

The RAGNAR GRANIT

INSTITUTE NEWS

Ragnar Granit Institute, P.O.Box 692, FIN-33101 Tampere, Finland, Tel. +358-3-365 2524, Fax +358-3-365 2162

Editor-in-Chief: Jaakko Malmivuo (malmivuo@cc.tut.fi), Editor: Soile Lönnqvist

www.cc.tut.fi/~malmivuo/news

ISSN: 1456-4343

Volume 6. No 1. 8.12.1999



Season's Greetings

*The personnel of the Ragnar Granit Institute thank all their friends
for good co-operation during 1999 and wish everyone a
Merry Christmas and a successful New Year 2000.*

6th Ragnar Granit Symposium: EEG Meets MRI May 20-21, 1999, Tampere-Hall

The Institute organized on May 20-21, 1999 at Tampere-Hall the 6th Ragnar Granit Symposium. Professor **Hannu Eskola** acted as chairman of the Symposium. The two days contained a total of 16 lectures given by top specialists. More than 100 participants from 11 countries enjoyed the lectures, commercial exhibition and the early summer days.

www.ee.tut.fi/rgi/symposia/6th/

7th Ragnar Granit Symposium - Electrocardiography in Ischemic Heart Disease, May 29-30, 2000, Helsinki

Ragnar Granit Institute, Finnish Cardiac Society, International Society for Bioelectromagnetism and Ragnar Granit Foundation will in collaboration arrange the "7th Ragnar Granit Symposium - Electrocardiography in Ischemic Heart Disease" on May 29-30, 2000 in Helsinki, Finland. Dr **Rami Lehtinen** will serve as the Chairman of the Organizing Committee and Professor **Jaakko Malmivuo** as the Chairman of the Scientific Committee of the Symposium.

The objective of this high-level international scientific symposium is to air the newest research information and to compare different ECG-methods and their role in the diagnosis of ischemic heart disease. The symposium is targeted to the researchers and medical doctors in the fields of electrocardiology, cardiology and clinical physiology. All lecturers are invited ones.

www.tut.fi/rgi/symposia/7th/

3rd ICBEM in Bled, Slovenia October 2000

The Slovenian Society for Biomedical Engineering will organize the 3rd International Conference on Bioelectromagnetism in Slovenia, October 2000. For more information please contact Dr. **Damijan Miklavcic** of the Slovenian Society for Biomedical Engineering:

lbk.fe.uni-lj.si/icbem/

International Journal of Bioelectromagnetism, IJBEM

International Society for Bioelectromagnetism, ISBEM, established a new scientific journal, International Journal of Bioelectromagnetism, IJBEM. Publishing of this Journal is supported by the Ragnar Granit Institute and the Ragnar Granit Foundation. Professor **Jaakko Malmivuo** serves as Editor-in-Chief for the Journal.

IJBEM is primarily published on the Internet, which makes the publishing fast and easily available to everyone interested.

The Proceedings of the 6th Ragnar Granit Symposium was published as the first issue of the Journal. Therefore this issue was also published as a printed version.

www.tut.fi/ijbem/

2nd Ragnar Granit Prize for Young Scientists

The 2nd Ragnar Granit Prize for Young Scientists was awarded at the 11th Nordic-Baltic Conference on Biomedical Engineering. The Prize is given by the Ragnar Granit Foundation and its value is 1000 €

The Prize was awarded to **Jaanus Lass** from the Institute of Biomedical Engineering of the Tallinn University of Technology, Tallinn, Estonia. His paper was entitled: "Modulated Microwave Effects of EEG Alpha Waves". He was also co-author of five other papers in the conference.

www.cb.ttu.ee/~jaanus/



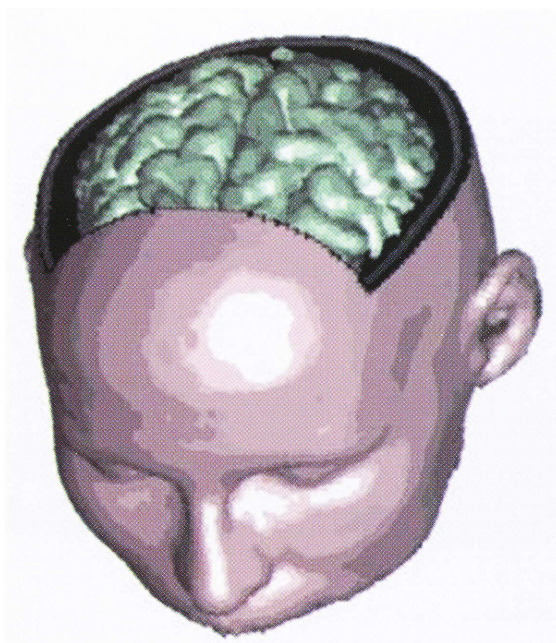
Jaanus Lass

Tomi Heinonen defended his Doctoral Thesis May 20th 1999

Application of Magnetic Resonance Image Segmentation in Neurology

The popularity of magnetic resonance imaging (MRI) is increasing in neurological studies due to its ability to efficiently visualize anatomical structures and pathological conditions. New imaging sequences are developed constantly to emphasize particular lesions caused by neurological diseases (e.g., multiple sclerosis). Although MR images are completely digital and include three-dimensional information for the patient anatomy, the images are analyzed conventionally applying printed films and 2D slices.

Three separate software and several algorithms were developed in the research project. The segmentation software called *Anatomic* operates in the Microsoft Windows 98 environment and utilizes a set of modular image processing tools, efficient user interface, and specific decision rules for integrating segmented structures. 3D visualization software *Medimag* applies volume rendering and center-of-gravity shading, and it enables multimodal visualization. Brain mapping software *3DEEG* includes an efficient implementation for integrating measured EEG signal and MR images. The technique is based on analytical geometry, heuristic triangulation methods and Phong shading.



All the software utilize similar image formats enabling a functional image processing toolkit for neurological research purposes.

The developed algorithms and software form an efficient and functional image analysis package for neurological and radiological application. The results suggest that segmentation and 3D presentation of medical images will become a standard tool in radiological diagnostics. Especially volumetric analysis increases the accuracy of patient follow-up. Furthermore, comparing such quantitative parameters to clinical estimations of patient state produces new information.

Professor **Lars-Olof Wahlund**, Huddinge Hospital, Stockholm, Sweden, and Professor **Raimo Sepponen**, Helsinki University of Technology served as examiners for Tomi Heinonen. Professor **Hannu Eskola** served as Custos.

ee.tut.fi/~tomi/3Dproject/3Dreconstruction.html

Pasi Kauppinen defended his Doctoral Thesis Nov. 27th 1999

Application of Lead Field Theory in the Analysis and Development of Impedance Cardiography

There is a definite need for a valid, non-invasive and inexpensive means of measuring cardiac hemodynamics. Impedance cardiography (ICG) offers a simple method to measure cardiac function on the basis of conductivity changes occurring in relation to the cardiac cycle. ICG has failed achieve wide clinical acceptance due to controversial results obtained with the method.

The purpose of this present work was to investigate and develop ICG based on advanced theoretical concepts and accurate modeling of the ICG measurement and the underlying physiological phenomena. Methods to compute the measurement sensitivity of ICG-leads were developed based on lead field analysis and models of the human thorax as a volume conductor. Furthermore, means were developed to devise alternative, regionally more sensitive ICG measurements that would reflect more in detail the changes of cardiac hemodynamics.

The results indicated that the traditional ICG basically measures conductivity changes in the whole thorax - it is not specifically sensitive to detect conductivity changes in the regions assumed to be the source of ICG. New ICG configurations were derived employing the 12-lead electrocardiograph (ECG) electrode system allowing rapid and easy clinical utilization with simultaneous standard ECG measurement. New ICG configurations, possessing substantially more regional measurement sensitivity than the traditional ICG, were utilized in an initial clinical test with healthy volunteers and patients undergoing valve replacement. Results exhibited significant correlation with the simulation data and valvular disease was distinguished within the study population. Furthermore, based on theoretical analysis, recommendations to improve ICG instrumentation were suggested to overcome some of the weaknesses of the ICG.

Although the lead field theory is old, its application with computational models presented in this study is unique. The encouraging results of this present thesis suggest that ICG measurements producing more direct physiological data can be developed. This may facilitate a new range of bioimpedance applications for monitoring the cardiac hemodynamics.

Professor **Robert Patterson**, University of Minnesota, Minneapolis, MN, USA and Professor **Olaf Dössel**, University of Karlsruhe, Karlsruhe, Germany served as examiners for Pasi Kauppinen. Professor **Jaakko Malmivuo** served as Custos.

Juha Nousiainen appointed Assistant Professor

Dr. Tech. **Juha Nousiainen** was appointed on 1st November 1999 Assistant Professor (lehtori). Juha Nousiainen has served the RGI since 1982 as research assistant and then acting Associate Professor on 1993. His main area of research is magnetocardiography and cardiac electrophysiology.

www.ee.tut.fi/~nousiain/

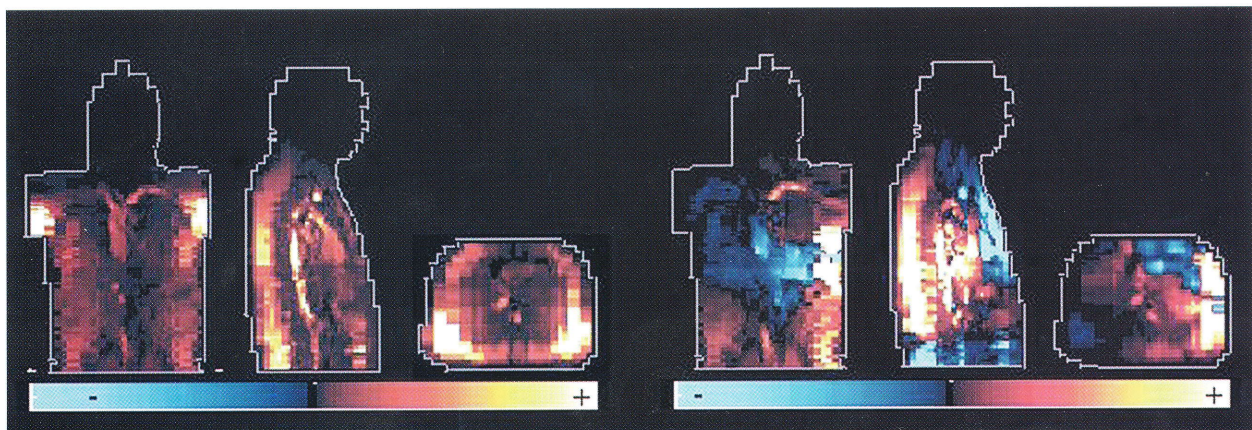
Jari Hyttinen appointed Assistant Professor

Dr. Tech. **Jari Hyttinen** is to be appointed on January 1st 2000 Assistant Professor (yli-assistentti). Jari Hyttinen has served the RGI since 1984 as assistant and as researcher of the Academy of Finland since 1994-97. His main area of research is modeling of the electric fields of the human body. His special interest has been in cardiac electric fields.

www.ee.tut.fi/~hyttinen/

Please visit the PowerPoint tour to the research projects of the RGI:

www.cc.tut.fi/~malmivuo/bem/bem.htm



Sensitivity distribution of impedance measurement