

Title: Biomagnetics: An Interdisciplinary Field Where Magnetics, Biology and Medicine Overlap

Speaker:

Prof. Shoogo Ueno
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Date: Friday, 22 October 2010

Time: 11:15 am

Venue: Room 603, Chow Yei Ching Building,
Department of Electrical and Electronic Engineering,
The University of Hong Kong

Abstract:

Biomagnetics is an interdisciplinary field where magnetics, biology and medicine overlap. It has a long history since 1600, when William Gilbert published his book *De Magnete*. Recent advances in biomagnetics have enabled us not only to detect extremely weak magnetic fields from the human brain, but also to control cell orientation and cell growth by extremely high magnetic fields. Pulsed magnetic fields are used for transcranial magnetic stimulation (TMS) of the human brain, and both high frequency magnetic fields and magnetic nanoparticles have promising therapeutic applications for treatments of cancers and brain diseases such as Alzheimer's and Parkinson's. On the imaging front, magnetic resonance imaging (MRI) is now a powerful tool for basic and clinical medicine. New methods of MRI based on the imaging of impedance of the human body, called impedance MRI, and the imaging of neuronal current activities in the human brain, called current MRI, are also being developed.

This lecture focuses on the advances in biomagnetics and bioimaging obtained mostly in our laboratory in recent years. The lecture describes: (1) a method of localized magnetic stimulation of the human brain by TMS with a figure-eight coil; (2) magneto-encephalography (MEG) to measure extremely weak magnetic fields produced from brain electrical activity using superconducting quantum interference device (SQUID) systems; (3) impedance MRI and current MRI; (4) cancer therapy and control of iron-ion release from, and uptake into, ferritin, an iron-storage

protein, by using both high frequency and pulsed magnetic fields and magnetic nanoparticles; and (5) magnetic control of biological cell orientation and cell growth by strong static magnetic fields. These new biomagnetic approaches will open new horizons in brain research, brain treatment, and regenerative medicine.

Biography of the speaker:

Prof. Shoogo Ueno received the B.S., M.S. and Ph.D. (Dr. Eng.) degrees in electronic engineering from Kyushu University, Fukuoka, Japan, in 1966, 1968, and 1972, respectively. Dr. Ueno was an associate professor with the Department of Electronics, Kyushu University, from 1976 to 1986. From 1979 to 1981, he spent his sabbatical with the Department of Biomedical Engineering, Linköping University, Linköping, Sweden, as a guest scientist. He subsequently served as a professor in the Department of Electronics, Kyushu University (1986-1994) and in the Department of Biomedical Engineering, Graduate School of Medicine, University of Tokyo (1994-2006). In 2006 he retired from the University of Tokyo as professor emeritus. Since 2006 he has been a professor with the Department of Applied Quantum Physics, Graduate School of Engineering, Kyushu University, and is also dean of the Faculty of Medical Technology, Teikyo University, Fukuoka.

Organizer: Dr. P.W.T. Pong

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