



**Glycoprotein dynamics observed by GlycoPET imaging.** This technique, pioneered by Koichi Fukase, visualizes the effect of sugar chains on protein dynamics.

“Sugar chains and proteins are just the beginning,” declares Fukase. “We could assemble those and other biomolecules into structures for performing useful functions, such as recognizing patterns in the communities on cell surfaces and regulating the molecular communities inside cells. That approach could even provide an effective means of correcting

autoimmune disorders and targeting anticancer drugs at tumours.”

Michio Murata, a colleague of Fukase in Osaka University’s Department of Chemistry, is also doing important work in the realm of biomolecular society. Murata works to elucidate biological phenomena by reconstituting the biomolecular communities required for various functions.

For example, he analyses the interaction of biomolecules and pharmaceutical compounds inside a liposome membrane as a model for the cell membrane. Using this approach, Murata has demonstrated that membrane lipids figure prominently in the pharmaceutical action of antibiotics.

“The cell membrane is a classic biomolecular society,” remarks Murata. “I look forward to developing methodologies for grasping the exact roles that lipids, proteins and other biomolecules play in that society.”

These achievements are but a small sample of the cutting-edge work under way in bioscience at Osaka University. Some of the other bioscience researchers at the university who have earned international acclaim include Hitoshi Watarai in analytical chemistry, Yasuhiro Kajihara in organic biochemistry and Yasuhisa Mizutani in biophysical chemistry.

**Graduate School of Science,  
Osaka University**

1-1 Machikaneyama, Toyonaka, Osaka  
560-0043, Japan

Tel: +81-6-6850-6111  
Web: [www.sci.osaka-u.ac.jp](http://www.sci.osaka-u.ac.jp)

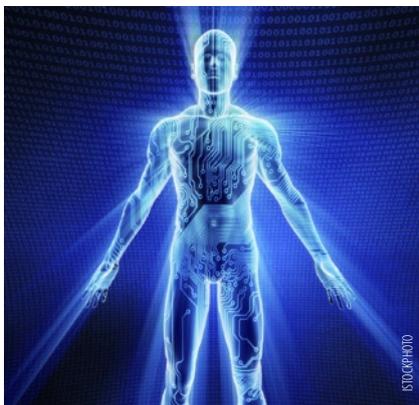
## Man on a chip: The frontiers of *in silico* medicine

**C**utting-edge mathematical modelling at the Center for Advanced Medical Engineering and Informatics (MEI) predicts the response of complex biological systems to external stimuli.

The MEI centre is a major Osaka University initiative that brings together researchers from various fields to collaborate on projects in medical sciences, bioengineering and bioinformatics. The centre is funded, mostly externally, to the tune of around one billion yen per year and houses 71 principal investigators who also maintain primary affiliations with other divisions of the university.

“In one sense it’s a ‘virtual’ department,” says Yoshihisa Kurachi, director of the MEI centre. At the heart of this virtual department is the Global Center of Excellence for an *in silico* medicine-oriented platform that forms the basis for collaboration with leading institutions from New Zealand, the US and the EU. The aim of the platform is to compile physiome databases of dynamic mathematical models describing biological systems — from the molecular and cellular level right through to organs and individuals — based on experimental data on the fundamental chemical and physical properties of physiological entities. These models, whether a

liver, a heart or even an entire human skeleton, are made available for download from a morphology database ([www.physiome.jp](http://www.physiome.jp)) for integration into biological modelling software, allowing the effects of given stimuli on the structure-based physiological function to be modelled and investigated. Current applications include a study on the risk of drug-induced cardiac arrhythmia for



**An *in silico* human.** The MEI centre’s *in silico* medicine project aims to build an open platform for multi-scale mathematical models of the human body and its functions.

pharmaceutical drug candidates, and the use of morphology data to predict optimal parameters for joint replacement surgery and rehabilitation aftercare packages.

The MEI centre offers tuition in medical engineering and informatics to postgraduate students from Osaka University and other institutes in the region. Although the classes — unique in Japan — are currently only an elective course module, there are plans to develop a fully accredited postgraduate degree program in the near future.

And what of the future? The dream is to construct a complete *in silico* human from mathematical data, but it’s a dream — admits Taishin Nomura, leader of the *in silico* medicine project — that may never be realized. “Building a model of a human being is probably impossible,” he says candidly, “but at least we can continue to improve human understanding.”

**The Center for Advanced Medical Engineering  
and Informatics**

2-2 Yamadaoka Suita, Osaka 565-0871, Japan

Tel: +81-6-6879-3514  
Web: [www.mei.osaka-u.ac.jp/gCOE/english](http://www.mei.osaka-u.ac.jp/gCOE/english)