720-048X
Ratings:
Scopus rating (2016): SJR 1.128 SNIP 1.345 CiteScore 2.69
Scopus rating (2015): SJR 1.195 SNIP 1.376 CiteScore 2.61
Scopus rating (2014): SJR 1.162 SNIP 1.333 CiteScore 2.52
Scopus rating (2013): SJR 1.044 SNIP 1.211 CiteScore 2.42
Scopus rating (2012): SJR 0.988 SNIP 1.477 CiteScore 2.54
Scopus rating (2011): SJR 1.146 SNIP 1.355 CiteScore 2.61
Scopus rating (2010): SJR 1.234 SNIP 1.403
Scopus rating (2009): SJR 1.135 SNIP 1.408
Scopus rating (2008): SJR 1.065 SNIP 1.299
Scopus rating (2007): SJR 0.913 SNIP 1.477
Scopus rating (2006): SJR 0.814 SNIP 1.242
Scopus rating (2005): SJR 0.862 SNIP 1.23
Scopus rating (2004): SJR 0.843 SNIP 1.236
A Monte-Carlo based model of the AX-PET demonstrator and its experimental validation

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing
Number of pages: 16
Pages: 5495-5510
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Physics in Medicine and Biology
Volume: 58
Issue number: 16
ISSN (Print): 0031-9155

Ratings:
Scopus rating (2016): CiteScore 3.08 SJR 1.315 SNIP 1.47
Scopus rating (2015): SJR 1.439 SNIP 1.764 CiteScore 3.31
Scopus rating (2014): SJR 1.489 SNIP 1.742 CiteScore 3.16
Scopus rating (2013): SJR 1.703 SNIP 1.783 CiteScore 3.4
Scopus rating (2012): SJR 1.301 SNIP 1.569 CiteScore 3.12
Scopus rating (2011): SJR 1.266 SNIP 1.581 CiteScore 3.08
Scopus rating (2010): SJR 1.527 SNIP 1.814
Scopus rating (2009): SJR 1.235 SNIP 1.971
Scopus rating (2008): SJR 1.261 SNIP 1.616
Scopus rating (2007): SJR 1.358 SNIP 2.059
Scopus rating (2006): SJR 1.302 SNIP 1.574
Scopus rating (2005): SJR 1.172 SNIP 1.694
Scopus rating (2004): SJR 1.026 SNIP 1.721
Scopus rating (2003): SJR 1.041 SNIP 1.503
Scopus rating (2002): SJR 0.981 SNIP 1.261
Scopus rating (2001): SJR 1.015 SNIP 1.242
Scopus rating (2000): SJR 1.1 SNIP 1.155
Scopus rating (1999): SJR 0.824 SNIP 1.318
Original language: English
DOIs:
10.1016/j.ejrad.2012.11.021
Links:
http://www.elsevier.com/locate/ejrad
Analysis of nonlinear dynamics of healthy and epileptic EEG signals using recurrence based complex network approach

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Subramaniyam, N., Hyttinen, J.
Number of pages: 4
Pages: 605-608
Publication date: 2013

Host publication information
Title of host publication: 2013 6th International IEEE/EMBS Conference on Neural Engineering (NER), San Diego, California, 6 - 8 November, 2013
Publisher: Institute of Electrical and Electronics Engineers

Publication series
ISSN (Print): 1948-3546
DOIs:
10.1109/NER.2013.6696007

Aquaporin Expression and Function In Human Pluripotent Stem Cell-Derived Retinal Pigmented Epithelial Cells

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Number of pages: 10
Pages: 3510-3519
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Investigative Ophthalmology and Visual Science
Volume: 54
Issue number: 5
ISSN (Print): 0146-0404
Ratings:
Scopus rating (2016): CiteScore 3.21 SJR 1.836 SNIP 1.283
Scopus rating (2015): SJR 2.04 SNIP 1.408 CiteScore 3.41
Scopus rating (2014): SJR 2.073 SNIP 1.46 CiteScore 3.49
Scopus rating (2013): SJR 2.133 SNIP 1.497 CiteScore 3.74
Scopus rating (2012): SJR 2.222 SNIP 1.409 CiteScore 3.41
Scopus rating (2011): SJR 1.998 SNIP 1.499 CiteScore 3.36
Arterial pulse waves measured with EMFi and PPG sensors and comparison of the pulse waveform spectral and decomposition analysis in healthy young and elderly subjects

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Huotari, M., Vehkaoja, A., Määttä, K., Röning, J.
Number of pages: 10
Pages: 57-66
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Finnish Journal of eHealth and eWelfare
Volume: 5
Issue number: 2-3
ISSN (Print): 1798-0798
Original language: English
Links: http://ojs.tsv.fi/index.php/stty

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2013-06-29
Publisher name: Association for Research in Vision and Ophthalmology
Source: researchoutputwizard
Source-ID: 2443
Research output: Scientific - peer-review › Article

Assessing the state of chronic spinal cord injury using diffusion tensor imaging

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Koskinen, E., Brander, A., Hakulinen, U., Luoto, T., Helminen, M., Ylinen, A., Öhman, J.
Number of pages: 9
Automatic statistical shape analysis of cerebral asymmetry in 3D T1-weighted magnetic resonance images at vertex-level: Application to neuroleptic-naive schizophrenia
**Cardio MEA Data Analysis (CardioMDA) software**

**General information**
State: Published
Ministry of Education publication type: I2 ICT software
Organisations: Department of Electronics and Communications Engineering
Authors: Pradhapan, P., Kuusela, J., Viik, J., Aalto-Setälä, K., Hyttinen, J.
Publication date: 2013
Media of output: Online
Links:
http://www.biomeditech.fi/CardioMDA

**Bibliographical note**
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2013-12-29
Source: researchoutputwizard
Source-ID: 3185
Research output: Scientific › Software

**Cardiomyocyte MEA Data Analysis (CardioMDA) - A Novel Field Potential Data Analysis Software for Pluripotent Stem Cell Derived Cardiomyocytes**

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA), Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Pradhapan, P., Kuusela, J., Viik, J., Aalto-Setälä, K., Hyttinen, J.
Number of pages: 11
Pages: 1-11
Publication date: 2013
Peer-reviewed: Yes

**Publication information**
Journal: PLoS One
Volume: 8
Comparison of different MRI sequences in lesion detection and early response evaluation of diffuse large B-cell lymphoma - a whole-body MRI and diffusion-Weighted imaging study

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Number of pages: 9
Pages: 1186-1194
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: NMR in Biomedicine
Volume: 26
Issue number: 9
ISSN (Print): 0952-3480
Ratings:

Scopus rating (2016): SJR 1.42 SNIP 1.038 CiteScore 3.18
Scopus rating (2015): SJR 1.604 SNIP 1.099 CiteScore 3.23
Scopus rating (2014): SJR 1.602 SNIP 1.165 CiteScore 3.45
Scopus rating (2013): SJR 1.63 SNIP 1.311 CiteScore 3.9
Scopus rating (2012): SJR 1.594 SNIP 1.242 CiteScore 3.47
Scopus rating (2011): SJR 1.347 SNIP 1.351 CiteScore 3.37
Scopus rating (2010): SJR 1.303 SNIP 1.152
Scopus rating (2009): SJR 1.567 SNIP 1.551
Scopus rating (2008): SJR 1.816 SNIP 1.453
Scopus rating (2007): SJR 1.709 SNIP 1.421
Scopus rating (2006): SJR 1.363 SNIP 1.28
Scopus rating (2005): SJR 1.633 SNIP 1.572
Scopus rating (2004): SJR 1.212 SNIP 1.262
Comparison of Five Parathyroid Scintigraphic Protocols

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering
Authors: Tunninen, V., Varjo, P., Schildt, J., Ahonen, A., Kauppinen, T., Lisinen, I., Holm, A., Eskola, H., Seppänen, M.
Number of pages: 12
Pages: 1-12
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: International Journal of Molecular Imaging
Volume: 2013
Article number: 921260
ISSN (Print): 2090-1712
Original language: English
DOIs:
10.1155/2013/921260

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2013-07-29<br/>Publisher name: Hindawi Publishing Corporation
Source: researchoutputwizard
Source-ID: 3567
Research output: Scientific - peer-review › Article

Computational Models of Ventricular- and Atrial-Like Human Induced Pluripotent Stem Cell Derived Cardiomyocytes

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Paci, M., Hyttinen, J., Aalto-Setälä, K., Severi, S.
Pages: 2334-2348
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Annals of Biomedical Engineering
Volume: 41
Issue number: 11
ISSN (Print): 0090-6964

Ratings:
Constructing Benchmark Databases and Protocols for Medical Image Analysis: Diabetic Retinopathy

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research Community on Data-to-Decision (D2D)
Authors: Kauppi, T., Kämäräinen, J., Lensu, L., Kalesnykiene, V., Sorri, I., Uusitalo, H., Kälviäinen, H.
Number of pages: 15
Pages: 1-15
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Computational and Mathematical Methods in Medicine
Volume: 2013
Article number: 368514
ISSN (Print): 1748-670X
Ratings:
Scopus rating (2016): SJR 0.381 SNIP 0.674 CiteScore 1.18
Scopus rating (2015): SJR 0.419 SNIP 0.602 CiteScore 1.03
Scopus rating (2014): SJR 0.333 SNIP 0.542 CiteScore 0.94
Scopus rating (2013): SJR 0.304 SNIP 0.597 CiteScore 1.23
Scopus rating (2012): SJR 0.231 SNIP 0.664 CiteScore 0.88
Scopus rating (2011): SJR 0.391 SNIP 0.623 CiteScore 0.88
Scopus rating (2010): SJR 0.45 SNIP 0.428
Scopus rating (2009): SJR 0.406 SNIP 0.526
Scopus rating (2008): SJR 0.406 SNIP 0.299
Scopus rating (2007): SJR 0.188 SNIP 0.107
Scopus rating (2006): SJR 0.357 SNIP 0.606
Scopus rating (2005): SJR 0.461 SNIP 0.51
Detection of concurrent atrial ischemia with continuous monitoring of dynamic PR-segment changes in patients with acute myocardial infarction

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering
Authors: Korhonen, P., Väisänen, J., Nousiainen, J., Huhtala, H., Yli-Mäyry, S., Raatikainen, P.
Number of pages: 7
Pages: 324-330
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Journal of Electrocardiology
Volume: 46
Issue number: 4
ISSN (Print): 0022-0736
Ratings:
Scopus rating (2016): SJR 0.653 SNIP 0.73 CiteScore 1.14
Scopus rating (2015): SJR 0.513 SNIP 0.743 CiteScore 1.06
Scopus rating (2014): SJR 0.68 SNIP 0.963 CiteScore 1.16
Scopus rating (2013): SJR 0.6 SNIP 0.844 CiteScore 1.33
Scopus rating (2012): SJR 0.522 SNIP 0.829 CiteScore 1.08
Scopus rating (2011): SJR 0.534 SNIP 0.793 CiteScore 1.02
Scopus rating (2010): SJR 0.51 SNIP 0.713
Scopus rating (2009): SJR 0.496 SNIP 0.856
Scopus rating (2008): SJR 0.611 SNIP 0.836
Scopus rating (2007): SJR 0.56 SNIP 1.022
Scopus rating (2006): SJR 0.545 SNIP 0.785
Scopus rating (2005): SJR 0.323 SNIP 0.529
Scopus rating (2004): SJR 0.317 SNIP 0.592
Scopus rating (2003): SJR 0.416 SNIP 0.559
Scopus rating (2002): SJR 0.501 SNIP 0.604
Scopus rating (2001): SJR 0.469 SNIP 0.5
Scopus rating (2000): SJR 0.43 SNIP 0.658
Scopus rating (1999): SJR 0.329 SNIP 0.613
Original language: English
DOIs:
10.1016/j.jelectrocard.2013.03.013
Effect of pressure and padding on motion artifact of textile electrodes

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Department of Materials Science, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Cömert, A., Honkala, M., Hyttinen, J.
Number of pages: 18
Pages: 1-18
Publication date: 2013
Peer-reviewed: Yes
Feasibility of a Personal Health Technology-Based Psychological Intervention for Men with Stress and Mood Problems: Randomized Controlled Pilot Trial

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Research group: Personal Health Informatics-PHI, Research Community on Data-to-Decision (D2D)
Number of pages: 17
Pages: 1-17
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: JMIR Research Protocols
Volume: 2
Issue number: 1
Article number: e1
ISSN (Print): 1929-0748
Original language: English
DOI: 10.2196/resprot.2389

Bibliographical note
Contribution: organisation=sgn,FACT1=1
Portfolio EDEND: 2013-07-29
Publisher name: JMIR Publications
Source: researchoutputwizard
Source-ID: 2727
Research output: Scientific - peer-review › Article

Femoral neck cross-sectional geometry and exercise loading

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA), Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Narra, N., Nikander, R., Viik, J., Hyttinen, J., Sievänen, H.
Number of pages: 9
Pages: 258-266
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Clinical Physiology and Functional Imaging
Volume: 33
Issue number: 4
ISSN (Print): 1475-0961
Scopus rating (2016): SJR 0.635 SNIP 0.778 CiteScore 1.49
Scopus rating (2015): SJR 0.538 SNIP 0.668 CiteScore 1.44
Scopus rating (2014): SJR 0.589 SNIP 0.837 CiteScore 1.53
Scopus rating (2013): SJR 0.595 SNIP 0.684 CiteScore 1.53
Scopus rating (2012): SJR 0.464 SNIP 0.909 CiteScore 1.51
Scopus rating (2011): SJR 0.512 SNIP 0.71 CiteScore 1.52
Scopus rating (2010): SJR 0.587 SNIP 0.825
Scopus rating (2009): SJR 0.444 SNIP 0.707
Genome-Wide Association Study Pinpoints a New Functional Apolipoprotein B Variant Influencing Oxidized Low-Density Lipoprotein Levels But Not Cardiovascular Events: AtheroRemo Consortium

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA), Integrated Technologies for Tissue Engineering Research (ITTE)
Number of pages: 9
Pages: 73-81
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Circulation: Cardiovascular Genetics
Volume: 6
Issue number: 1
ISSN (Print): 1942-325X
Ratings:
Scopus rating (2016): SJR 2.494 SNIP 1.227 CiteScore 3.82
Scopus rating (2015): SJR 2.564 SNIP 1.17 CiteScore 3.43
Scopus rating (2014): SJR 2.404 SNIP 1.184 CiteScore 3.6
Scopus rating (2013): SJR 3.328 SNIP 1.36 CiteScore 4.65
Scopus rating (2012): SJR 3.644 SNIP 1.451 CiteScore 5.06
Scopus rating (2011): SJR 3.821 SNIP 1.608 CiteScore 5.4
Scopus rating (2010): SJR 2.323 SNIP 0.871
Scopus rating (2009): SJR 1.201
Original language: English
DOIs: 10.1161/CIRCGENETICS.112.964965
Impact of EPR systems on information flow in Finnish health centers

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering
Authors: Mäkelä, K., Virjo, I., Aho, J., Kalliola, P., Kurunmäki, H., Uusitalo, L., Valli, M., Ylinen, S.
Number of pages: 5
Pages: 155-159
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Telemedicine and E-Health
Volume: 19
Issue number: 3
ISSN (Print): 1530-5627
Ratings:
Scopus rating (2016): SJR 0.481 SNIP 0.674 CiteScore 1.06
Scopus rating (2015): SJR 0.501 SNIP 0.638 CiteScore 1.15
Scopus rating (2014): SJR 0.437 SNIP 0.582 CiteScore 0.88
Scopus rating (2013): SJR 0.539 SNIP 0.565 CiteScore 0.95
Scopus rating (2012): SJR 0.397 SNIP 0.686 CiteScore 0.89
Scopus rating (2011): SJR 0.49 SNIP 0.983 CiteScore 1.05
Scopus rating (2010): SJR 0.517 SNIP 0.919
Scopus rating (2009): SJR 0.512 SNIP 0.82
Scopus rating (2008): SJR 0.609 SNIP 0.978
Scopus rating (2007): SJR 0.462 SNIP 0.684
Scopus rating (2006): SJR 0.462 SNIP 0.997
Scopus rating (2005): SJR 0.405 SNIP 0.884
Scopus rating (2004): SJR 0.493 SNIP 1.355
Scopus rating (2003): SJR 0.487 SNIP 0.881
Scopus rating (2002): SJR 0.409 SNIP 0.442
Scopus rating (2001): SJR 0.582 SNIP 0.741
Scopus rating (2000): SJR 0.644
Scopus rating (1999): SJR 0.287
Original language: English
DOIs:
10.1089/tmj.2012.0075

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2013-12-29
Publisher name: Mary Ann Liebert, Inc.
Publishers
Source: researchoutputwizard
Source-ID: 2856
Research output: Scientific - peer-review › Article
Impedance Spectra of Polypyrrole Coated Platinum Electrodes

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Onnela, N., Savolainen, V., Hiltunen, M., Kellomäki, M., Hyttinen, J.
Number of pages: 4
Pages: 539-542
Publication date: 2013

Host publication information
Title of host publication: EMBC 2013, 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBS), 3-7 July 2013, Osaka, Japan
ISBN (Print): 978-1-4577-0216-7

Publication series
Name: Annual International Conference of the IEEE Engineering in Medicine and Biology Society
ISSN (Print): 1557-170X
DOIs: 10.1109/EMBC.2013.6609556

Bibliographical note
Contribution: organisation= elt,FACT1=1<br/>Portfolio EDEND: 2013-10-29
Source: researchoutputwizard
Source-ID: 3061
Research output: Scientific - peer-review › Conference contribution

Integration of Microfluidic System with Silicon Nanowires Biosensor for Multiplexed Detection

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Gao, A., Dai, P., Lu, N., Li, T., Wang, Y., Hemmilä, S., Kallio, P.
Number of pages: 4
Pages: 348-351
Publication date: 2013

Host publication information
Title of host publication: Proceedings of the Third International Conference on Manipulation, Manufacturing and Measurement on the Nanoscale, 3M-NANO, Suzhou, China, 26-30 August, 2013

Publication series
Name: International Conference on Manipulation, Manufacturing and Measurement on the Nanoscale
ISSN (Print): 1932-4510

Bibliographical note
Contribution: organisation=ase,FACT1=1<br/>Portfolio EDEND: 2013-10-29
Source: researchoutputwizard
Source-ID: 2156
Research output: Scientific - peer-review › Conference contribution

Intercellular Ca2+ wave propagation in human retinal pigment epithelium cells induced by mechanical stimulation

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Abu Khamidakh, A., Juuti-Uusitalo, K., Larsson, K., Skottman, H., Hyttinen, J.
Number of pages: 11
Pages: 129-139
In vitro electroretinogram for the study of the functionality of differentiated retinal pigment epithelium cells

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Onnela, N., Lehtonen, L., Koski, M., Hyttinen, J.
Pages: 61-70
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Medical & Biological Engineering & Computing
Volume: 51
Issue number: 1-2
ISSN (Print): 0140-0118
Ratings:
Scopus rating (2016): CiteScore 2.05 SJR 0.699 SNIP 1.238
Scopus rating (2015): SJR 0.805 SNIP 1.177 CiteScore 2.14
Scopus rating (2014): SJR 0.634 SNIP 1.321 CiteScore 2.16
Scopus rating (2013): SJR 0.668 SNIP 1.266 CiteScore 2.19
Local Ballistocardiographic Spectrum Studies from Signals Obtained from Limbs and Carotid Artery with an EMFi Sensor Induced with a Tilt Table

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Augmented Human Activities (AHA)
Authors: Alametsä, J., Palomäki, A., Viik, J.
Number of pages: 4
Pages: 7008-7011
Publication date: 2013
Host publication information
Title of host publication: EMBC 2013, 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBS) , 3-7 July 2013, Osaka, Japan
ISBN (Print): 978-1-4577-0216-7
Publication series
Name: Annual International Conference of the IEEE Engineering in Medicine and Biology Society
ISSN (Print): 1557-170X
DOIs:
10.1109/EMBC.2013.6611171

Microparticles Based on Hydrophobically Modified Chitosan as Drug Carriers

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering
Authors: Calejo, M. T., Kjoniksen, A., Maleki, A., Nyström, B., Sande, S. A.
Number of pages: 11
New insights to the role of aryl hydrocarbon receptor in bone phenotype and in dioxin-induced modulation of bone microarchitecture and material properties

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Number of pages: 8
Pages: 219-226
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Toxicology and Applied Pharmacology
Volume: 273
Issue number: 1
ISSN (Print): 0041-008X
Ratings:
Scopus rating (2016): SJR 1.476 SNIP 1.299 CiteScore 4.26
Scopus rating (2015): SJR 1.564 SNIP 1.325 CiteScore 4.28
Non-Binary Coding for Texture Descriptors in Sub-Cellular and Stem Cell Image Classification

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Paci, M., Nanni, L., Lahti, A., Aalto-Setälä, K., Hyttinen, J., Severi, S.
Number of pages: 12
Pages: 208-219
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Current Bioinformatics
Volume: 8
Issue number: 2
ISSN (Print): 1574-8936
Ratings:
Scopus rating (2016): SJR 0.23 SNIP 0.288 CiteScore 0.6
Scopus rating (2015): SJR 0.32 SNIP 0.428 CiteScore 0.86
Scopus rating (2014): SJR 0.315 SNIP 0.528 CiteScore 0.93
Scopus rating (2013): SJR 0.359 SNIP 0.665 CiteScore 1.9
Scopus rating (2012): SJR 0.236 SNIP 0.594 CiteScore 1.74
Scopus rating (2011): SJR 0.393 SNIP 0.436 CiteScore 1.06
Scopus rating (2010): SJR 0.294 SNIP 0.264
Scopus rating (2009): SJR 0.615 SNIP 0.651
Scopus rating (2008): SJR 0.678 SNIP 0.472
Scopus rating (2007): SJR 0.123 SNIP 0
Scopus rating (2006): SJR 0.122 SNIP 0

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2013-10-29
Source: researchoutputwizard
Source-ID: 2298
Research output: Scientific - peer-review › Article
Performance of two commercial electron beam algorithms over regions close to the lung–mediastinum interface, against Monte Carlo simulation and point dosimetry in virtual and anthropomorphic phantoms

Original language: English

Performance of two commercial electron beam algorithms over regions close to the lung–mediastinum interface, against Monte Carlo simulation and point dosimetry in virtual and anthropomorphic phantoms

Original language: English

Personal Health Technologies in Employee Health Promotion: Usage Activity, Usefulness, and Health-Related Outcomes in a 1-Year Randomized Controlled Trial

Original language: English
Postural control in restless legs syndrome with medication intervention using pramipexole

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering
Authors: Ahlgren-Rimpiläinen, A., Lauerma, H., Kähkönen, S., Aalto, H., Tuisku, K., Holi, M., Pyykkö, I., Rimpiläinen, I.
Number of pages: 6
Pages: 1-6
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Neurological Sciences
ISSN (Print): 1590-1874
Ratings:
Scopus rating (2016): SJR 0.681 SNIP 0.663 CiteScore 1.3
Scopus rating (2015): SJR 0.665 SNIP 0.669 CiteScore 1.29
Scopus rating (2014): SJR 0.598 SNIP 0.693 CiteScore 1.23
Scopus rating (2013): SJR 0.505 SNIP 0.772 CiteScore 1.41
Scopus rating (2012): SJR 0.539 SNIP 0.76 CiteScore 1.38
Scopus rating (2011): SJR 0.498 SNIP 0.766 CiteScore 1.46
Scopus rating (2010): SJR 0.564 SNIP 0.599
Scopus rating (2009): SJR 0.537 SNIP 0.589
Scopus rating (2008): SJR 0.635 SNIP 0.757
Scopus rating (2007): SJR 0.508 SNIP 0.7
Scopus rating (2006): SJR 0.512 SNIP 0.644
Scopus rating (2005): SJR 0.495 SNIP 0.733
Scopus rating (2004): SJR 0.526 SNIP 0.513
Scopus rating (2003): SJR 0.247 SNIP 0.367
Scopus rating (2002): SJR 0.18 SNIP 0.254
Scopus rating (2001): SJR 0.14 SNIP 0.177
Scopus rating (2000): SJR 0.119 SNIP 0.25
Scopus rating (1999): SJR 0.134 SNIP 0.265
Original language: English
DOIs:
10.1007/s10072-013-1478-6

Bibliographical note
Regional compensation for statistical maximum likelihood reconstruction error of PET image pixels

**General information**

State: Published  
Ministry of Education publication type: A1 Journal article-refereed  
Organisations: Department of Signal Processing, Department of Mathematics  
Authors: Forma, J., Niemi, J., Ruotsalainen, U.  
Number of pages: 16  
Pages: 4849-4864  
Publication date: 2013  
Peer-reviewed: Yes

**Publication information**

Journal: Physics in Medicine and Biology  
Volume: 58  
Issue number: 14  
ISSN (Print): 0031-9155  
Ratings:  
Scopus rating (2016): CiteScore 3.08 SJR 1.315 SNIP 1.47  
Scopus rating (2015): SJR 1.439 SNIP 1.764 CiteScore 3.31  
Scopus rating (2014): SJR 1.489 SNIP 1.742 CiteScore 3.16  
Scopus rating (2013): SJR 1.703 SNIP 1.783 CiteScore 3.4  
Scopus rating (2012): SJR 1.301 SNIP 1.569 CiteScore 3.12  
Scopus rating (2011): SJR 1.266 SNIP 1.581 CiteScore 3.08  
Scopus rating (2010): SJR 1.527 SNIP 1.814  
Scopus rating (2009): SJR 1.235 SNIP 1.971  
Scopus rating (2008): SJR 1.261 SNIP 1.616  
Scopus rating (2007): SJR 1.358 SNIP 2.059  
Scopus rating (2006): SJR 1.302 SNIP 1.574  
Scopus rating (2005): SJR 1.172 SNIP 1.694  
Scopus rating (2004): SJR 1.026 SNIP 1.721  
Scopus rating (2003): SJR 1.041 SNIP 1.503  
Scopus rating (2002): SJR 0.981 SNIP 1.261  
Scopus rating (2001): SJR 1.015 SNIP 1.242  
Scopus rating (2000): SJR 1.1 SNIP 1.155  
Scopus rating (1999): SJR 0.824 SNIP 1.318  
Original language: English  
DOIs: 10.1088/0031-9155/58/14/4849

**Bibliographical note**

Contribution: organisation=sgn,FAC1=0.5  
Contribution: organisation=mat,FAC2=0.5  
Portfolio EDEND: 2013-07-29  
Publisher name: IOP Publishing  
Source: researchoutputwizard  
Source-ID: 2144  
Research output: Scientific - peer-review » Article

Simulation of Microporous Architecture's Effects on Fluid Flow Characteristics in Cell Seeding

**General information**

State: Published  
Ministry of Education publication type: A4 Article in a conference publication  
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Sleepiness and stress among long-haul truck drivers: an educational intervention to promote safe and economic truck driving

General information
State: Published
Ministry of Education publication type: D4 Published development or research report or study
Organisations: Department of Electronics and Communications Engineering
Number of pages: 65
Publication date: 2013

Publication information
Publisher: TYÖTERVEYSLAITOS
ISBN (Print): 978-952-261-286-1
Original language: English
Links:

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2013-11-29
Source: researchoutputwizard
Source-ID: 3201
Research output: Professional › Commissioned report

Source Localization Based on Ictal Electroencephalographic Recordings

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Puthanmadam Subramaniyam, N., Peltola, J., Tanskanen, J. M., Wendel-Mitoraj, K., Hytinen, J., Malmivuo, J.
Number of pages: 5
Pages: 26-30
Publication date: 2013

Host publication information
Title of host publication: International Symposium on Biomedical Engineering and Medical Physics, 10-12 October, 2012, Riga, Latvia
The AX-PET experiment: A demonstrator for an axial Positron Emission Tomograph

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing
Number of pages: 4
Pages: 126-129
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Nuclear instruments and Methods in Physics Research Section A: Accelerators Spectrometers Detectors and Associated Equipment
Volume: 718
ISSN (Print): 0168-9002
Ratings:
Scopus rating (2016): SJR 0.916 SNIP 1.352 CiteScore 1.44
Scopus rating (2015): SJR 0.915 SNIP 1.334 CiteScore 1.21
Scopus rating (2014): SJR 0.852 SNIP 1.303 CiteScore 1.24
Scopus rating (2013): SJR 0.944 SNIP 1.398 CiteScore 1.48
Scopus rating (2012): SJR 0.806 SNIP 1.071 CiteScore 1.19
Scopus rating (2011): SJR 0.918 SNIP 1.424 CiteScore 1.29
Scopus rating (2010): SJR 0.893 SNIP 1.113
Scopus rating (2009): SJR 0.75 SNIP 1.386
Scopus rating (2008): SJR 0.753 SNIP 1.073
Scopus rating (2007): SJR 0.716 SNIP 1.383
Scopus rating (2006): SJR 0.818 SNIP 1.108
Scopus rating (2005): SJR 0.819 SNIP 1.156
Scopus rating (2004): SJR 0.844 SNIP 1.489
Scopus rating (2003): SJR 0.673 SNIP 1.226
Scopus rating (2002): SJR 0.628 SNIP 1.108
Scopus rating (2001): SJR 0.688 SNIP 1.104
Scopus rating (2000): SJR 0.594 SNIP 0.974
Scopus rating (1999): SJR 0.754 SNIP 1.006
Original language: English
DOIs:
10.1016/j.nima.2012.07.054

Bibliographical note
Thermoresponsive polymers as gene and drug delivery vectors: architecture and mechanism of action

General information
State: Published
Ministry of Education publication type: A2 Review article in a scientific journal
Organisations: Department of Electronics and Communications Engineering
Authors: Calejo, M. T., Sande, S. A., Nyström, B.
Number of pages: 18
Pages: 1669-1686
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Expert Opinion on Drug Delivery
Volume: 10
Issue number: 12
ISSN (Print): 1742-5247
Ratings:
Scopus rating (2016): SJR 1.469 SNIP 1.45 CiteScore 5.49
Scopus rating (2015): SJR 1.439 SNIP 1.449 CiteScore 5.06
Scopus rating (2014): SJR 1.439 SNIP 1.423 CiteScore 4.78
Scopus rating (2013): SJR 1.507 SNIP 1.363 CiteScore 4.85
Scopus rating (2012): SJR 1.882 SNIP 1.577 CiteScore 5.48
Scopus rating (2011): SJR 1.683 SNIP 1.323 CiteScore 5.03
Scopus rating (2010): SJR 1.542 SNIP 1.237
Scopus rating (2009): SJR 1.12 SNIP 1.024
Scopus rating (2008): SJR 0.937 SNIP 1.008
Scopus rating (2007): SJR 1.068 SNIP 0.857
Scopus rating (2006): SJR 0.583 SNIP 0.581
Scopus rating (2005): SJR 0.368 SNIP 0.442
Original language: English
DOIs:
10.1517/17425247.2013.846906

Bibliographical note
Contribution: organisation=elt,FACT1=1
Portfolio EDEND: 2013-10-29
Publisher name: Informa Healthcare

Towards designing a multi-modal neuronal recording for a non-human primate - an EEG/SEP study

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering
Authors: Joutsen, A., Takahashi, K., van Drongelen, W., Hatsopoulos, N. G., Wendel-Mitoraj, K.
Number of pages: 1
Pages: R-287
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Transactions of Japanese Society for Medical and Biological Engineering
Volume: 51
ISSN (Print): 1347-443X
Transcriptome and small RNA deep sequencing reveals deregulation of miRNA biogenesis in human glioma

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Signal Processing, Prostate cancer research center (PCRC)
Number of pages: 11
Pages: 449-459
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Journal of Pathology
Volume: 229
Issue number: 3
Article number: 4109
ISSN (Print): 0022-3417
Ratings:
Scopus rating (2016): SJR 3.623 SNIP 1.669 CiteScore 6.68
Scopus rating (2015): SJR 4.163 SNIP 1.816 CiteScore 7.06
Scopus rating (2014): SJR 4.26 SNIP 1.916 CiteScore 6.94
Scopus rating (2013): SJR 4.382 SNIP 1.854 CiteScore 7.15
Scopus rating (2012): SJR 3.727 SNIP 1.873 CiteScore 7.05
Scopus rating (2011): SJR 3.8 SNIP 1.943 CiteScore 6.9
Scopus rating (2010): SJR 3.463 SNIP 1.868
Scopus rating (2009): SJR 3.054 SNIP 1.623
Scopus rating (2008): SJR 2.752 SNIP 1.498
Scopus rating (2007): SJR 2.953 SNIP 1.638
Scopus rating (2006): SJR 2.892 SNIP 1.809

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2013-10-29
Source: researchoutputwizard
Source-ID: 2425
Research output: Scientific - peer-review » Article
Allelic variant of NOS1AP effects on cardiac alternans of repolarization during exercise testing

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Augmented Human Activities (AHA)
Number of pages: 8
Pages: 100-107
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Scandinavian Journal of Clinical and Laboratory Investigation
Volume: 72
Issue number: 2
ISSN (Print): 0036-5513
Ratings:
Scopus rating (2016): SJR 0.584 SNIP 0.69 CiteScore 1.4
Scopus rating (2015): SJR 0.729 SNIP 0.741 CiteScore 1.79
Scopus rating (2014): SJR 0.746 SNIP 0.897 CiteScore 1.9
Scopus rating (2013): SJR 0.632 SNIP 0.676 CiteScore 1.84
Scopus rating (2012): SJR 0.482 SNIP 0.67 CiteScore 1.43
Scopus rating (2011): SJR 0.545 SNIP 0.769 CiteScore 1.54
Scopus rating (2010): SJR 0.54 SNIP 0.703
Scopus rating (2009): SJR 0.453 SNIP 0.607
Scopus rating (2008): SJR 0.487 SNIP 0.588
Scopus rating (2007): SJR 0.49 SNIP 0.598
Scopus rating (2006): SJR 0.49 SNIP 0.622
Scopus rating (2005): SJR 0.416 SNIP 0.636
Scopus rating (2004): SJR 0.415 SNIP 0.672
Scopus rating (2003): SJR 0.486 SNIP 0.66
Scopus rating (2002): SJR 0.43 SNIP 0.704
Scopus rating (2001): SJR 0.456 SNIP 0.721
Scopus rating (2000): SJR 0.493 SNIP 0.736
Scopus rating (1999): SJR 0.402 SNIP 0.66
Original language: English
DOIs:
10.1002/path.4109

Bibliographical note
Contribution: organisation=sgn,FACT1=1<br/>Portfolio EDEND: 2013-07-29<br/>Publisher name: John Wiley & Sons
Source: researchoutputwizard
Source-ID: 2941
Research output: Scientific - peer-review › Article
Analysis of the effects of lead configuration on cardiac spectrum

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Beltran-Molina, F., Requena-Carrion, J., Väisänen, J.
Number of pages: 4
Pages: 833-836
Publication date: 2012

Host publication information
Title of host publication: 39th Computing in Cardiology Conference, CINC 2012, September 9-12, 2012, Krakow, Poland.
Computing in Cardiology
Publisher: IEEE
ISBN (Print): 978-1-4673-2074-0

Publication series
Name: Computing in Cardiology
Volume: 39
ISSN (Print): 2325-8861
Links:

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2013-12-29<br/>Publisher name: IEEE
Source: researchoutputwizard
Source-ID: 3903
Research output: Scientific - peer-review › Conference contribution

Analysis of the spatial resolution of body-surface dominant-frequency mapping systems

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Requena-Carrion, J., Väisänen, J., Beltran-Molina, F.
Number of pages: 4
Pages: 345-348
Publication date: 2012

Host publication information
Title of host publication: 39th Computing in Cardiology Conference, CINC 2012, September 9-12, 2012, Krakow, Poland.
Computing in Cardiology
Publisher: IEEE
ISBN (Print): 978-1-4673-2074-0

Publication series
Name: Computing in Cardiology
Volume: 39
ISSN (Print): 2325-8861
Links:

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2013-12-29<br/>Publisher name: IEEE
Source: researchoutputwizard
Source-ID: 5173
Research output: Scientific - peer-review › Conference contribution
Arterial pulse wave velocity in relation to carotid intima-media thickness brachial flow-mediated dilation and carotid artery distensibility: The Cardiovascular Risk in Young Finns Study and the Health 2000 Survey

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Pages: 387-393
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Atherosclerosis
Volume: 220
Issue number: 2
ISSN (Print): 0021-9150
Ratings:
Scopus rating (2016): SJR 1.848 SNIP 1.302 CiteScore 3.81
Scopus rating (2015): SJR 1.894 SNIP 1.363 CiteScore 3.9
Scopus rating (2014): SJR 1.808 SNIP 1.426 CiteScore 3.86
Scopus rating (2013): SJR 1.734 SNIP 1.387 CiteScore 3.94
Scopus rating (2012): SJR 1.673 SNIP 1.376 CiteScore 3.9
Scopus rating (2011): SJR 1.714 SNIP 1.282 CiteScore 3.79
Scopus rating (2010): SJR 1.744 SNIP 1.368
Scopus rating (2009): SJR 1.833 SNIP 1.331
Scopus rating (2008): SJR 1.908 SNIP 1.231
Scopus rating (2007): SJR 1.909 SNIP 1.262
Scopus rating (2006): SJR 1.848 SNIP 1.331
Scopus rating (2005): SJR 1.636 SNIP 1.267
Scopus rating (2004): SJR 1.714 SNIP 1.243
Scopus rating (2003): SJR 1.673 SNIP 1.193
Scopus rating (2002): SJR 1.435 SNIP 1.105
Scopus rating (2001): SJR 1.502 SNIP 1.263
Scopus rating (2000): SJR 1.463 SNIP 1.174
Scopus rating (1999): SJR 1.237 SNIP 1.029
Original language: English
DOIs:
10.1016/j.atherosclerosis.2011.08.007

Bibliographical note
Contribution: organisation=bme,FACT1=1<br/>Publisher name: Elsevier Ireland Ltd
Source: researchoutputwizard
Source-ID: 4511
Research output: Scientific - peer-review › Article

Atomic layer deposited iridium oxide thin film as microelectrode coating in stem cell applications

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering, Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Ryynänen, T., Ylä-Outinen, L., Narkilahti, S., Tanskanen, J. M., Hytinen, J., Hämäläinen, J., Leskelä, M., Lekkala, J.
Number of pages: 5
Pages: 1-5
Publication date: 2012
Binary image representation by contour trees

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Aydogan, D. B., Hyttinen, J.
Publication date: 2012

Host publication information
Place of publication: Bellingham, WA
Publisher: SPIE
Editors: David, R. H., Sebastien, O.
Article number: 83142X
ISBN (Print): 978-081948963-0

Publication series
Name: Medical Imaging 2012: Image Processing
Volume: 8314
ISSN (Print): 0277-786X
DOIs:
10.1117/12.911493

Bibliographical note
Contribution: organisation=bme,FACT1=1<br/>Publisher name: SPIE
Source: researchoutputwizard
Source-ID: 3873
Research output: Scientific - peer-review › Conference contribution

BP Neural Networks with Harmony Search Method-based Training for Epileptic EEG Signal Classification

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Gao, X., Wang, J., Tanskanen, J. M., Bie, R., Guo, P.
Pages: 252-257
Publication date: 2012

Host publication information
Title of host publication: CIS 2012, Proceedings of the 2012 Eight International Conference on Computational Intelligence and Security, 17-18 November, Guangzhou, Guangdong, China
Place of publication: Los Alamitos, CA
Burst analysis tool for developing neuronal networks exhibiting highly varying action potential dynamics

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Kapucu, F. E., Tanskanen, J. M., Mikkonen, J. E., Ylä-Outinen, L., Narkilahti, S., Hyttinen, J. A.
Number of pages: 14
Pages: 1-14
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Frontiers in Computational Neuroscience
Volume: 6
Article number: 38
ISSN (Print): 1662-5188
Ratings:
Scopus rating (2016): CiteScore 2.18 SJR 1.192 SNIP 0.791
Scopus rating (2015): SJR 1.351 SNIP 0.857 CiteScore 2.48
Scopus rating (2014): SJR 1.218 SNIP 0.79 CiteScore 2.31
Scopus rating (2013): SJR 1.409 SNIP 0.819 CiteScore 2.07
Scopus rating (2012): SJR 1.398 SNIP 0.953 CiteScore 2.19
Scopus rating (2011): SJR 1.476 SNIP 0.688 CiteScore 3
Scopus rating (2010): SJR 1.728 SNIP 0.863
Scopus rating (2009): SJR 1.331 SNIP 0.43
Scopus rating (2008): SJR 1.108 SNIP 0.174
Original language: English
DOIs:
10.3389/fncom.2012.00038
Links:
http://www.frontiersin.org

Bibliographical note
Contribution: organisation=bme,FACT1=1
Publisher name: Frontiers Res Found
Source: researchoutputwizard
Source-ID: 4416
Research output: Scientific - peer-review › Article

Carotid and radial pulse feature analysis with EMFi sensor

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Alametsä, J., Palomäki, A., Viik, J.
Pages: 80-88
Combining unobtrusive electrocardiography and ballistography for more accurate monitoring of sleep

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Vehkaoja, A., Peltokangas, M., Verho, J., Lekkala, J.
Pages: 202-207
Publication date: 2012

Host publication information
Title of host publication: Proceedings of the IEEE 12th International Conference on BioInformatics and BioEngineering BIBE, November 11-13, 2012, Larnaca, Cyprus
Place of publication: Piscataway, NJ
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4673-4357-2

Publication series
Name: IEEE International Conference on Bioinformatics and Bioengineering
ASJC Scopus subject areas: Biomedical Engineering
Electronic versions:
Combining Unobtrusive Electrocardiography and Ballistography for more Accurate Monitoring of Sleep
DOIs:
10.1109/BIBE.2012.6399674
Links:
http://urn.fi/URN:NBN:fi:tty-201603183713

Bibliographical note
Contribution: organisation=bme,FACT1=1
Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 5528
Research output: Scientific - peer-review › Conference contribution

Comparison of local pulse wave velocity values acquired with EMFi sensor

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Alametsä, J., Palomäki, A.
Pages: 89-98
Publication date: 2012
Peer-reviewed: Yes
Comparison of the Properties of EEG and MEG in Detecting the Electric Activity of the Brain

General information
State: Published
Ministry of Education publication type: A2 Review article in a scientific journal
Organisations: Department of Biomedical Engineering
Authors: Malmivuo, J.
Number of pages: 19
Pages: 1-19
Publication date: 2012
Peer-reviewed: Yes
Electrical Field Stimulation with a Novel Platform: Effect on Cardiomyocyte Gene Expression but not on Orientation

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Kujala, K., Ahola, A., Pekkanen-Mattila, M., Ikonen, L., Kerkelä, E., Hyttinen, J., Aalto-Setälä, K.
Number of pages: 12
Pages: 109-120
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: International Journal of Biomedical Science
Volume: 8
Issue number: 2
ISSN (Print): 1550-9702
Ratings:
Scopus rating (2016): SJR 0.341 SNIP 0.795
Scopus rating (2015): SJR 0.386 SNIP 0.691 CiteScore 1.1
Scopus rating (2014): SJR 0.305 SNIP 0.717 CiteScore 0.95
Scopus rating (2013): SJR 0.247 SNIP 0.475 CiteScore 0.72
Scopus rating (2012): SJR 0.215 SNIP 0.532 CiteScore 0.77
Scopus rating (2011): SJR 0.159 SNIP 0.364 CiteScore 0.59
Scopus rating (2010): SJR 0.146 SNIP 0.248
Scopus rating (2009): SJR 0.129 SNIP 0.143
Original language: English
Links:
http://www.ijbs.org/User/All-by-date.aspx

Bibliographical note
ei ut-numeroa 19.8.2013<br/>Contribution: organisation=bme,FACT1=1<br/>Publisher name: Master Publishing Group
Source: researchoutputwizard
Source-ID: 4561
Research output: Scientific - peer-review › Article

Electric impedance of human embryonic stem cell derived retinal pigment epithelium

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Onnela, N., Savolainen, V., Juuti-Uusitalo, K., Vaajasaari, H., Skottman, H., Hyttinen, J.
Number of pages: 10
Pages: 107-116
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Medical & Biological Engineering & Computing
Volume: 50
Issue number: 2
ISSN (Print): 0140-0118
Ratings:
Scopus rating (2016): CiteScore 2.05 SJR 0.699 SNIP 1.238
Scopus rating (2015): SJR 0.805 SNIP 1.177 CiteScore 2.14
Scopus rating (2014): SJR 0.634 SNIP 1.321 CiteScore 2.16
Scopus rating (2013): SJR 0.668 SNIP 1.266 CiteScore 2.19
Scopus rating (2012): SJR 0.732 SNIP 1.343 CiteScore 2.15
Scopus rating (2011): SJR 0.621 SNIP 1.221 CiteScore 2.15
Enhanced map-based indoor navigation system of a humanoid robot using ultrasound measurements

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Bäck, I., Kallio, J., Mäkelä, K.
Number of pages: 6
Pages: 111-116
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Intelligent Control and Automation
Volume: 3
Issue number: 2
ISSN (Print): 2153-0653
Original language: English
DOI:
10.4236/ica.2012.32013
Links:
http://www.scirp.org/journal/ica

Bibliographical note
ei ut-numeroa 9.8.2013<br/>Contribution: organisation=bme,FACT1=1<br/>Publisher name: Scientific Research Publishing, Inc.
Source: researchoutputwizard
Source-ID: 4986
Research output: Scientific - peer-review → Article

Epileptic EEG Signal Classification with ANFIS based on Harmony Search Method

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Wang, J., Gao, X., Tanskanen, J. M., Guo, P.
Pages: 690-694
Publication date: 2012
Epileptic EEG signal classification with marching pursuit based on harmony search method

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Guo, P., Wang, J., Gao, X., Tanskanen, J. M.
Pages: 283-288
Publication date: 2012

Host publication information
Place of publication: Piscataway, NJ
Publisher: Institute of Electrical and Electronics Engineers IEEE
Article number: 6377715
ISBN (Print): 978-146731714-6

Publication series
Name: IEEE International Conference on Systems, Man and Cybernetics
ISSN (Print): 1062-922X
DOIs: 10.1109/ICSMC.2012.6377715

Bibliographical note
Contribution: organisation=bme,FACT1=1
Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 4115
Research output: Scientific - peer-review → Conference contribution

Experimental Comparison of Geometric, Arithmetic and Harmonic Means for EEG Event Related Potential Detection

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Number of pages: 5
Pages: 112-116
Publication date: 2012

Host publication information
Title of host publication: CIS 2012, Proceedings of the 2012 Eight International Conference on Computational Intelligence and Security, 17-18 November, Guangzhou, Guangdong, China
Place of publication: Los Alamitos, CA
Fabrication of electroconductive polypyrrole coatings on platinum electrodes

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Electronics and Communications Engineering
Authors: Savolainen, V., Hiltunen, M., Albrecht, K., Nymark, S., Kellomäki, M., Hyttinen, J.
Number of pages: 2
Pages: 291-292
Publication date: 2012

Host publication information
Title of host publication: Proceedings MEA Meeting 2012, July 10 - July 13, 2012, Reutlingen, Germany, 8th International Meeting on Substrate-Integrated Microelectrode Arrays

Publication series
Name: International Meeting on Substrate-Integrated Microelectrode Arrays
ISSN (Print): 2194-5519
Links:
http://www.nmi.de/nc/ueber-uns/aktuell/publikationen/detailseite-publikationen/artikel/mea-meeting-2012-proceedings/

Bibliographical note
Contribution: organisation=elt,FACT1=1<br/>Portfolio EDEND: 2013-10-29
Source: researchoutputwizard
Source-ID: 5288
Research output: Scientific - peer-review › Conference contribution

Glucose metabolism correlated with cellular proliferation in diffuse large B-cell lymphoma

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Wu, X., Pertovaara, H., Korkola, P., Vornanen, M., Eskola, H., Kellokumpu-Lehtinen, P.
Pages: 400-405
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Leukemia and Lymphoma
Volume: 53
Issue number: 3
ISSN (Print): 1042-8194
Ratings:
Scopus rating (2016): SJR 1.042 SNIP 0.664 CiteScore 1.49
Scopus rating (2015): SJR 1.191 SNIP 0.798 CiteScore 1.7
Scopus rating (2014): SJR 1.141 SNIP 0.805 CiteScore 1.67
Heart rate variability changes at 2400 m altitude predicts acute mountain sickness on further ascent at 3000-4300 m altitudes

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Augmented Human Activities (AHA)
Number of pages: 7
Pages: 1-7
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Frontiers in Physiology
Volume: 3
Issue number: August
Article number: 336
ISSN (Print): 1664-042X
Ratings:
Scopus rating (2016): CiteScore 3.89 SJR 1.765 SNIP 1.157
Scopus rating (2015): SJR 1.871 SNIP 1.185 CiteScore 3.78
Scopus rating (2014): SJR 1.517 SNIP 1.049 CiteScore 3.29
Scopus rating (2013): SJR 1.227 SNIP 0.82 CiteScore 2.82
Scopus rating (2012): SJR 0.822 SNIP 0.691 CiteScore 2.14
Scopus rating (2011): SJR 0.501 SNIP 0.534
Original language: English
DOIs:
10.3389/fphys.2012.00336
Links:

Bibliographical note
Published online 2012 August 30. ei ut-numeroa 19.8.2013<br/>
Implantable Measurement System for Dairy-Cattle Monitoring with Long Recording Time

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering, Department of Electronics, Department of Biomedical Engineering
Authors: Bjarnason, A., Vuorela, T., Verho, J., Riistama, J., Vanhala, J., Lekkala, J., Hyttinen, J.
Pages: 33-38
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Advances in Science and Technology
Volume: 85
Issue number: Chapter 2
ISSN (Print): 1662-8969
Original language: English
DOIs:
10.4028/www.scientific.net/AST.85.33
Links:
http://www.scientific.net/AST

Bibliographical note
Online since September, 2012<br/>Contribution: organisation=bme,FACT1=0.4<br/>Contribution: organisation=ele,FACT2=0.3<br/>Contribution: organisation=ase,FACT3=0.3<br/>Publisher name: Trans Tech Publications

Independent Component Analysis in ECG Signal Processing

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Biomedical Engineering
Authors: Tanskanen, J. M., Viik, J. J.
Pages: 349-372
Publication date: 2012

Host publication information
Title of host publication: Advances in Electrocardiograms - Methods and Analysis
Place of publication: Rijeka, Croatia
Publisher: InTech
Editor: Millis, R. M.
DOIs:
10.5772/22719
Links:
http://www.intechopen.com/books/advances-in-electrocardiograms-methods-and-analysis

Bibliographical note
ei ut-numeroa 30.8.2013<br/>Contribution: organisation=bme,FACT1=1
Low count PET sinogram denoising

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing
Authors: Peltonen, S., Tuna, U., Ruotsalainen, U.
Number of pages: 4
Pages: 3964-3967
Publication date: 2012

Host publication information
Title of host publication: IEEE Nuclear Science Symposium and Medical Imaging Conference Record (NSS/MIC), October 29 - November 3, 2012, Anaheim, USA
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4673-2028-3

Publication series
Name: IEEE Nuclear Science Symposium and Medical Imaging Conference
ISSN (Print): 1082-3654
DOI:
10.1109/NSSMIC.2012.6551908

Bibliographical note
Contribution: organisation=sgn,FACT1=1<br/>Portfolio EDEND: 2013-07-29<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 5040
Research output: Scientific - peer-review › Conference contribution

Metal Artifact Reduction With DCT-Domain Gap-filling Method

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing
Authors: Tuna, U., Ruotsalainen, U.
Number of pages: 3
Pages: 2322-2324
Publication date: 2012

Host publication information
Title of host publication: IEEE Nuclear Science Symposium and Medical Imaging Conference Record (NSS/MIC), October 29 - November 3, 2012, Anaheim, USA
Publisher: Institute of Electrical and Electronics Engineers IEEE
ISBN (Print): 978-1-4673-2028-3

Publication series
Name: IEEE Nuclear Science Symposium and Medical Imaging Conference
ISSN (Print): 1082-3654
DOI:
10.1109/NSSMIC.2012.6551526

Bibliographical note
Contribution: organisation=sgn,FACT1=1<br/>Portfolio EDEND: 2013-07-29<br/>Publisher name: Institute of Electrical and Electronics Engineers IEEE
Source: researchoutputwizard
Source-ID: 5040
Research output: Scientific - peer-review › Conference contribution

Mobile Phone Messaging in Health Care - Where are we Now?

General information
State: Published
Ministry of Education publication type: A2 Review article in a scientific journal
Model for long QT syndrome type 2 using human IPS cells demonstrates arrhythmogenic characteristics in cell culture

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Number of pages: 11
Pages: 1-11
Publication date: 2012
Peer-reviewed: Yes
Publication information
Journal: Disease Models and Mechanisms
Volume: 5
Article number: 008409
ISSN (Print): 1754-8403
Ratings:
Scopus rating (2016): SJR 2.552 SNIP 1.235 CiteScore 4.47
Scopus rating (2015): SJR 2.676 SNIP 1.085 CiteScore 4.4
Scopus rating (2014): SJR 2.955 SNIP 1.259 CiteScore 4.81
Scopus rating (2013): SJR 3.059 SNIP 1.328 CiteScore 4.38
Scopus rating (2012): SJR 2.957 SNIP 1.415 CiteScore 3.73
Scopus rating (2011): SJR 2.873 SNIP 1.2 CiteScore 3.36
Scopus rating (2010): SJR 2.636 SNIP 1.041
Scopus rating (2009): SJR 1.658 SNIP 0.699
Original language: English
DOIs:
10.1242/dmm.008409

Bibliographical note
Contribution: organisation=bme,FACT1=1<br/>Publisher name: The Company of Biologists Ltd
Source: researchoutputwizard
Source-ID: 4621
Research output: Scientific - peer-review › Article

Multilead Measurement System for the Time-Domain Analysis of Bioimpedance Magnitude

General information
Postexercise recovery of the spatial QRS/T angle as a predictor of sudden cardiac death

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Augmented Human Activities (AHA)
Authors: Kenttä, T., Viik, J., Karsikas, M., Seppänen, T., Nieminen, T., Lehtimäki, T., Nikus, K., Lehtinen, R., Kähönen, M., Huikuri, H. V.
Pages: 1083-1089
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Heart Rhythm
Volume: 9
Issue number: 7
ISSN (Print): 1547-5271
Ratings:
Scopus rating (2016): CiteScore 3.44 SJR 2.945 SNIP 1.798
Scopus rating (2015): SJR 2.895 SNIP 1.87 CiteScore 3.19
Scopus rating (2014): SJR 3.127 SNIP 1.879 CiteScore 3.14
Scopus rating (2013): SJR 3.379 SNIP 1.794 CiteScore 3.1
Scopus rating (2012): SJR 2.945 SNIP 1.792 CiteScore 3.39
Scopus rating (2011): SJR 2.469 SNIP 1.43 CiteScore 2.6
Scopus rating (2010): SJR 2.304 SNIP 1.429
Scopus rating (2009): SJR 1.849 SNIP 1.396
Scopus rating (2008): SJR 2.028 SNIP 1.394
Scopus rating (2007): SJR 2.177 SNIP 1.251
Scopus rating (2006): SJR 1.554 SNIP 1.195
Scopus rating (2005): SJR 0.768 SNIP 0.561
Original language: English
DOIs:
10.1016/j.hrthm.2012.02.030

Postoperative Sternal Stability Assessed by Vibration: A Preliminary Study

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Hautalahti, J., Beev, N., Hytinen, J., Tarkka, M., Laurikka, J.
Pages: 260-264
Publication date: 2012
Peer-reviewed: Yes
Production of short and long Finnish vowels with and without noise masking

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Eerola, O., Savela, J.
Pages: 200-208
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Linguistica Uralica
Volume: 48
Issue number: 3
ISSN (Print): 0868-4731
Ratings:
Scopus rating (2016): SJR 0.1 SNIP 0.286 CiteScore 0.05
Scopus rating (2015): SJR 0.18 SNIP 0.054 CiteScore 0.18
Scopus rating (2014): SJR 0.151 SNIP 0.715 CiteScore 0.21
Scopus rating (2013): SJR 0.115 SNIP 0.057 CiteScore 0.06
Scopus rating (2012): SJR 0.113 SNIP 0.086 CiteScore 0.02
Scopus rating (2011): SJR 0.122 SNIP 0.696 CiteScore 0.13
Scopus rating (2010): SJR 0.12 SNIP 0.083
Scopus rating (2009): SJR 0.101 SNIP 0
Recurrent CSPs after transcranial magnetic stimulation of motor cortex in restless legs syndrome

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Electronics and Communications Engineering
Authors: Ahlgren-Rimpiläinen, A., Lauerma, H., Kähkönen, S., Markkula, J., Rimpiläinen, I.
Number of pages: 7
Pages: 1-7
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Neurology Research International
Volume: 2012
Article number: 628949
ISSN (Print): 2090-1852
Ratings:
Scopus rating (2016): SJR 0.694 SNIP 0.845 CiteScore 1.93
Scopus rating (2015): SJR 1.24 SNIP 1.071 CiteScore 2.8
Scopus rating (2014): SJR 1.19 SNIP 0.884 CiteScore 2.63
Scopus rating (2013): SJR 1.023 SNIP 0.878 CiteScore 2.63
Scopus rating (2012): SJR 0.491 SNIP 0.609
Scopus rating (2011): SJR 0.12 SNIP 0.202

Remote monitoring of nursing home residents using a humanoid robot

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Bäck, I., Kallio, J., Perälä, S., Mäkelä, K.
Pages: 357-361
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Journal of Telemedicine and Telecare
Volume: 18
Issue number: 6
ISSN (Print): 1357-633X
Ratings:
Scopus rating (2016): SJR 0.694 SNIP 0.921 CiteScore 1.87
Repeatability and variation of region-of-interest methods using quantitative diffusion tensor MR imaging of the brain

General information
State: Published
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: BMC Medical Imaging
Volume: 12
Article number: 30
ISSN (Print): 1471-2342
Ratings:
Scopus rating (2016): SJR 0.549 SNIP 0.702 CiteScore 1.56
Scopus rating (2015): SJR 0.706 SNIP 0.994 CiteScore 1.93
Scopus rating (2014): SJR 0.473 SNIP 0.809 CiteScore 1.37
Scopus rating (2013): SJR 0.531 SNIP 1.196 CiteScore 1.82
Scopus rating (2012): SJR 0.765 SNIP 1.387 CiteScore 2.55
Scopus rating (2011): SJR 0.614 SNIP 1.125 CiteScore 2.18
Scopus rating (2010): SJR 0.633 SNIP 0.765
Scopus rating (2009): SJR 0.457 SNIP 0.629
Scopus rating (2008): SJR 0.636 SNIP 1.654
Scopus rating (2007): SJR 0.478 SNIP 1.224
Scopus rating (2006): SJR 0.274 SNIP 0.849
Scopus rating (2005): SJR 0.216 SNIP 0.501
Scopus rating (2004): SJR 0.191 SNIP 0.55
Scopus rating (2003): SJR 0.127 SNIP 0.477
Seven years follow-up of ballistocardiography

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Former organisation of the author
Authors: Alametsä, J.
Pages: 67-79
Publication date: 2012
Peer-reviewed: Yes

**Publication information**
Journal: Finnish Journal of eHealth and eWelfare
Volume: 4
Issue number: 2
ISSN (Print): 1798-0798
Original language: English
Links:
http://ojs.tsv.fi/index.php/stty/index

**Bibliographical note**
Publication date 11 October 2012
Contribution: organisation=bme,FACT1=1
Publisher name: BioMed Central Ltd.
Source: researchoutputwizard
Source-ID: 4128
Research output: Scientific - peer-review » Article

The effect of duration on vowel categorization and perceptual prototypes in a quantity language

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Eerola, O., Savela, J., Laaksonen, J., Aaltonen, O.
Pages: 315-328
Publication date: 2012
Peer-reviewed: Yes

**Publication information**
Journal: Journal of Phonetics
Volume: 40
Issue number: 2
ISSN (Print): 0095-4470
Ratings:
Scopus rating (2016): SJR 1.345 SNIP 1.59 CiteScore 1.97
Scopus rating (2015): SJR 1.086 SNIP 1.411 CiteScore 1.6
Scopus rating (2014): SJR 1.363 SNIP 1.756 CiteScore 2.29
Scopus rating (2013): SJR 0.983 SNIP 2.348 CiteScore 1.85
Scopus rating (2012): SJR 1.473 SNIP 1.853 CiteScore 1.74
The temporal relationship between growth hormone and slow wave sleep is weaker after menopause
Threshold-Free Automatic Detection of Cortical Bone Geometry by Peripheral Quantitative Computed Tomography

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Cervinka, T., Hyttinen, J., Sievänen, H.
Pages: 413-421
Publication date: 2012
Peer-reviewed: Yes

Publication information
Journal: Journal of Clinical Densitometry
Volume: 15
Issue number: 4
ISSN (Print): 1094-6950
Ratings:
Scopus rating (2016): SJR 1.166 SNIP 1.222 CiteScore 2.61
Scopus rating (2015): SJR 0.942 SNIP 1.062 CiteScore 2.21
Scopus rating (2014): SJR 0.857 SNIP 0.842 CiteScore 1.82
Scopus rating (2013): SJR 0.664 SNIP 0.884 CiteScore 1.57
Scopus rating (2012): SJR 0.726 SNIP 0.89 CiteScore 1.97
Scopus rating (2011): SJR 1.018 SNIP 1.179 CiteScore 2.34
Scopus rating (2010): SJR 0.911 SNIP 0.938
Scopus rating (2009): SJR 1.126 SNIP 1.036
Scopus rating (2008): SJR 0.771 SNIP 0.75
Scopus rating (2007): SJR 0.837 SNIP 0.952
Scopus rating (2006): SJR 0.746 SNIP 1.144
Scopus rating (2005): SJR 0.864 SNIP 1.002
Scopus rating (2004): SJR 0.819 SNIP 1.13
Scopus rating (2003): SJR 0.694 SNIP 0.811
Scopus rating (2002): SJR 0.68 SNIP 0.73
Scopus rating (2001): SJR 0.741 SNIP 0.7
Scopus rating (2000): SJR 0.438 SNIP 0.536
Scopus rating (1999): SJR 0.423 SNIP 0.305
Original language: English
DOIs: 10.1016/j.jocd.2012.03.001

Timing-dependent modulation of the posterior parietal cortex-primary motor cortex pathway by sensorimotor training

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Karabanov, A., Jin, S., Joutsen, A., Poston, B., Aizen, J., Ellenstein, A., Hallett, M.
Magnetic Resonance Image Segmentation and Signal Analysis for Medical Applications

Magnetic resonance imaging (MRI) is a medical imaging method used mainly for imaging soft tissue, such as the brain. It has various advantages, such as the noninvasive and nonionizing technique used; high contrast and signal-to-noise ratio; and excellent definition of both anatomical and physiological details. Most of the current clinical MRI applications are qualitative. However, to reduce both intra- and interreader variability and thus, possibly, to improve patient diagnosis, treatment, and recovery, advantages may be gained through quantitative means. These include parametric imaging methods, such as T1- and T2-mapping, and analyses, such as histogram analysis, segmentation, and volumetry. These methods, along with qualitative imaging, were studied at various magnetic field strengths in healthy volunteers, non-Hodgkin lymphoma patients, patients with mild traumatic brain injury, and patients with symptoms of Parkinson's disease. Quantitative volumetric analyses using semi-automatic segmentation of both MRI and computed tomographic images were easy and reliable but slow. In the lymphoma patients, the tumor volume was greatly reduced, beginning immediately after the initiation of chemotherapy. A small residual tumor volume six months after the completion of treatment was predictive of survival. Besides percentage volume changes, absolute tumor volumes and their absolute changes during early stages of treatment were considered useful. Several imaging sequences, including both quantitative and qualitative, were correlated with putative iron content. Their clinical correlation and the possibility as early biomarkers of disease progression require further investigation.

Texture Analysis as a Tool for Tissue Characterization in Clinical MRI

Magnetic resonance imaging (MRI) is a valuable tool for medical diagnosis, as it is a non-invasive technique that allows superior visualisation of soft tissues. Because of the vast growth of the acquired information from medical images the development of new computer-aided diagnosis (CAD) systems has become increasingly important. The application of texture analysis (TA) in the diagnostic interpretation of MR images has become a rapidly expanding field of research. The goal of this thesis was to test the feasibility of texture analysis methods in diagnostic radiology. In this dissertation, texture analysis was applied to three different clinical materials. This study investigates whether the texture could be used to discriminate breast cancer and visible and non-visible changes in brain MRI of mild traumatic brain injuries and multiple sclerosis patients and, if so, which is the optimal texture analysis method for these applications. This study showed that TA could provide a quantitative method to aid radiologists in the detection and classification of pathological findings. A case-specific selection of the texture parameters from histogram-, co-occurrence-, run-length- and wavelet- based
methods would be the optimal solution for the evaluated clinical applications. However, larger study samples are needed to further validate these findings. Another conclusion was that the texture analysis process should be simplified considerably and implemented in other CAD systems to be considered for clinical use in the future.

**General information**

State: Published
Ministry of Education publication type: G5 Doctoral dissertation (article)
Organisations: Department of Biomedical Engineering
Authors: Holli, K. K.
Number of pages: 133
Publication date: 28 Oct 2011

**Publication information**

Place of publication: Tampere
Publisher: Tampere University of Technology
Original language: English

**Publication series**

Name: Tampereen teknillinen yliopisto. Julkaisu
Publisher: Tampere University of Technology
Volume: 988
ISSN (Print): 1459-2045

Electronic versions:
holli.pdf
Links:
http://urn.fi/URN:NBN:fi:tty-2011111714883

**Bibliographical note**

Awarding institution: Tampere University of Technology
Source: researchoutputwizard
Source-ID: 6097
Research output: Collection of articles › Doctoral Thesis

**A characteristic time sequence of epileptic activity in EEG during dynamic penicillin-induced focal epilepsy-A preliminary study**

**General information**

State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Silfverhuth, M. J., Kortelainen, J., Ruohonen, J., Suominen, K., Niinimäki, J., Sonkajärvi, E., Kiviniemi, V., Alahuhta, S., Jäntti, V., Tervonen, O., Seppänen, T.
Pages: 513-519
Publication date: 2011
Peer-reviewed: Yes

**Publication information**

Journal: Seizure: European Journal of Epilepsy
Volume: 20
Issue number: 7
ISSN (Print): 1059-1311
Ratings:
Scopus rating (2016): SJR 1.023 SNIP 1.084 CiteScore 2.3
Scopus rating (2015): SJR 0.783 SNIP 1.178 CiteScore 2.14
Scopus rating (2014): SJR 0.829 SNIP 0.98 CiteScore 2.15
Scopus rating (2013): SJR 0.847 SNIP 1.111 CiteScore 2.25
Scopus rating (2012): SJR 0.898 SNIP 1.03 CiteScore 2.1
Scopus rating (2011): SJR 0.788 SNIP 1.09 CiteScore 1.93
Scopus rating (2010): SJR 0.756 SNIP 0.988
Scopus rating (2009): SJR 1.011 SNIP 1.223
Scopus rating (2008): SJR 0.892 SNIP 0.951
Scopus rating (2007): SJR 0.767 SNIP 0.95
All Titanium Microelectrode Array for Field Potential Measurements from Neurons and Cardiomyocytes-A Feasibility Study

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Automation Science and Engineering, Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Pages: 394-409
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Micromachines
Volume: 2
Issue number: 4
ISSN (Print): 2072-666X
Ratings:
Scopus rating (2016): SJR 0.382 SNIP 0.766 CiteScore 1.83
Scopus rating (2015): SJR 0.438 SNIP 0.931 CiteScore 1.78
Scopus rating (2014): SJR 0.638 SNIP 1.384 CiteScore 2.1
Scopus rating (2013): SJR 0.479 SNIP 1.151 CiteScore 1.73
Scopus rating (2012): SJR 0.477 SNIP 1.34 CiteScore 1.28
Scopus rating (2011): SJR 0.226 SNIP 0.892
Original language: English
DOIs:
10.3390/mi2040394
Links:
http://www.mdpi.com/journal/micromachines

Analysis of the Lead Sensitivity Distribution in Implantable Cardioverter Defibrillator

General information
State: Published
Ministry of Education publication type: A3 Part of a book or another research book
Organisations: Department of Biomedical Engineering
Anatomical sector analysis of load-bearing tibial bone structure during 90-day bed rest and 1-year recovery

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Cervinka, T., Rittweger, J., Hyttinen, J., Felsenberg, D., Sievänen, H.
Pages: 249-257
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Clinical Physiology and Functional Imaging
Volume: 31
Issue number: 4
ISSN (Print): 1475-0961
Ratings:
Scopus rating (2016): SJR 0.635 SNIP 0.778 CiteScore 1.49
Scopus rating (2015): SJR 0.538 SNIP 0.668 CiteScore 1.44
Scopus rating (2014): SJR 0.589 SNIP 0.837 CiteScore 1.53
Scopus rating (2013): SJR 0.595 SNIP 0.684 CiteScore 1.53
Scopus rating (2012): SJR 0.464 SNIP 0.909 CiteScore 1.51
Scopus rating (2011): SJR 0.512 SNIP 0.71 CiteScore 1.52
Scopus rating (2010): SJR 0.587 SNIP 0.825
Scopus rating (2009): SJR 0.444 SNIP 0.707
Scopus rating (2008): SJR 0.468 SNIP 0.841
Scopus rating (2007): SJR 0.435 SNIP 0.703
Scopus rating (2006): SJR 0.446 SNIP 0.776
Scopus rating (2005): SJR 0.505 SNIP 0.715
Scopus rating (2004): SJR 0.424 SNIP 0.69
Scopus rating (2003): SJR 0.519 SNIP 0.791
Scopus rating (2002): SJR 0.427 SNIP 0.592
Scopus rating (2001): SJR 0.393 SNIP 0.796
Scopus rating (2000): SJR 0.378 SNIP 0.78
Scopus rating (1999): SJR 0.264 SNIP 0.634
Original language: English
DOIs:
10.1111/j.1475-097X.2011.01009.x
Arterial tension time reflects subclinical atherosclerosis, arterial stiffness and stroke volume

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Koivistoinen, T., Kööbi, T., Moilanen, L., Jula, A., Lehtimäki, T., Hyttinen, J., Kähönen, M.
Pages: 464-471
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Clinical Physiology and Functional Imaging
Volume: 31
Issue number: 6
ISSN (Print): 1475-0961
Ratings:
Scopus rating (2016): SJR 0.635 SNIP 0.778 CiteScore 1.49
Scopus rating (2015): SJR 0.538 SNIP 0.668 CiteScore 1.44
Scopus rating (2014): SJR 0.589 SNIP 0.837 CiteScore 1.53
Scopus rating (2013): SJR 0.595 SNIP 0.684 CiteScore 1.53
Scopus rating (2012): SJR 0.464 SNIP 0.909 CiteScore 1.51
Scopus rating (2011): SJR 0.512 SNIP 0.71 CiteScore 1.52
Scopus rating (2010): SJR 0.587 SNIP 0.825
Scopus rating (2009): SJR 0.444 SNIP 0.707
Scopus rating (2008): SJR 0.468 SNIP 0.841
Scopus rating (2007): SJR 0.435 SNIP 0.703
Scopus rating (2006): SJR 0.446 SNIP 0.776
Scopus rating (2005): SJR 0.505 SNIP 0.715
Scopus rating (2004): SJR 0.424 SNIP 0.69
Scopus rating (2003): SJR 0.519 SNIP 0.791
Scopus rating (2002): SJR 0.427 SNIP 0.592
Scopus rating (2001): SJR 0.393 SNIP 0.796
Scopus rating (2000): SJR 0.378 SNIP 0.78
Scopus rating (1999): SJR 0.264 SNIP 0.634
Original language: English
DOIs:
10.1111/j.1475-097X.2011.01042.x

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 6398
Research output: Scientific - peer-review › Article

Averaging in vitro cardiac field potential recordings obtained with microelectrode arrays

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Kujala, V. J., Jimenez, Z. C., Väisänen, J., Tanskanen, J. M., Kerkeleä, E., Hyttinen, J., Aalto-Setälä, K.
Pages: 199-205
Publication date: 2011
Peer-reviewed: Yes
Bioactive glass microspheres as osteopromotive inlays in macrotextured surfaces of Ti and CoCr alloy bone implants: Trapezoidal surface grooves without inlay most efficient in resisting torsional forces
Carotid Artery Atherosclerosis Plaque Analysis Using CT and Histology

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Santos, F.; Joutsen, A.; Salenius, J.; Eskola, H.
Number of pages: 5
Pages: 1-5
Publication date: 2011

Host publication information
Title of host publication: Computational Vision and Medical Image Processing, VIPIMAGE 2011 - III ECCOMAS Thematic Conference on Computational Vision and Medical Image Processing, Olhao, Algarve, Portugal, 12-14 October, 2011
Place of publication: Boca Raton, FL
Publisher: CRS Press
Editors: Tavares, J. M. R., Jorge, R. N.
ISBN (Print): 978-0-415-68395-1

Publication series
Name: VIPIMAGE - ECCOMAS Thematic Conference on Computational Vision and Medical Image Processing
Publisher: CRS Press

Common variation in the ADAM8 gene affects serum sADAM8 concentrations and the risk of myocardial infarction in two independent cohorts

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Augmented Human Activities (AHA), Integrated Technologies for Tissue Engineering Research (ITTE)
Pages: 127-133
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Atherosclerosis
Volume: 218
Issue number: 1
ISSN (Print): 0021-9150
Ratings:
Scopus rating (2016): SJR 1.848 SNIP 1.302 CiteScore 3.81
Comparison of Diffusion Tensor Imaging and Texture Analysis Findings on Classification of Multiple Sclerosis Patients

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Savio, S., Hakulinen, U., Ryymin, P., Dastidar, P., Soimakallio, S., Eskola, H.
Pages: 579-582
Publication date: 2011

Host publication information
Title of host publication: 5th European Conference of the International Federation for Medical and Biological Engineering IFMBE, 14-18, September 2011, Budapest, Hungary. IFMBE Proceedings
Place of publication: Heidelberg
Publisher: Springer
Editor: Jobbagy, A.
ISBN (Print): 978-3-642-23507-8

Publication series
Name: European Conference of the International Federation for Medical and Biological Engineering IFMBE
Publisher: Springer
Volume: 37
ISSN (Print): 1680-0737
DOIs: 10.1007/978-3-642-23508-5_150

Bibliographical note
Contribution: organisation=bme
Source: researchoutputwizard
Source-ID: 7078
Research output: Scientific - peer-review › Article
Comparison of Electrode Materials for the Use of Retinal Prosthesis

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Onnela, N., Takeshita, H., Kailo, Y., Kojima, T., Kobayashi, R., Tanaka, T., Hyttinen, J.
Pages: 83-97
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Bio-Medical Materials and Engineering
Volume: 21
Issue number: 2
ISSN (Print): 0959-2989
Ratings:
Scopus rating (2016): SJR 0.254 SNIP 0.415 CiteScore 0.81
Scopus rating (2015): SJR 0.334 SNIP 0.754 CiteScore 0.99
Scopus rating (2014): SJR 0.284 SNIP 0.486 CiteScore 0.94
Scopus rating (2013): SJR 0.349 SNIP 0.55 CiteScore 0.98
Scopus rating (2012): SJR 0.434 SNIP 0.73 CiteScore 1.4
Scopus rating (2011): SJR 0.424 SNIP 0.584 CiteScore 1.31
Scopus rating (2010): SJR 0.403 SNIP 0.328
Scopus rating (2009): SJR 0.367 SNIP 0.434
Scopus rating (2008): SJR 0.428 SNIP 0.543
Scopus rating (2007): SJR 0.544 SNIP 0.534
Scopus rating (2006): SJR 0.405 SNIP 0.581
Scopus rating (2005): SJR 0.295 SNIP 0.511
Scopus rating (2004): SJR 0.354 SNIP 0.831
Scopus rating (2003): SJR 0.392 SNIP 0.523
Scopus rating (2002): SJR 0.461 SNIP 0.69
Scopus rating (2001): SJR 0.373 SNIP 0.623
Scopus rating (2000): SJR 0.215 SNIP 0.32
Scopus rating (1999): SJR 0.426 SNIP 0.661
Original language: English
DOIs:
10.3233/BME-2011-0658

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 6925
Research output: Scientific - peer-review › Article

Computer Vision for Human Stem Cell Derived Cardiomyocyte Classification: the Induced Pluripotent vs Embryonic Stem Cell Case Study

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Paci, M., Nanni, L., Lahti, A., Severi, S., Aalto-Setälä, K., Hyttinen, J.
Pages: 569-572
Publication date: 2011

Host publication Information
Title of host publication: 38th Annual Scientific Conference of Computing in Cardiology , 18.-21.9.2011, Hangzhou, China
Place of publication: Hangzhou
**Connections of daytime napping and vigilance measures to activity behaviour and physical functioning**

**General information**
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research Community on Data-to-Decision (D2D), Former organisation of the author
Authors: Merilahti, J., Pärkkä, J., Korhonen, I.
Number of pages: 7
Pages: 1-7
Publication date: 2011

**Host publication information**
Title of host publication: IASTED 8th International Conference on Biomedical Engineering, Biomed 2011, Innsbruck, Austria; 16.-18.2.2011
Place of publication: Calgary
Publisher: ACTA Press

**Bibliographical note**
Suullinen esitys, julkaistu toisen organisaation nimissä.<br/>Contribution: organisation=bme,FACT1=1

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**Development of a Research Dedicated Archival System (TARAS) in a University Hospital**

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Rajala, T., Savio, S., Penttinen, J., Dastidar, P., Kähönen, M., Eskola, H., Miettunen, R., Turjanmaa, V., Järvenpää, R.
Pages: 864-873
Publication date: 2011
Peer-reviewed: Yes

**Publication information**
Journal: Journal of Digital Imaging
Volume: 24
Issue number: 5
ISSN (Print): 0897-1889
Ratings:
Scopus rating (2016): SJR 0.624 SNIP 1.199 CiteScore 1.75
Scopus rating (2015): SJR 0.537 SNIP 1.205 CiteScore 1.56
Scopus rating (2014): SJR 0.504 SNIP 1.177 CiteScore 1.38
Scopus rating (2013): SJR 0.502 SNIP 1.342 CiteScore 1.47
Scopus rating (2012): SJR 0.512 SNIP 1.218 CiteScore 1.39
Scopus rating (2011): SJR 0.483 SNIP 1.17 CiteScore 1.35
Scopus rating (2010): SJR 0.466 SNIP 1.026
Scopus rating (2009): SJR 0.528 SNIP 1.271
Scopus rating (2008): SJR 0.528 SNIP 0.803
Device for Recording the EEG in Emergency Neurology using existing ECG Infrastructure

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Jakab, A. D., Kauppinen, P. K., Hyttinen, J. A., Salmi, T.
Pages: 195-200
Publication date: 2011
Peer-reviewed: Yes

**Publication information**
Journal: International Journal of Bioelectromagnetism
Volume: 13
Issue number: 4
ISSN (Print): 1456-7857
Original language: English
Links:
http://www.ijbem.org/

**Bibliographical note**
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 7080
Research output: Scientific - peer-review › Article

Diffusion-weighted MRI in early chemotherapy response evaluation of patients with diffuse large B-cell lymphoma - a pilot study: comparison with 2-deoxy-2-fluoro-D-glucose-positron emission tomography/computed tomography

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Wu, X., Kellokumpu-Lehtinen, P., Pertovaara, H., Korkola, P., Soimakallio, S., Eskola, H., Dastidar, P.
Pages: 1181-1190
Publication date: 2011
Peer-reviewed: Yes

**Publication information**
Journal: NMR in Biomedicine
Volume: 24
Issue number: 10
ISSN (Print): 0952-3480
Early treatment response evaluation in patients with diffuse large B-Cell Lymphoma-A Pilot study comparing volumetric MRI and PET/CT

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Wu, X., Dastidar, P., Pertovaara, H., Korkola, P., Järvenpää, R., Rossi, M., Kööbi, T., Eskola, H., Kellokumpu-Lehtinen, P.
Pages: 785-792
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Molecular Imaging and Biology
Volume: 13
Issue number: 4
ISSN (Print): 1536-1632
Ratings:
Scopus rating (2016): SJR 0.935 SNIP 0.745 CiteScore 2.67
Scopus rating (2015): SJR 0.995 SNIP 0.875 CiteScore 2.44
Scopus rating (2014): SJR 1.022 SNIP 1.035 CiteScore 2.8
Scopus rating (2013): SJR 1.038 SNIP 1.061 CiteScore 3.08
Scopus rating (2012): SJR 1.068 SNIP 0.927 CiteScore 2.66
Scopus rating (2011): SJR 1.114 SNIP 1.068 CiteScore 3
Scopus rating (2010): SJR 1.033 SNIP 0.966
Scopus rating (2009): SJR 1.037 SNIP 1.043
Scopus rating (2008): SJR 0.941 SNIP 1.013
Scopus rating (2007): SJR 1.433 SNIP 1.384
Scopus rating (2006): SJR 1.214 SNIP 1.232
Scopus rating (2005): SJR 0.806 SNIP 0.914
Scopus rating (2004): SJR 0.511 SNIP 0.925
Scopus rating (2003): SJR 0.412 SNIP 0.442
Scopus rating (2002): SJR 0.514
Scopus rating (2001): SJR 0.34
Scopus rating (2000): SJR 0.434
Scopus rating (1999): SJR 0.351
Original language: English
DOIs: 10.1007/s11307-010-0404-z

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 7568
Research output: Scientific - peer-review › Article

Estimating Older People's Physical Functioning with Automated Health Monitoring Technologies at Home: Feature Correlations and Multivariate Analysis

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Research Community on Data-to-Decision (D2D), Former organisation of the author
Authors: Merilahti, J., Pärkkä, J., Korhonen, I.
Number of pages: 11
Pages: 94-104
Publication date: 2011

Host publication information
Title of host publication: International Workshop on Health and Well-being Technologies and Services for Elderly HWTS 2011, Oulu, 11 May 2011. LNCS

Bibliographical note
Suullinen esitys, julkaistu toisen organisaation nimissä<br/>Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 6789
Research output: Scientific - peer-review › Conference contribution

Estimation of sufficient signal to noise ratio for texture analysis of magnetic resonance images

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Savio, S., Harrison, L., Ryymin, P., Dastidar, P., Soimakallio, S., Eskola, H.
Publication date: 2011

Host publication information
Place of publication: Bellingham, WA
Publisher: SPIE
Article number: 79622C
ISBN (Print): 978-081948504-5

Publication series
Name: Medical Imaging - Image Processing Conference
Publisher: SPIE
Volume: 7962
ISSN (Print): 1605-7422
DOIs:
Identification of the Finnish vowels [e:], [i:], [y:] and [ø:] in noise

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Eerola, O., Tuomainen, J.
Pages: 22-26
Publication date: 2011

Host publication information
Title of host publication: XXVI Fonetikan päivät 2010, Mekrijärven tutkimusasema 25-26.2.2010. University of Eastern Finland electronic publications
Place of publication: Joensuu
Publisher: University of Eastern Finland
Editors: Werner, S., Kinnunen, T.
ISBN (Print): 978-952-61-0391-4

Publication series
Name: Fonetikan päivät
Publisher: University of Eastern Finland
Links:

Image-based segmentation for characterization and quantitative analysis of the spinal cord injuries by using diffusion patterns

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Hannula, M., Olubamiji, A., Kunttu, I., Dastidar, P., Soimakallio, S., Ohman, J., Hyttinen, J.
Publication date: 2011

Host publication information
Place of publication: Bellingham, WA
Publisher: SPIE
Editors: Astola, J. T., Egiazarian, K. O.
Article number: 78700D
ISBN (Print): 978-081948407-9

Publication series
Name: Image Processing: Algorithms and Systems Conference
Publisher: SPIE
Volume: 7870
ISSN (Print): 0277-786X
DOIs:
10.1117/12.872306
Impact of EPR Systems: How Have Seven Years Improved Information Flow in Finnish Health Centers?

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Mäkelä, K., Virjo, I., Aho, J., Kalliola, P., Kurunmäki, H., Uusitalo, L., Valli, M., Ylinen, S.
Pages: 667-671
Publication date: 2011

Host publication information
Publisher: International Society for Telemedicine & eHealth
Editor: Malina Jordanova, F. L.

Publication series
Name: International eHealth, Telemedicine and Health ICT Forum for Educational, Networking and Business
Volume: 4
ISSN (Print): 1998-5509
ISSN (Electronic): 1818-9334
Links:

Bibliographical note
Poistettu tupla r=4470 (J2TUT).Ei ut-numeroa 5.4.2014
Contribution: organisation=bme,FACT1=1
Publisher name: International Society for Telemedicine & eHealth ISfTeH
Source: researchoutputwizard
Source-ID: 7233

Impedance pneumography for assessment of a tidal breathing parameter in patients with airway obstruction

General information
State: Published
Ministry of Education publication type: B3 Non-refereed article in conference proceedings
Organisations: Department of Biomedical Engineering
Authors: Seppä, V., Kööbi, T., Kähönen, M., Hyttinen, J., Viik, J.
Number of pages: 2
Pages: 1-2
Publication date: 2011

Host publication information
Title of host publication: European Respiratory Society Annual Congress, 24.-28.9.2011, Amsterdam, Netherlands
Place of publication: Amsterdam
Publisher: European Respiratory Society

Publication series
Name: European Respiratory Society Annual Congress
Publisher: European Respiratory Society
Links:
http://www.erscongress2011.org

Bibliographical note
ei ut-numeroa 10.5.2014<br/>Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 7233
Impedance Spectroscopy in Monitoring the Maturation of Stem Cell-Derived Retinal Pigment Epithelium

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Savolainen, V., Juuti-Uusitalo, K., Onnela, N., Vaajasaari, H., Narkilahti, S., Suuronen, R., Skottman, H., Hyttinen, J.
Pages: 3055-3069
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Annals of Biomedical Engineering
Volume: 39
Issue number: 12
ISSN (Print): 0090-6964
Ratings:
Scopus rating (2016): CiteScore 3.13 SJR 1.054 SNIP 1.221
Scopus rating (2015): SJR 1.179 SNIP 1.355 CiteScore 3.21
Scopus rating (2014): SJR 1.095 SNIP 1.521 CiteScore 3.29
Scopus rating (2013): SJR 1.257 SNIP 1.451 CiteScore 3.38
Scopus rating (2012): SJR 0.926 SNIP 1.242 CiteScore 2.77
Scopus rating (2011): SJR 0.863 SNIP 1.135 CiteScore 2.54
Scopus rating (2010): SJR 0.812 SNIP 1.266
Scopus rating (2009): SJR 0.892 SNIP 1.337
Scopus rating (2008): SJR 1.003 SNIP 1.268
Scopus rating (2007): SJR 1.073 SNIP 1.322
Scopus rating (2006): SJR 1.049 SNIP 1.283
Scopus rating (2005): SJR 0.802 SNIP 1.111
Scopus rating (2004): SJR 0.694 SNIP 1.214
Scopus rating (2003): SJR 0.355 SNIP 1.069
Scopus rating (2002): SJR 0.295 SNIP 0.911
Scopus rating (2001): SJR 0.282 SNIP 1.276
Scopus rating (2000): SJR 0.663 SNIP 0.956
Scopus rating (1999): SJR 0.524 SNIP 0.984
Original language: English
DOIs: 10.1007/s10439-011-0387-1

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 7219
Research output: Scientific - peer-review › Article

Importance of regional specificity of T-wave alternans in assessing risk for cardiovascular mortality and sudden cardiac death during routine exercise testing

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Augmented Human Activities (AHA)
Pages: 385-390
Publication date: 2011
Peer-reviewed: Yes
Intra-and Inter-observer Variation of Region-of-Interest Methods in Quantitative Clinical Diffusion Tensor Imaging
MRI Texture Analysis of Femoral Neck: Detection of Exercise Load-Associated Differences in Trabecular Bone

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Pages: 1359-1399
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Journal of Magnetic Resonance Imaging
Volume: 34
Issue number: 6
ISSN (Print): 1053-1807
Ratings:
Scopus rating (2016): SJR 1.544 SNIP 1.264 CiteScore 3.23
Scopus rating (2015): SJR 1.738 SNIP 1.35 CiteScore 3.31
Scopus rating (2014): SJR 1.69 SNIP 1.292 CiteScore 3.3
Scopus rating (2013): SJR 1.624 SNIP 1.331 CiteScore 3.23
Scopus rating (2012): SJR 1.518 SNIP 1.244 CiteScore 3.02
Scopus rating (2011): SJR 1.639 SNIP 1.277 CiteScore 3.1
Scopus rating (2010): SJR 1.695 SNIP 1.29
Scopus rating (2009): SJR 1.632 SNIP 1.266
Scopus rating (2008): SJR 1.727 SNIP 1.169
Scopus rating (2007): SJR 1.623 SNIP 1.199
Scopus rating (2006): SJR 1.702 SNIP 1.214
Scopus rating (2005): SJR 1.627 SNIP 1.334
Scopus rating (2004): SJR 1.722 SNIP 1.474
Scopus rating (2003): SJR 1.87 SNIP 1.385
Scopus rating (2002): SJR 1.902 SNIP 1.251
Scopus rating (2001): SJR 1.867 SNIP 1.371
Scopus rating (2000): SJR 1.703 SNIP 1.201
No correlation between glucose metabolism and apparent diffusion coefficient in diffuse large B-cell lymphoma: A PET/CT and DW-MRI study

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Wu, X., Korkola, P., Pertovaara, H., Eskola, H., Järvenpää, R., Kellokumpu-Lehtinen, P.
Pages: 117-121
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: European Journal of Radiology
Volume: 79
Issue number: 2
ISSN (Print): 0720-048X
Ratings:
Scopus rating (2016): SJR 1.128 SNIP 1.345 CiteScore 2.69
Scopus rating (2015): SJR 1.195 SNIP 1.376 CiteScore 2.61
Scopus rating (2014): SJR 1.162 SNIP 1.333 CiteScore 2.52
Scopus rating (2013): SJR 1.044 SNIP 1.211 CiteScore 2.42
Scopus rating (2012): SJR 0.988 SNIP 1.477 CiteScore 2.54
Scopus rating (2011): SJR 1.146 SNIP 1.355 CiteScore 2.61
Scopus rating (2010): SJR 1.234 SNIP 1.403
Scopus rating (2009): SJR 1.135 SNIP 1.408
Scopus rating (2008): SJR 1.065 SNIP 1.299
Scopus rating (2007): SJR 0.913 SNIP 1.477
Scopus rating (2006): SJR 0.814 SNIP 1.242
Scopus rating (2005): SJR 0.862 SNIP 1.23
Scopus rating (2004): SJR 0.843 SNIP 1.236
Scopus rating (2003): SJR 0.693 SNIP 0.904
Scopus rating (2002): SJR 0.649 SNIP 0.927
Scopus rating (2001): SJR 0.623 SNIP 0.97
Scopus rating (2000): SJR 0.453 SNIP 0.778
Scopus rating (1999): SJR 0.349 SNIP 0.613

Original language: English
DOIs:
10.1016/j.ejrad.2011.04.062
Links:
http://www.elsevier.com/locate/ejrad

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 7569
Research output: Scientific - peer-review › Article
Ohjaavatko prototyyppit suomen vokaalien tunnistamista ja tuottamista?

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Eerola, O., Tuomainen, J.
Pages: 27-28
Publication date: 2011

Host publication information
Title of host publication: XXVI Fonetiikan päivät 2010, Mekrijärven tutkimusasema 25-26.2.2010
Place of publication: Joensuu
Publisher: University of Eastern Finland
Editors: Werner, S., Kinnunen, T.
ISBN (Print): 978-952-61-0391-4

Publication series
Name: University of Eastern Finland Electronic Publications
Publisher: University of Eastern Finland
Links:
http://urn.fi/urn:isbn:978-952-61-0391-4

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 5903
Research output: Scientific - peer-review » Conference contribution

Parkinson's disease. Interhemispheric textural differences in MR images

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Pages: 1217-1224
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Academic Radiology
Volume: 18
Issue number: 10
ISSN (Print): 1076-6332
Ratings:
Scopus rating (2016): SJR 0.935 SNIP 0.988 CiteScore 1.87
Scopus rating (2015): SJR 1.008 SNIP 0.986 CiteScore 1.9
Scopus rating (2014): SJR 0.957 SNIP 0.984 CiteScore 1.75
Scopus rating (2013): SJR 1.039 SNIP 1.124 CiteScore 2.05
Scopus rating (2012): SJR 0.823 SNIP 0.869 CiteScore 1.79
Scopus rating (2011): SJR 0.917 SNIP 1.044 CiteScore 1.87
Scopus rating (2010): SJR 1.021 SNIP 1.146
Scopus rating (2009): SJR 0.909 SNIP 1.127
Scopus rating (2008): SJR 0.863 SNIP 1.055
Scopus rating (2007): SJR 0.902 SNIP 1.02
Scopus rating (2006): SJR 0.779 SNIP 0.776
Scopus rating (2005): SJR 0.668 SNIP 0.813
Scopus rating (2004): SJR 0.768 SNIP 0.786
PET imaging in a longitudinal non-Hodgkin's lymphoma study: association with tumor volume

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Rossi, M., Korkola, P., Pertovaara, H., Järvenpää, R., Dastidar, P., Wu, X., Soimakallio, S., Eskola, H., Kellokumpu-Lehtinen, P.
Pages: 995-1002
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Acta Radiologica
Volume: 52
Issue number: 9
ISSN (Print): 0284-1851
Ratings:
Scopus rating (2016): SJR 0.693 SNIP 0.909 CiteScore 1.54
Scopus rating (2015): SJR 0.741 SNIP 0.953 CiteScore 1.64
Scopus rating (2014): SJR 0.761 SNIP 0.993 CiteScore 1.54
Scopus rating (2013): SJR 0.694 SNIP 0.91 CiteScore 1.58
Scopus rating (2012): SJR 0.659 SNIP 0.879 CiteScore 1.55
Scopus rating (2011): SJR 0.703 SNIP 0.795 CiteScore 1.47
Scopus rating (2010): SJR 0.76 SNIP 0.887
Scopus rating (2009): SJR 0.642 SNIP 0.839
Scopus rating (2008): SJR 0.585 SNIP 0.771
Scopus rating (2007): SJR 0.584 SNIP 0.814
Scopus rating (2006): SJR 0.531 SNIP 0.747
Scopus rating (2005): SJR 0.523 SNIP 0.826
Scopus rating (2004): SJR 0.65 SNIP 0.984
Scopus rating (2003): SJR 0.578 SNIP 0.883
Scopus rating (2002): SJR 0.552 SNIP 0.745
Scopus rating (2001): SJR 0.565 SNIP 0.775
Scopus rating (2000): SJR 0.677 SNIP 0.764
Scopus rating (1999): SJR 0.571 SNIP 0.847
Original language: English
DOIs:
10.1016/j.acra.2011.06.007

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 7254
Research output: Scientific - peer-review › Article
QRS-T morphology measured from exercise electrocardiogram as a predictor of cardiac mortality.

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Augmented Human Activities (AHA)
Pages: 701-707
Publication date: 2011
Peer-reviewed: Yes

**Publication information**
Journal: Europace
Volume: 13
Issue number: 5
ISSN (Print): 1099-5129
Ratings:
Scopus rating (2016): SJR 2.363 SNIP 1.57 CiteScore 2.78
Scopus rating (2015): SJR 2.336 SNIP 1.602 CiteScore 2.93
Scopus rating (2014): SJR 2.235 SNIP 1.609 CiteScore 2.8
Scopus rating (2013): SJR 1.913 SNIP 1.386 CiteScore 2.7
Scopus rating (2012): SJR 1.525 SNIP 1.16 CiteScore 2.3
Scopus rating (2011): SJR 1.287 SNIP 1.082 CiteScore 1.88
Scopus rating (2010): SJR 1.061 SNIP 1.016
Scopus rating (2009): SJR 0.98 SNIP 1.133
Scopus rating (2008): SJR 0.775 SNIP 0.972
Scopus rating (2007): SJR 0.967 SNIP 1.056
Scopus rating (2006): SJR 0.977 SNIP 1.047
Scopus rating (2005): SJR 0.567 SNIP 0.948
Recording cortical EEG subcortically - Improved EEG monitoring from depth-stimulation electrodes

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Wendel, K., Suominen, K., Kauppinen, P., Sonkajärvi, E., Tanskanen, J. M., Kamata, K., Väisänen, O., Hyttinen, J., Jäntti, V.
Pages: 126-130
Publication date: 2011

Host publication information
Title of host publication: 2011 8th International Symposium on Noninvasive Functional Source Imaging of the Brain and Heart & 2011 8th International Conference on Bioelectromagnetism NFSI & ICBEM, 13.-16.5.2011, Banff, AB
Place of publication: Piscataway, NJ
Publisher: IEEE
Article number: 5936834

Publication series
Name: International Symposium on Noninvasive Functional Source Imaging of the Brain and Heart & International Conference on Bioelectromagnetism NFSI & ICBEM
Publisher: IEEE
DOIs: 10.1109/NFSI.2011.5936834

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 6340
Research output: Scientific - peer-review › Article

Short and longer term repeatability of ballistocardiography in a sitting position with EMFi sensor

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Augmented Human Activities (AHA)
Authors: Alametsä, J., Palomäki, A., Viik, J.
Pages: 881-889
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Medical & Biological Engineering & Computing
Volume: 49
Issue number: 8
ISSN (Print): 0140-0118
Texture Analysis as a Tool in Diagnosis of Parkinson's Disease

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Sikiö, M., Harrison, L., Holli, K., Ruottinen, H., Elovaara, I., Soimakallio, S., Dastidar, P., Eskola, H.
Pages: 571-574
Publication date: 2011

Host publication information
Title of host publication: 5th European Conference of the International Federation for Medical and Biological Engineering IFMBE, 14-18, September 2011, Budabest, Hungary. IFMBE Proceedings
Place of publication: Heidelberg
Publisher: Springer
Editor: Jobbagy, A.
ISBN (Print): 978-3-642-23507-8

Publication series
Name: European Conference of the International Federation for Medical and Biological Engineering IFMBE
Publisher: Springer
Volume: 37
ISSN (Print): 1680-0737
DOIs:
10.1007/978-3-642-23508-5_148

Bibliographical note
poistettu tupla r=4540<br/>Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 5677
Research output: Scientific - peer-review › Article

Texture Analysis as a Tool in Diagnosis of Parkinson's Disease

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Sikiö, M., Harrison, L., Holli, K., Ruottinen, H., Elovaara, I., Soimakallio, S., Dastidar, P., Eskola, H.
Pages: 571-574
Publication date: 2011

Host publication information
Title of host publication: 5th European Conference of the International Federation for Medical and Biological Engineering IFMBE, 14-18, September 2011, Budabest, Hungary. IFMBE Proceedings
Place of publication: Heidelberg
Publisher: Springer
Editor: Jobbagy, A.
ISBN (Print): 978-3-642-23507-8

Publication series
Name: European Conference of the International Federation for Medical and Biological Engineering IFMBE
Publisher: Springer
Volume: 37
ISSN (Print): 1680-0737
DOIs:
10.1007/978-3-642-23508-5_148

Bibliographical note
poistettu tupla r=2893, posteri<br/>Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 7255
Research output: Scientific - peer-review › Conference contribution
The effects of vibration loading on adipose stem cell number, viability and differentiation towards bone-forming cells

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Tirkkonen, L., Halonen, H., Hyttinen, J., Kuokkanen, H., Sievänen, H., Koivisto, A., Mannerström, B., Sandor, G. K., Suuronen, R., Miettinen, S., Haimi, S.
Pages: 1736-1747
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Journal of the Royal Society. Interface
Volume: 8
Issue number: 65
ISSN (Print): 1742-5689
Ratings:
Scopus rating (2016): CiteScore 3.04 SJR 1.412 SNIP 1.22
Scopus rating (2015): SJR 1.571 SNIP 1.38 CiteScore 3.5
Scopus rating (2014): SJR 1.564 SNIP 1.572 CiteScore 3.59
Scopus rating (2013): SJR 1.8 SNIP 1.825 CiteScore 4.88
Scopus rating (2012): SJR 1.999 SNIP 2.043 CiteScore 5.06
Scopus rating (2011): SJR 1.776 SNIP 1.87 CiteScore 4.53
Scopus rating (2010): SJR 1.613 SNIP 1.541
Scopus rating (2009): SJR 1.65 SNIP 1.54
Scopus rating (2008): SJR 1.326 SNIP 1.261
Scopus rating (2007): SJR 1.385 SNIP 1.357
Scopus rating (2006): SJR 0.878 SNIP 1.197
Scopus rating (2005): SJR 0.629 SNIP 0.987
Original language: English
DOIs:
10.1098/rsif.2011.0211

Bibliographical note
online first<br/>
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 7386
Research output: Scientific - peer-review › Article

The Potential of Adipose Stem Cells in Regenerative Medicine

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Lindroos, B., Suuronen, R., Miettinen, S.
Pages: 269-291
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Stem Cell Reviews and Reports
Volume: 7
Issue number: 2
ISSN (Print): 1550-8943
Ratings:
Scopus rating (2016): SJR 1.14 SNIP 0.903
Scopus rating (2015): SJR 1.431 SNIP 1.014
Scopus rating (2014): SJR 1.523 SNIP 1.176
Toward the defined and xeno-free differentiation of functional human pluripotent stem cell-derived retinal pigment epithelial cells

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering, Integrated Technologies for Tissue Engineering Research (ITTE)
Authors: Vaajasaari, H., Ilmarinen, T., Juutti-Uusitalo, K., Rajala, K., Onnela, N., Narkilahti, S., Suuronen, R., Hyttinen, J., Uusitalo, H., Skottman, H.
Pages: 558-575
Publication date: 2011
Peer-reviewed: Yes

Publication information
Journal: Molecular Vision
Volume: 17
ISSN (Print): 1090-0535
Ratings:
Scopus rating (2016): SJR 0.996 SNIP 0.901 CiteScore 2.33
Scopus rating (2015): SJR 1.042 SNIP 0.842 CiteScore 2.29
Scopus rating (2014): SJR 0.991 SNIP 0.891 CiteScore 2.24
Scopus rating (2013): SJR 1.083 SNIP 0.995 CiteScore 2.65
Scopus rating (2012): SJR 1.055 SNIP 0.937 CiteScore 2.23
Scopus rating (2011): SJR 1.131 SNIP 0.974 CiteScore 2.45
Scopus rating (2010): SJR 1.116 SNIP 0.977
Scopus rating (2009): SJR 1.08 SNIP 0.87
Scopus rating (2008): SJR 1.218 SNIP 0.917
Scopus rating (2007): SJR 1.147 SNIP 0.954
Scopus rating (2006): SJR 1.183 SNIP 0.834
Scopus rating (2005): SJR 1.141 SNIP 0.76
Scopus rating (2004): SJR 1.242 SNIP 0.868
Scopus rating (2003): SJR 1.189 SNIP 0.815
Scopus rating (2002): SJR 1.156 SNIP 0.586
Scopus rating (2001): SJR 1.113 SNIP 0.465
Scopus rating (2000): SJR 0.786 SNIP 0.055
Scopus rating (1999): SJR 0.631
Original language: English
Links:
http://www.molvis.org/molvis/v17/a64

Bibliographical note
The influence of tissue conductivity and head geometry on EEG measurement sensitivity distributions

Electrical neuroimaging is a contemporary functional imaging method that evolves electroencephalography (EEG) beyond traditional signal analysis. It exploits the millisecond temporal resolution of EEG and integrates it with its spatial resolution, which is mapped according to the measurement sensitivity distribution of the measurement leads. This thesis assesses the EEG measurement sensitivity distribution according to the influence of tissue conductivities, electrode placement, electrode type, and geometries upon volume conductor head models. The conductivity of the skull is correlated with the age of the patient, recognizing that juveniles have higher spatial resolution than adults. Surface electrodes are compared with subdermal electrodes and are found to be non-interchangeable because the subdermal electrodes measure electric activity from one-eighth the volume of their surface-electrode counterparts. More accurate geometrical definitions naturally yield more precise forward and inverse calculations; however, a stochastically deformable generic head model based on anthropometric data addresses the void in imaged and segmented heads of different ages, genders, and head shapes. Comprehensively, the investigation of these three key areas improves the knowledge of the EEG measurement sensitivity distributions, which will conceivably translate into clinical improvements in the diagnostics of brain functionality.

Methods for analysing the sensitivities of bioelectric measurements

In the 21st century the trend in healthcare is towards the early detection and prevention of disease and from hospitalization to increased personalization. The novel wearable and implantable systems for electrocardiographic (ECG) and electroencephalographic (EEG) measurements are being developed to enable monitoring of people during their everyday lives or in emergency situations. The objectives of these novel devices and bioelectrical measurements in general are to register signals arising from a certain region of interest (ROI). The aim might be to direct the measurement to a limited area of the cardiac muscle, such as an apical region of ventricles. This is of particular interest when monitoring different cardiac arrhythmias or changes in activation of a certain segment of the myocardium after infarction. The sensitivity of an ideal measurement should give greater and more intense focus on these target areas than on other areas of the volume conductor, thus yielding more specific and better quality measurements. When designing novel measurement devices and setups it would be beneficial to know where to locate the electrodes in order to measure the target signals and monitor their source regions as efficiently as possible. This is especially important in the application of wearable or implantable measurement systems when there is a limit to the number and location of recording electrodes. The selection of the electrode system should be based on quantitative analysis of certain characteristics such as sensitivity distributions. Because different electrode setups are suitable for different measurement purposes or conditions
it would be beneficial to be able to evaluate their sensitivity properties before conducting the actual measurements. The modelling of bioelectric measurements provides an effective means of studying sensitivity distributions. The present thesis introduces a novel quantitative analysis method called region of interest sensitivity ratio (ROISR) for the evaluation of bioelectric measurement setups through the modelling of sensitivity distributions. ROISR is applied to analyse the specificity of EEG and ECG measurement setups to a certain ROI within brain and heart. Using simulations and measurements, the thesis proposes that the ROISR method developed here has a strong correlation to the signal-to-noise ratio (SNR) of a measurement and thus provides an efficient tool for the analysis and development of bioelectric measurement setups. In the thesis the sensitivity distribution analysis is also applied to the analysis of the effects of the dimensions of an implantable ECG device on measurement. The interelectrode distance was found to be the major factor in implant design that determines sensitivity. Other parameters related to implant dimensions have only a minor effect on the average sensitivity of the measurement. It was also observed here that implanting the electrodes deeper under the skin has major effects on the local sensitivities in heart muscle which may affect the morphology of the measured ECG.

General information
State: Published
Ministry of Education publication type: G5 Doctoral dissertation (article)
Organisations: Department of Biomedical Engineering
Authors: Väisänen, J.
Number of pages: 75
Publication date: 4 Jun 2010

Publication information
Place of publication: Tampere
Publisher: Tampere University of Technology
Original language: English

Publication series
Name: Tampere University of Technology. Publication
Publisher: Tampere University of Technology
Volume: 888
ISSN (Print): 1459-2045
Electronic versions:
vaisanen.pdf
Links:
http://urn.fi/URN:NBN:fi: tty-201005251135

Bibliographical note
Awarding institution:Tampere University of Technology
Source: researchoutputwizard
Source-ID: 9493
Research output: Collection of articles › Doctoral Thesis

Assessment of GPS tracking devices for elderly care

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Wasim, M. M., Mäkelä, K., Perälä, S.
Pages: 21-21
Publication date: 2010

Host publication information
Title of host publication: 4th International Hyvite Sympopsium on Wellbeing, 9.6.2010, Tampere, Finland

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 9629
Research output: Scientific › peer-review › Conference contribution

Assessment of pulmonary flow using impedance pneumography
Assessment of well-being technology at home

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Mäkelä, K.
Pages: 10-12
Publication date: 2010

Host publication information
Title of host publication: 4th International Hyvite Symposium on Wellbeing Technology, 9.6.2010, Tampere, Finland

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 8708
Research output: Scientific - peer-review ➔ Conference contribution
Atrioventricular conduction and cardiovascular mortality: Assessment of recovery PR interval is superior to pre-exercise measurement

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Nieminen, T., Verrier, R. L., Leino, J., Nikus, K., Lehtinen, R., Lehtimäki, T., Minkkinen, M., Kööbi, T., Turjanmaa, V., Viik, J., Kähönen, M.
Pages: 796-801
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Heart Rhythm
Volume: 7
Issue number: 6
ISSN (Print): 1547-5271
Ratings:
Scopus rating (2016): CiteScore 3.44 SJR 2.945 SNIP 1.798
Scopus rating (2015): SJR 2.895 SNIP 1.87 CiteScore 3.19
Scopus rating (2014): SJR 3.127 SNIP 1.879 CiteScore 3.14
Scopus rating (2013): SJR 3.379 SNIP 1.794 CiteScore 3.1
Scopus rating (2012): SJR 2.945 SNIP 1.792 CiteScore 3.39
Scopus rating (2011): SJR 2.469 SNIP 1.43 CiteScore 2.6
Scopus rating (2010): SJR 2.304 SNIP 1.429
Scopus rating (2009): SJR 1.849 SNIP 1.396
Scopus rating (2008): SJR 2.028 SNIP 1.394
Scopus rating (2007): SJR 2.177 SNIP 1.251
Scopus rating (2006): SJR 1.554 SNIP 1.195
Scopus rating (2005): SJR 0.768 SNIP 0.561
Original language: English
DOIs:
10.1016/j.hrthm.2010.02.029

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 8843
Research output: Scientific - peer-review › Article

Automatic classification of penicillin-induced epileptic EEG spikes

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Kortelainen, J., Silfverhuth, M., Suominen, K., Sonkajärvi, E., Alahuhta, S., Jäntti, V., Seppänen, T.
Pages: 6674-6677
Publication date: 2010

Host publication information
Title of host publication: 32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society EMBC, Buenos Aires, Argentina, 31.8.-4.9.2010
DOIs:
10.1109/IEMBS.2010.5627154

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
BEAMnrc Monte Carlo modelling of linear accelerator using parallel computing grid - Validation of a common, fixed geometry model for photon and electron beams

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Ojala, J., Hyödynmaa, S., Pitkänen, M.
Number of pages: 4
Pages: 1-4
Publication date: 2010

Host publication information
Editor: Sonke, J.

Bibliographical note
Proceedings -julkaisu ja posteri<br/>Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 8899
Research output: Scientific - peer-review › Conference contribution

Brain Iron Deposition and Sequence Characteristics in Parkinsonism

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Rossi, M., Ruottinen, H., Elovaara, I., Ryymin, P., Soimakallio, S., Eskola, H., Dastidar, P.
Pages: 795-802
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Investigative Radiology
Volume: 45
Issue number: 12
ISSN (Print): 0020-9996
Ratings:
Scopus rating (2016): SJR 2.475 SNIP 1.552 CiteScore 4.7
Scopus rating (2015): SJR 2.91 SNIP 1.634 CiteScore 4.84
Scopus rating (2014): SJR 2.891 SNIP 1.791 CiteScore 4.81
Scopus rating (2013): SJR 3.075 SNIP 1.777 CiteScore 5.11
Scopus rating (2012): SJR 3.246 SNIP 1.71 CiteScore 5.21
Scopus rating (2011): SJR 3.43 SNIP 1.54 CiteScore 4.77
Scopus rating (2010): SJR 3.203 SNIP 1.659
Scopus rating (2009): SJR 3.473 SNIP 1.603
Scopus rating (2008): SJR 3.532 SNIP 1.656
Scopus rating (2006): SJR 1.883 SNIP 1.221
Scopus rating (2005): SJR 1.612 SNIP 1.066
Scopus rating (2004): SJR 1.285 SNIP 1.035
Scopus rating (2003): SJR 1.186 SNIP 1.05
Scopus rating (2002): SJR 1.276 SNIP 0.968
Scopus rating (2001): SJR 1.285 SNIP 0.988
Scopus rating (2000): SJR 0.959 SNIP 0.756
Characterization of breast cancer types by texture analysis of magnetic resonance images

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Holli, K., Lääperi, A., Harrison, L., Luukkaala, T., Toivonen, T., Ryymin, P., Dastidar, P., Soimakallio, S., Eskola, H.
Pages: 135-141
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Academic Radiology
Volume: 17
Issue number: 2
ISSN (Print): 1076-6332
Ratings:
Scopus rating (2016): SJR 0.935 SNIP 0.988 CiteScore 1.87
Scopus rating (2015): SJR 1.008 SNIP 0.986 CiteScore 1.9
Scopus rating (2014): SJR 0.957 SNIP 0.984 CiteScore 1.75
Scopus rating (2013): SJR 1.039 SNIP 1.124 CiteScore 2.05
Scopus rating (2012): SJR 0.823 SNIP 0.869 CiteScore 1.79
Scopus rating (2011): SJR 0.917 SNIP 1.044 CiteScore 1.87
Scopus rating (2010): SJR 1.021 SNIP 1.146
Scopus rating (2009): SJR 0.909 SNIP 1.127
Scopus rating (2008): SJR 0.863 SNIP 1.055
Scopus rating (2007): SJR 0.902 SNIP 1.02
Scopus rating (2006): SJR 0.779 SNIP 0.776
Scopus rating (2005): SJR 0.668 SNIP 0.813
Scopus rating (2004): SJR 0.768 SNIP 0.786
Scopus rating (2003): SJR 0.7 SNIP 0.751
Scopus rating (2002): SJR 0.681 SNIP 0.904
Scopus rating (2001): SJR 0.616 SNIP 0.975
Scopus rating (2000): SJR 0.646 SNIP 0.73
Scopus rating (1999): SJR 0.629 SNIP 0.776
Original language: English
DOIs:
10.1016/j.acra.2009.08.012

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 9143
Research output: Scientific - peer-review › Article
Coherence in depth electrodes during induction of deep anesthesia

**General information**
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Silfverhuth, M., Kortelainen, J., Sonkajärvi, E., Suominen, K., Alahuhta, S., Jäntti, V., Seppänen, T.
Pages: 5963-5966
Publication date: 2010

**Host publication information**
Title of host publication: 32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society EMBC, Buenos Aires, Argentina, 31.8.-4.9.2010
DOIs: 10.1109/IEMBS.2010.5627573

**Bibliographical note**
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 9271
Research output: Scientific - peer-review › Conference contribution

Cortical potential imaging using L-curve and GCV method to choose the regularisation parameter

**General information**
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Subramaniyam, N., Väisänen, O., Wendel, K., Malmivuo, J.
Number of pages: 11
Pages: 1-11
Publication date: 2010
Peer-reviewed: Yes

**Publication information**
Journal: Nonlinear Biomedical Physics
Volume: 4
Issue number: Suppl. 1, 4
ISSN (Print): 1753-4631
Ratings:
Scopus rating (2015): SJR 0.78 SNIP 3.2
Scopus rating (2014): SJR 0.587 SNIP 1.123
Scopus rating (2013): SJR 0.26 SNIP 0.457
Scopus rating (2012): SJR 0.452 SNIP 0.967
Scopus rating (2011): SJR 0.371 SNIP 0.853
Scopus rating (2010): SJR 0.73 SNIP 1.033
Scopus rating (2009): SJR 1.18 SNIP 1.998
Scopus rating (2008): SJR 0.497 SNIP 0.266
Original language: English
DOIs: 10.1186/1753-4631-4-S1-S4

**Bibliographical note**
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 9331
Research output: Scientific - peer-review › Article

Design and Implementation of a portable long-term physiological signal recorder

**General information**
State: Published
Diffusion tensor imaging correlates with lesion volume in cerebral hemisphere infarctions

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Rossi, M. E., Jason, E., Marchesotti, S., Dastidar, P., Ollikainen, J., Soimakallio, S.
Number of pages: 11
Pages: 1-11
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: BMC Medical Imaging
Volume: 10
Issue number: 21
ISSN (Print): 1471-2342

Ratings:
Scopus rating (2016): SJR 0.549 SNIP 0.702 CiteScore 1.56
Scopus rating (2015): SJR 0.706 SNIP 0.994 CiteScore 1.93
Scopus rating (2014): SJR 0.473 SNIP 0.809 CiteScore 1.37
Scopus rating (2013): SJR 0.531 SNIP 1.196 CiteScore 1.82
Scopus rating (2012): SJR 0.765 SNIP 1.387 CiteScore 2.55
Scopus rating (2011): SJR 0.614 SNIP 1.125 CiteScore 2.18
Scopus rating (2010): SJR 0.633 SNIP 0.765
Scopus rating (2009): SJR 0.457 SNIP 0.629
Scopus rating (2008): SJR 0.636 SNIP 1.654
Scopus rating (2007): SJR 0.478 SNIP 1.224
Scopus rating (2006): SJR 0.274 SNIP 0.849
Scopus rating (2005): SJR 0.216 SNIP 0.501
Scopus rating (2004): SJR 0.191 SNIP 0.55
Scopus rating (2003): SJR 0.127 SNIP 0.477
Scopus rating (2002): SJR 0.121 SNIP 3.537
Effect of noise on texture analysis of MR images

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Savio, S., Harrison, L., Luukkaala, T., Dastidar, P., Soimakallio, S., Eskola, H.
Number of pages: 1
Pages: 1-1
Publication date: 2010

Host publication information
Title of host publication: 23rd European Conference on Biomaterials, 11.-15.9.2010, Tampere, Finland

Effect of slice thickness on brain magnetic resonance image texture analysis

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Savio, S. J., Harrison, L. C., Luukkaala, T., Heinonen, T., Dastidar, P., Soimakallio, S., Eskola, H. J.
Number of pages: 14
Pages: 1-14
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Biomedical Engineering Online
Volume: 9
Issue number: 60
ISSN (Print): 1475-925X
Ratings:
Scopus rating (2016): CiteScore 2.01 SJR 0.487 SNIP 1.048
Scopus rating (2015): SJR 0.521 SNIP 0.84 CiteScore 1.67
Scopus rating (2014): SJR 0.517 SNIP 1.133 CiteScore 2.02
Scopus rating (2013): SJR 0.577 SNIP 1.007 CiteScore 2.14
Scopus rating (2012): SJR 0.443 SNIP 1.059 CiteScore 1.81
Scopus rating (2011): SJR 0.401 SNIP 1.054 CiteScore 1.73
Scopus rating (2010): SJR 0.428 SNIP 1.102
Scopus rating (2009): SJR 0.521 SNIP 1.408
Scopus rating (2008): SJR 0.537 SNIP 0.97
Scopus rating (2007): SJR 0.453 SNIP 1.205
Scopus rating (2006): SJR 0.622 SNIP 1.282
Effect of visual information on postural control in patients with schizophrenia

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Ahlgren-Rimpiläinen, A., Lauerma, H., Kähkönen, S., Aalto, H., Pyykkö, I., Palmgren, K., Rimpiläinen, I.
Pages: 601-603
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Journal of Nervous and Mental Disease
Volume: 198
Issue number: 8
ISSN (Print): 0022-3018
Ratings:
Scopus rating (2016): SJR 1.07 SNIP 1.006 CiteScore 2.03
Scopus rating (2015): SJR 0.962 SNIP 0.888 CiteScore 1.85
Scopus rating (2014): SJR 0.932 SNIP 0.953 CiteScore 1.72
Scopus rating (2013): SJR 1.013 SNIP 1.105 CiteScore 2.05
Scopus rating (2012): SJR 1.155 SNIP 1.073 CiteScore 2.19
Scopus rating (2011): SJR 1.056 SNIP 1.2 CiteScore 2.13
Scopus rating (2010): SJR 1.155 SNIP 1.156
Scopus rating (2009): SJR 1.156 SNIP 0.999
Scopus rating (2008): SJR 1.175 SNIP 1.029
Scopus rating (2007): SJR 1.229 SNIP 1.182
Scopus rating (2006): SJR 1.274 SNIP 1.272
Scopus rating (2005): SJR 1.3 SNIP 1.208
Scopus rating (2004): SJR 1.188 SNIP 1.18
Scopus rating (2003): SJR 1.133 SNIP 1.216
Scopus rating (2002): SJR 1.168 SNIP 1.178
Scopus rating (2001): SJR 1.06 SNIP 1.064
Scopus rating (2000): SJR 1.18 SNIP 1.304
Scopus rating (1999): SJR 0.809 SNIP 0.978
Original language: English
DOIs:
10.1097/NMD.0b013e3181ea16bc

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 7622
Research output: Scientific - peer-review › Article
Effects of sauna and winter swimming on heart rate variability, quality of sleep and perceived well-being

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Viik, J., Rajala, S., Riikonen, R., Heinonen, R., Nygård, C., Perttunen, J., Smolander, J.
Pages: 30-31
Publication date: 2010

Host publication information
Title of host publication: 4th International Hyvite Symposium on Wellbeing Technology, 9.6.2010, Tampere, Finland

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 9559
Research output: Scientific - peer-review › Conference contribution

Electrophysiological studies of human embryonic stem cell-derived cardiomyocytes with novel microelectrode arrays

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Department of Biomedical Engineering
Authors: Kujala, V., Ryynänen, T., Hyttinen, J., Lekkala, J., Kerkelä, E., Aalto-Setälä, K.
Pages: 122-123
Publication date: 2010

Host publication information
Title of host publication: 7th International Meeting on Substrate-Integrated Microelectrode Arrays, 29.6. - 2.7.2010, Reutlingen, Germany

Bibliographical note
Contribution: organisation=bme,FACT1=0.5<br/>Contribution: organisation=ase mit,FACT2=0.5
Source: researchoutputwizard
Source-ID: 8477
Research output: Scientific - peer-review › Conference contribution

Enhanced bone structural analysis through pQCT image preprocessing

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Cervinka, T., Hyttinen, J., Sievänen, H.
Pages: 398-406
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Medical Engineering and Physics
Volume: 32
Issue number: 4
ISSN (Print): 1350-4533
Ratings:
Scopus rating (2016): SJR 0.713 SNIP 1.199 CiteScore 2.1
Scopus rating (2015): SJR 0.791 SNIP 1.273 CiteScore 2.11
Scopus rating (2014): SJR 0.739 SNIP 1.638 CiteScore 2.36
Scopus rating (2013): SJR 0.834 SNIP 1.562 CiteScore 2.51
Scopus rating (2012): SJR 0.797 SNIP 1.599 CiteScore 2.34
Scopus rating (2011): SJR 0.753 SNIP 1.638 CiteScore 2.39
Entropy of the EEG in transition to burst suppression in deep anesthesia: surrogate analysis

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Tampere University of Technology, Pori, Department of Biomedical Engineering
Authors: Anier, A., Lipping, T., Jäntti, V., Puumala, P., Huotari, A.
Pages: 2790-2793
Publication date: 2010

Host publication information
Title of host publication: 32nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society EMBC, Buenos Aires, Argentina, 31.8.-4.9.2010
DOIs:
10.1109/IEMBS.2010.5626366

Exercise electrocardiography detection of coronary artery disease by ST-segment depression/heart rate hysteresis in women: The Finnish Cardiovascular Study

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Svart, K., Lehtinen, R., Nieminen, T., Nikus, K., Lehtimäki, T., Kööbi, T., Niemelä, K., Niemi, M., Turjanmaa, V., Kähönen, M., Viik, J.
Pages: 182-188
Publication date: 2010
Peer-reviewed: Yes

Publication Information
Journal: International Journal of Cardiology
Volume: 140
Issue number: 2
Facilitation of Goal-Setting and Follow-Up in an Internet Intervention for Health and Wellness

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Former organisation of the author
Authors: Kaipainen, K., Mattila, E., Kinnunen, M., Korhonen, I.
Pages: 238-249
Publication date: 2010

Host publication information
Title of host publication: 5th International Conference on Persuasive Technology PERSUASIVE 2010, 7.-10.6.2010, Copenhagen, Denmark. LNCS
DOIs: 10.1007/978-3-642-13226-1_24

Bibliographical note
Julkaisutu toisen organisaation nimeä<br/>Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 8258
Research output: Scientific - peer-review › Conference contribution

IL-18 gene polymorphism, cardiovascular mortality and coronary artery disease

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Pages: 994-1001
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: European Journal of Clinical Investigation
Volume: 40
Issue number: 11
ISSN (Print): 0014-2972
Ratings:
Scopus rating (2016): SJR 1.186 SNIP 0.857 CiteScore 2.66
Scopus rating (2015): SJR 1.239 SNIP 0.95 CiteScore 2.73
Scopus rating (2014): SJR 1.214 SNIP 0.978 CiteScore 2.74
Scopus rating (2013): SJR 1.306 SNIP 1.171 CiteScore 3.19
Scopus rating (2012): SJR 1.294 SNIP 1.191 CiteScore 3.21
Scopus rating (2011): SJR 1.22 SNIP 0.978 CiteScore 2.73
Scopus rating (2010): SJR 1.037 SNIP 0.947
Scopus rating (2009): SJR 1.008 SNIP 1.049
Scopus rating (2008): SJR 1.199 SNIP 0.997
Scopus rating (2007): SJR 1.193 SNIP 0.995
Scopus rating (2006): SJR 1.195 SNIP 1.076
Impact of modern educational technologies on learning outcomes

General information
State: Published
Ministry of Education publication type: G5 Doctoral dissertation (article)
Organisations: Department of Biomedical Engineering
Authors: Kybartaite, A.
Publication date: 2010

Publication information
Place of publication: Tampere
Publisher: Tampere University of Technology
Original language: English

Publication series
Name: Tampereen teknillinen yliopisto. Julkaisu
Publisher: Tampere University of Technology
Volume: 901
ISSN (Print): 1459-2045

Bibliographical note
Awarding institution: Tampere University of Technology
Source: researchoutputwizard
Source-ID: 8505
Research output: Collection of articles › Doctoral Thesis

Impedance pneumography - A novel tool for pulmonology?

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Seppä, V., Viik, J., Hyttinen, J.
Pages: 15-15
Publication date: 2010

Host publication information
Title of host publication: 4th International Hyvite Symposium on Wellbeing Technology, 9.6.2010, Tampere, Finland

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 9252
Research output: Scientific - peer-review › Conference contribution
Järjestelmä aineen jakelemiseksi kohteeseen

General information
State: Published
Ministry of Education publication type: H1 Granted patent
Organisations: Department of Biomedical Engineering
Authors: Alametsä, J.
Publication date: 2010

Publication information
Patent number: Pat. FI 121215 B
Priority date: 31/08/10
Priority number: (21) FI 20065273 (22) 27.04.2006 (41) 28.10.2007
Original language: Finnish

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 7657
Research output: Scientific › Patent

Kulunvalvontateknologia muistisairaan apuna

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Perälä, S., Ämmälä, M., Latvala, R., Mäkelä, K.
Pages: 115-115
Publication date: 2010

Host publication information
Title of host publication: VII Gerontologian päivät, 15.-17.4.2010, Kuopio

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 8980
Research output: Scientific - peer-review › Conference contribution

Learning objects for the Virtual Campus of Biomedical Engineering

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Kybartaite, A., Nousiainen, J., Malmivuo, J.
Pages: 11-15
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: IEEE Multidisciplinary Engineering Education Magazine
Volume: 5
Issue number: 1
ISSN (Print): 1558-7908
Original language: English

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 8506
Research output: Scientific - peer-review › Article
Location based technology for memory impaired elderly

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Perälä, S., Ämmälä, M., Latvala, R., Mäkelä, K.
Pages: 242-242
Publication date: 2010

Host publication information
Title of host publication: 7th World Conference - International Society for Gerontechnology, 27.-30.5.2010, Vancouver, BC, Canada. Gerontechnology
Editors: Sixsmith, A., Gutman, G.

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 8979
Research output: Scientific - peer-review › Conference contribution

MAC 2010, 8th International Conference on the Mechanisms of Anesthesia (MAC2010), 15.-18.6.2010, Toronto, Kanada

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Biomedical Engineering
Authors: Jäntti, V.
Pages: 354-355
Publication date: 2010
Peer-reviewed: Unknown

Publication information
Journal: Finnanest
Volume: 43
Issue number: 4
ISSN (Print): 0781-4364
Original language: English

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 8192
Research output: Professional › Article

Management of electronic patient record systems in primary healthcare in a Finnish county

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Mäkelä, K., Virjo, I., Aho, J., Kalliola, P., Kurunmäki, H., Uusitalo, L., Valli, M., Ylinen, S.
Pages: 1017-1023
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Telemedicine and E-Health
Volume: 16
Issue number: 10
ISSN (Print): 1530-5627
Ratings:
Scopus rating (2016): SJR 0.481 SNIP 0.674 CiteScore 1.06
MRI texture analysis in multiple sclerosis: Toward a clinical analysis protocol

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Harrison, L. C., Raunio, M., Holli, K. K., Luukkaala, T., Savio, S., Elovaara, I., Soimakallio, S., Eskola, H. J., Dastidar, P.
Pages: 696-707
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Academic Radiology
Volume: 17
Issue number: 6
ISSN (Print): 1076-6332
Ratings:
Scopus rating (2016): SJR 0.935 SNIP 0.988 CiteScore 1.87
Scopus rating (2015): SJR 1.008 SNIP 0.986 CiteScore 1.9
Scopus rating (2014): SJR 0.957 SNIP 0.984 CiteScore 1.75
Scopus rating (2013): SJR 1.039 SNIP 1.124 CiteScore 2.05
Scopus rating (2012): SJR 0.823 SNIP 0.869 CiteScore 1.79
Scopus rating (2011): SJR 0.917 SNIP 1.044 CiteScore 1.87
Scopus rating (2010): SJR 1.021 SNIP 1.146
Scopus rating (2009): SJR 0.909 SNIP 1.127
Scopus rating (2008): SJR 0.863 SNIP 1.055
Scopus rating (2007): SJR 0.902 SNIP 1.02
Scopus rating (2006): SJR 0.779 SNIP 0.776
Scopus rating (2005): SJR 0.668 SNIP 0.813
Scopus rating (2004): SJR 0.768 SNIP 0.786
Scopus rating (2003): SJR 0.7 SNIP 0.751
Scopus rating (2002): SJR 0.681 SNIP 0.904
Scopus rating (2001): SJR 0.616 SNIP 0.975
Scopus rating (2000): SJR 0.646 SNIP 0.73
Scopus rating (1999): SJR 0.629 SNIP 0.776
Original language: English
DOI: 10.1016/j.acra.2010.04.009
Multichannel ballistocardiographic measurementis with EMFi sensors

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Alametsä, J., Viik, J., Palomäki, A.
Pages: 16-17
Publication date: 2010

Host publication information
Title of host publication: 4th International Hyvite Symposium on Wellbeing, 9.6.2010, Tampere, Finland

New precordial bipolar electrocardiographic leads for detecting left ventricular hypertrophy

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Puurtinen, M., Väisänen, J., Viik, J., Hyttinen, J.
Pages: 654-659
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Journal of Electrocardiology
Volume: 43
Issue number: 6
ISSN (Print): 0022-0736

Ratings:
Scopus rating (2016): SJR 0.653 SNIP 0.73 CiteScore 1.14
Scopus rating (2015): SJR 0.513 SNIP 0.743 CiteScore 1.06
Scopus rating (2014): SJR 0.68 SNIP 0.963 CiteScore 1.16
Scopus rating (2013): SJR 0.6 SNIP 0.844 CiteScore 1.33
Scopus rating (2012): SJR 0.522 SNIP 0.829 CiteScore 1.08
Scopus rating (2011): SJR 0.534 SNIP 0.793 CiteScore 1.02
Scopus rating (2010): SJR 0.51 SNIP 0.713
Scopus rating (2009): SJR 0.496 SNIP 0.856
Scopus rating (2008): SJR 0.611 SNIP 0.836
Scopus rating (2007): SJR 0.56 SNIP 1.022
Scopus rating (2006): SJR 0.545 SNIP 0.785
Scopus rating (2005): SJR 0.323 SNIP 0.529
Scopus rating (2004): SJR 0.317 SNIP 0.592
Scopus rating (2003): SJR 0.416 SNIP 0.559
Scopus rating (2002): SJR 0.501 SNIP 0.604
Scopus rating (2001): SJR 0.469 SNIP 0.5
Scopus rating (2000): SJR 0.43 SNIP 0.658
Scopus rating (1999): SJR 0.329 SNIP 0.613
Original language: English
DOIs:
10.1016/j.jelectrocard.2010.04.002

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 9056
Research output: Scientific - peer-review › Article

On microelectrode impedance measurements

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Automation Science and Engineering, Department of Biomedical Engineering
Authors: Tanskanen, J. M., Kauppinen, P., Ryynänen, T., Lekkala, J., Hyttinen, J. A.
Pages: 243-244
Publication date: 2010

Host publication information
Title of host publication: 7th International Meeting on Substrate-Integrated Microelectrode Arrays, 29.6. - 2.7.2010, Reutlingen, Germany

Bibliographical note
Contribution: organisation=bme,FACT1=0.5<br/>Contribution: organisation=ase mit,FACT2=0.5
Source: researchoutputwizard
Source-ID: 9375
Research output: Scientific - peer-review › Conference contribution

Plasticity of human embryonic stem cell -derived neuronal networks: Effect of low-frequency stimulation

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Department of Biomedical Engineering, Research group: Sleep and Sensory Signal Analysis Group-SSSAG
Authors: Ylä-Outinen, L., Korhonen, I., Mikkonen, J. E., Hyttinen, J., Narkilahti, S.
Pages: 92-93
Publication date: 2010

Host publication information
Title of host publication: Proceedings of MEA Meeting 2010, the 7th International Meeting on Substrate-Integrated Microelectrode Arrays, Reutlingen, Germany, June 29 - July 2, 2010
ISBN (Print): 3-938345-08-5

Bibliographical note
Contribution: organisation=sgn,FACT1=0.5<br/>Contribution: organisation=bme,FACT2=0.5
Source: researchoutputwizard
Practice of e-learning development and application in biomedical engineering Education in Europe

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Kybartaitė, A., Salerud, E., Malmivuo, J. A.
Pages: 67-84
Publication date: 2010

Host publication information
Title of host publication: eLearning Baltics 2010, Proceedings of the 3rd International eLBA Science Conference, Rostock, Germany, 1.-2.7.2010
Editors: Hambach, S., Martens, A., Tavangarian, D., Urban, B.
ISBN (Print): 978-3-8396-0135-8
Links: https://verlag.fraunhofer.de

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 8507
Research output: Scientific - peer-review › Conference contribution

Safety and monitoring technologies for the homes of people with dementia

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Riikonen, M., Mäkelä, K., Perälä, S.
Pages: 32-45
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Gerontechnology
Volume: 9
Issue number: 1
ISSN (Print): 1569-1101
Ratings:
Scopus rating (2016): SJR 0.176 SNIP 0.223 CiteScore 0.29
Scopus rating (2015): SJR 0.233 SNIP 0.177 CiteScore 0.26
Scopus rating (2014): SJR 0.397 SNIP 2.953 CiteScore 1.35
Scopus rating (2013): SJR 0.213 SNIP 0.446 CiteScore 0.86
Scopus rating (2012): SJR 0.19 SNIP 0.285 CiteScore 0.61
Original language: English
DOIs: 10.4017/gt.2010.09.01.003.00

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 9109
Research output: Scientific - peer-review › Article

Sauna, winter swimming and perceived well-being

General information
State: Published
Short distance bipolar electrocardiographic leads in diagnosis of left ventricular hypertrophy

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Väisänen, J., Puurtinen, M., Hyttinen, J., Viik, J.
Pages: 293-296
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Computers in Cardiology
Volume: 37
ISSN (Print): 0276-6574
Ratings:
Scopus rating (2012): SJR 0.149 SNIP 0.263
Scopus rating (2011): SJR 0.155 SNIP 0.455
Scopus rating (2010): SJR 0.141 SNIP 0.34
Scopus rating (2009): SJR 0.191 SNIP 0.288
Scopus rating (2008): SJR 0.2 SNIP 0.349
Scopus rating (2007): SJR 0.262 SNIP 0.351
Scopus rating (2006): SJR 0.227 SNIP 0.332
Scopus rating (2005): SJR 0.268 SNIP 0.508
Scopus rating (2004): SJR 0.231 SNIP 0.419
Scopus rating (2003): SJR 0.245 SNIP 0.46
Scopus rating (2002): SJR 0.223 SNIP 0.281
Scopus rating (2001): SJR 0.216 SNIP 0.34
Scopus rating (2000): SJR 0.229 SNIP 0.085
Scopus rating (1999): SJR 0.194 SNIP 0.3
Original language: English

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 9494
Research output: Scientific - peer-review › Article

Snoring second detection with EMFi sensor strips

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Department of Biomedical Engineering, Research group: Sleep and Sensory Signal Analysis Group-SSSAG
Authors: Alametsä, J., Viik, J., Huupponen, E., Kulkas, A., Värri, A., Himanen, S.
Pages: 265-268
Texture analysis for magnetic resonance images of the brain

General information
State: Published

Host publication information
Title of host publication: 37th International Congress on Electrocardiology, 3.-5.6.2010, Lund, Sweden
DOI: 10.1016/j.jelectrocard.2010.12.050

Bibliographical note
Published also in Journal of Electrocardiology 2011;44(2):e17
Source: researchoutputwizard
Source-ID: 9350
Research output: Scientific › Conference contribution
Texture analysis of MR Images of patients with mild traumatic brain injury

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Holli, K. K., Harrison, L., Dastidar, P., Wåljas, M., Liimatainen, S., Luukkaala, T., Öhman, J., Soimakallio, S., Eskola, H.
Number of pages: 8
Pages: 1-8
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: BMC Medical Imaging
Volume: 10
Issue number: 8
ISSN (Print): 1471-2342
Ratings:
Scopus rating (2016): SJR 0.549 SNIP 0.702 CiteScore 1.56
Scopus rating (2015): SJR 0.706 SNIP 0.994 CiteScore 1.93
Scopus rating (2014): SJR 0.473 SNIP 0.809 CiteScore 1.37
Scopus rating (2013): SJR 0.531 SNIP 1.196 CiteScore 1.82
Scopus rating (2012): SJR 0.765 SNIP 1.387 CiteScore 2.55
Scopus rating (2011): SJR 0.614 SNIP 1.125 CiteScore 2.18
Scopus rating (2010): SJR 0.633 SNIP 0.765
Scopus rating (2009): SJR 0.457 SNIP 0.629
Scopus rating (2008): SJR 0.636 SNIP 1.654
Scopus rating (2007): SJR 0.478 SNIP 1.224
Scopus rating (2006): SJR 0.274 SNIP 0.849
Scopus rating (2005): SJR 0.216 SNIP 0.501
Scopus rating (2004): SJR 0.191 SNIP 0.55
Scopus rating (2003): SJR 0.127 SNIP 0.477
Scopus rating (2002): SJR 0.121 SNIP 3.537
Original language: English
DOIs: 10.1186/1471-2342-10-8

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 8086
Research output: Scientific - peer-review › Article
The pattern of crescendo TWA may disclose the underlying cardiac pathology

The prognostic capacity of clinically indicated exercise test is enhanced by combined analysis of exercise capacity, heart rate recovery and T-wave alternans
The significance of relative conductivity on thin layers in EEG sensitivity distributions

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Wendel, K., Väisänen, J., Kybartaite, A., Hyttinen, J., Malmivuo, J.
Pages: 123-131
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Biomedizinische Technik
Volume: 55
Issue number: 3
ISSN (Print): 0013-5585
Ratings:
Scopus rating (2016): CiteScore 0.4 SJR 0.178 SNIP 0.191
Scopus rating (2015): CiteScore 0.4 SJR 0.184 SNIP 0.228
Scopus rating (2014): CiteScore 0.45 SJR 0.192 SNIP 0.448
Scopus rating (2013): CiteScore 0.56 SJR 0.183 SNIP 0.276
Scopus rating (2012): CiteScore 0.66 SJR 0.199 SNIP 0.376
Scopus rating (2011): CiteScore 0.79 SJR 0.235 SNIP 0.568
Scopus rating (2010): SJR 0.201 SNIP 0.383
Scopus rating (2009): SJR 0.23 SNIP 0.505
Scopus rating (2008): SJR 0.186 SNIP 0.256
Scopus rating (2007): SJR 0.251 SNIP 0.528
Scopus rating (2006): SJR 0.184 SNIP 0.31
Scopus rating (2005): SJR 0.239 SNIP 0.438
Scopus rating (2004): SJR 0.189 SNIP 0.326
Scopus rating (2003): SJR 0.165 SNIP 0.456
Scopus rating (2002): SJR 0.244 SNIP 0.456
Scopus rating (2001): SJR 0.174 SNIP 0.381
Scopus rating (2000): SJR 0.235 SNIP 0.505
Scopus rating (1999): SJR 0.213 SNIP 0.637
Original language: English
DOIs:
10.1515/BMT.2010.012

Tracheal Sound Analysis of Sleep Disordered Breathing

General information
State: Published
Ministry of Education publication type: G5 Doctoral dissertation (article)
Organisations: Department of Biomedical Engineering
Authors: Kulkas, A.
Number of pages: 109
Publication date: 2010
Tracking the network development of hESC derived neurons during maturation

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Signal Processing, Department of Biomedical Engineering, Research group: Sleep and Sensory Signal Analysis Group-SSSAG
Authors: Kapucu, F. E., Tanskanen, J. M. A., Mikkonen, J. E., Ylä-Outinen, L., Narkilahti, S., Hyttinen, J. A. K.
Pages: 94-95
Publication date: 2010

Host publication information
Title of host publication: Proceedings of MEA Meeting 2010, the 7th International Meeting on Substrate-Integrated Microelectrode Arrays, Reutlingen, Germany, June 29 - July 2, 2010
ISBN (Print): 3-938345-08-5

Bibliographical note
Contribution: organisation=bme,FACT1=0.5<br/>Contribution: organisation=sgn,FACT2=0.5
Source: researchoutputwizard
Source-ID: 8286
Research output: Scientific - peer-review › Conference contribution

T-wave morphology and its spatial relationship with QRS complex morphology in exercise electrocardiogram predicts cardiac mortality in a population undergoing a clinically indicated exercise test

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Kenttä, T., Junttila, J., Karsikas, M., Perkiömäki, J., Seppänen, T., Nieminen, T., Lehtimäki, T., Nikus, K., Lehtinen, R., Viik, J., Kähönen, M., Huikari, H.
Pages: 7-7
Publication date: 2010

Host publication information
Title of host publication: Finnish Cardiac Society, 36th Progress Report Meeting, 29.1.2010, Helsinki, Finland

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 8334
Research output: Scientific - peer-review › Conference contribution

Usability evaluation of a web-based patient information system for individuals with severe mental health problems

General information
Use of videoconferencing for consultation in dental prosthetics and oral rehabilitation

General information
State: Published
Ministry of Education publication type: A1 Journal article-refereed
Organisations: Department of Biomedical Engineering
Authors: Ignatius, E., Perälä, S., Mäkelä, K.
Pages: 467-470
Publication date: 2010
Peer-reviewed: Yes

Publication information
Journal: Journal of Telemedicine and Telecare
Volume: 16
ISSN (Print): 1357-633X
Ratings:
Scopus rating (2016): SJR 0.694 SNIP 0.921 CiteScore 1.87
Scopus rating (2015): SJR 0.835 SNIP 1.19 CiteScore 1.99
Scopus rating (2014): SJR 0.905 SNIP 1.156 CiteScore 2.04
Scopus rating (2013): SJR 1.095 SNIP 1.213 CiteScore 2.04
Scopus rating (2012): SJR 0.618 SNIP 1.028 CiteScore 1.64
Scopus rating (2011): SJR 0.624 SNIP 1.082 CiteScore 1.61
Scopus rating (2010): SJR 0.668 SNIP 0.864
Scopus rating (2009): SJR 0.52 SNIP 0.811
Scopus rating (2008): SJR 0.467 SNIP 0.648
Scopus rating (2007): SJR 0.506 SNIP 0.809
Scopus rating (2006): SJR 0.447 SNIP 0.895
Scopus rating (2005): SJR 0.399 SNIP 0.99
Scopus rating (2004): SJR 0.422 SNIP 0.941
Scopus rating (2003): SJR 0.492 SNIP 0.836
Scopus rating (2002): SJR 0.362 SNIP 1.018
Scopus rating (2001): SJR 0.534 SNIP 1.369
Scopus rating (2000): SJR 0.543 SNIP 1.444
Scopus rating (1999): SJR 0.496 SNIP 1.402
Original language: English
DOI:
10.1258/jtt.2009.091103

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 8766
Research output: Scientific - peer-review › Article

Scopus rating (2015): SJR 0.835 SNIP 1.19 CiteScore 1.99
Scopus rating (2014): SJR 0.905 SNIP 1.156 CiteScore 2.04
Scopus rating (2013): SJR 1.095 SNIP 1.213 CiteScore 2.04
Scopus rating (2012): SJR 0.618 SNIP 1.028 CiteScore 1.64
Scopus rating (2011): SJR 0.624 SNIP 1.082 CiteScore 1.61
Scopus rating (2010): SJR 0.668 SNIP 0.864
Scopus rating (2009): SJR 0.52 SNIP 0.811
Scopus rating (2008): SJR 0.467 SNIP 0.648
Scopus rating (2007): SJR 0.506 SNIP 0.809
Scopus rating (2006): SJR 0.447 SNIP 0.895
Scopus rating (2005): SJR 0.399 SNIP 0.99
Scopus rating (2004): SJR 0.422 SNIP 0.941
Scopus rating (2003): SJR 0.492 SNIP 0.836
Using mobile phone as a part of an ECG measurement and analysis system

General information
State: Published
Ministry of Education publication type: A4 Article in a conference publication
Organisations: Department of Biomedical Engineering
Authors: Kailanto, H., Hyttinen, J.
Pages: 23-23
Publication date: 2010

Host publication information
Title of host publication: 4th International Hyvite Symposium on Wellbeing, 9.6.2010, Tampere, Finland

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 8256
Research output: Scientific - peer-review › Conference contribution

Uutta teknikkaa lehmien hyvinvoinnin seurantaan

General information
State: Published
Ministry of Education publication type: D1 Article in a trade journal
Organisations: Department of Biomedical Engineering
Authors: Saarijärvi, K., Siivonen, J., Väisänen, J.
Pages: 34-34
Publication date: 2010
Peer-reviewed: Unknown

Publication information
Journal: KMVET, Kotieläinten terveydenhoitolehti
Issue number: 6
Original language: Finnish

Bibliographical note
Contribution: organisation=bme,FACT1=1
Source: researchoutputwizard
Source-ID: 9179
Research output: Professional › Article