2019
Bio-Nano Science Fusion
Master and Doctoral Courses

Graduate School of Interdisciplinary New Science
Toyo University

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Toyo University

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Outline of the Graduate School of Interdisciplinary New Science

The Graduate School of Interdisciplinary New Science, Toyo University, was opened in 2007 to initiate and promote several innovative educational programmes and systems based on the advanced bio-nano science and technology research carried out at the Bio-Nano Electronics Research Centre, which was established in 1996. State-of-the-art facilities and equipment such as nanotechnology super clean rooms, biotechnology clean rooms, transmission electron microscopes, scanning electron microscopes, scanning probe microscopes and all sorts of spectroscopic analysers are installed at the Bio-Nano Electronics Research Centre. The main aim of the Graduate School is to create advanced researchers in the fields of nanoscience/nanotechnology, bioscience/biotechnology and bio-nano fusion science/technology from an international point of view. The Graduate School provides a unique curriculum composed of web educational programmes and research workshops and seminars in addition to lectures on fundamental and applied science and technology. The Graduate School also organises and holds international symposia, seminars, workshops and internship programmes for young researchers. The students carry out advanced research in collaboration with the Bio-Nano Electronics Research Centre, and overseas partner universities and research institutes.

Admission policy

The Graduate School of Interdisciplinary New Science accepts motivated master and doctoral students from all over the world and creates internationally advanced researchers in the fields of bioscience, nanotechnology and bio-nano fusion science and technology, the latter being one of the most important subjects in the 21st Century. An enquiring spirit of study on advanced subjects, an adventurous spirit for cutting-edge research areas, and high English communication skills; i.e., writing, reading, discussion and presentations, are required for the admission to the Graduate School.

Curriculum policy

The Graduate School provides a unique curriculum as shown in the table on page 3. The curriculum is designed to create advanced researchers from an international point of view. All the educational courses; i.e., lectures, seminars, workshops, performance of research and preparation of scientific papers, theses and presentations, are given in English. The courses do not focus on only enumeration and memorisation of facts and the solutions to simple ready-made problems. In the classes, students are encouraged to discuss and give their own ideas and opinions on important scientific, technological, political, economical and social issues.

Diploma policy

Master students, who have presented their research results at the “International Symposium on Bioscience and Nanotechnology” organised by the Bio-Nano Electronics Research Centre, are eligible to submit their master theses. Doctoral students, who have published at least two scientific papers in international journals, are eligible to submit their doctoral theses. However, the publication or acceptance of two papers is only a necessary requirement, but may not be sufficient for the conferment of the doctoral degree. Master and doctoral candidates are required to write their theses in good English and give presentations on the contents of their theses in English at the Theses Committee and the final public hearing. The Graduate School confers the “Master and Doctoral Degrees of Bio-Nano Science Fusion” on successful students.

Doctoral double degree programmes

The Graduate School of Interdisciplinary New Science provides “Doctoral Double Degree Programmes” in collaboration with the following partner universities;

- Sorbonne Université, Paris, France
- Université de Nantes, Nantes, France

Doctoral degrees are conferred on successful students from both Toyo University and one of the above universities.
Supervisors

Tatsuro Hanajiri
Dean of the School
Design and fabrication of nanoscale electron devices

I am currently studying the physics of nanoscale electron devices and am interested in its application to nanoelectronics. I have studied the electric properties of thin SOI films and the structures of SOI MOSFETs with decananano scale gates. I propose fully inverted (FI) SOI MOSFETs with ultra-thin SOI films and novel fully depleted (FD) SOI MOSFETs.

Hisao Morimoto
Head of the Course
Self-organisation/nonlinear dynamics of nano/micro materials

I am interested in self-organisations, phase transitions, and non-linear dynamics of nano/micro materials disperse systems such as suspensions, in which nano/micro particles, carbon nanotubes, fullerences or biological cells are dispersed. I am also interested in bio-nano fusion technologies utilising the above phenomena induced in nano/micro materials disperse systems.

Sakthi Kumar
Bio-nano fusion/nanotechnology/biomaterials

I am interested in the research work based on fusion of different science fields, namely physics, chemistry and biotechnology. I focus on research themes such as
(a) Nano drug delivery, aptamer (DNA and RNA based) sensors and bio/chemical sensors.
(b) Carbon nanotubes, nano particles and quantum dots for solar cell applications and plasma processing thin films.

Tomofumi Ukai
Self-organisation of nano/micro particles

I am interested in self-organisation, self-assembly and pattern formations of nano/micro particles. I am also developing microfluidic systems using nano/micro particles.
My current research is summarised below.
(a) Patterns formed by magnetic nano/micro particles in external magnetic fields.
(b) Synthesis of magnetic nano/micro particles.

Mohamed Sheikh Mohamed
Bio-nano science/Cancer diagnosis/Anti-cancer therapy

My focus area of research involves synthesis of biocompatible nanomaterials and their applications in animal and plant systems. I am particularly inclined towards hard to treat cancers as brain cancer and pancreatic cancer.
(a) Bio-functionalization of nanomaterials for in vitro and in vivo applications.
(b) Formulating nanomaterials.

Shunji Kurosu
Carbon nano-materials/self-assembly

I am very interested in the creation of new nano-structures using carbon materials such as fullerences and carbon nanotubes via self-organisation. I particularly focus on the pattern formation utilising the coffee ring effect. Some of my recent studies are listed below;
(a) Creation of nano fibres composed of C_{60} molecules.
(b) Capture of target cancer cells.

Toru Maekawa
Self-organisation/self-assembly in nano/micro systems

I am very much interested in pattern formations, synchronisation and chaos created via self-organisation/self-assembly, which are induced in nano/micro systems. Fluctuations, surface effects and quantum effects, in particular, become significant on nanometre scales, which makes nano systems completely different from our macroscopic world.
Visiting professors

Daniel Morse
UCSB

Régine Perzynsky
Sorbonne University

Nicole Grobert
University of Oxford

Loonid Kalachev
University of Montana

P.V. Mohanan
Sree Chitra Tirunal Institute for Medical S & T

Chris Ewels
University of Nantes

Silvia Giordani
Dublin City University

Emanuelle Dubois
Sorbonne University

Yoshikata Nakajima
Osaka University

Toru Mizuki
BNERC

Shigeru Deguchi
JAMSTEC

Koji Ishibashi
RIKEN

Curriculum

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<tr>
<th>Year</th>
<th>Type</th>
<th>Title</th>
<th>Credits</th>
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<tr>
<td>1</td>
<td>Lectures</td>
<td>Introduction to bio-nano science fusion</td>
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<td></td>
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<td>English for science and technology</td>
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<td></td>
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<td>Fundamental mathematics</td>
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<td>Fundamental physics</td>
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<td>Fundamental chemistry</td>
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<td>Fundamental biotechnology</td>
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<td>Extremophiles</td>
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<td>Nanoelectronics</td>
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<td>Nano materials</td>
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<td>Bio materials and nanotechnology</td>
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<td>Microbiology</td>
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<td>Workshop on advanced equipment II</td>
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<td>Workshop on advanced equipment IV</td>
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<td></td>
<td>Web programme</td>
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<td>Research</td>
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<td>Bio-nano science fusion research III and IV</td>
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Web educational programmes: GEOSET TOYO

The Graduate School of Interdisciplinary New Science produces web educational programmes named “Global Educational Outreach for Science, Engineering and Technology, Toyo University” abbreviated to “GEOSET TOYO”. Students also participate in the GEOSET TOYO programmes.
Facilities and equipment

State-of-the-art facilities and equipment are installed at the Bio-Nano Electronics Research Centre, which Master and Doctoral Course students are actively using for their research. A unique course such as “Workshops on advanced equipment” is specially designed for Master Course students.
Events

The Graduate School organises and holds international symposia, seminars and workshops for the students both overseas and in Japan. The students also present their latest results at international symposia and seminars

“International Symposia on Bioscience and Nanotechnology”

“International Seminars for Young Scientists (overseas)”

“International Seminars for Young Scientists (Kawagoe Campus)”
“Sir Harry Kroto’s Seminars for Young Scientists (Kawagoe Campus)"

Recent publications

DOI: 10.1016/j.addr.2018.10.007

DOI: 10.1021/acs.abm.8b00724

DOI: 10.1039/C8NA00222C

DOI: 10.1021/acsami.8b17162

DOI: 10.7150/thno.25286

DOI: 10.1016/heliyon.2018.e00861

DOI: 10.1016/j.ijpharm.2018.09.033

DOI: 10.1557/mrc.2018.148

DOI: 10.1039/C8RA06362A

DOI: 10.1039/C8NR02866D

DOI: 10.1002/term.2689

DOI: 10.1007/s10853-018-2403-4

DOI: 10.1021/acs.analchem.7b03533
International collaboration on research and educational programmes

The Graduate School of Interdisciplinary New Science has been carrying out collaborative research on nanoscience/technology, bioscience/technology and bio-nano science/technology with advanced researchers and has exchanged Memoranda of Understanding on “Bio-Nano Innovation Programmes” with 18 universities and 10 companies.

Universities

<table>
<thead>
<tr>
<th>Country</th>
<th>University of Brighton / University of Oxford</th>
<th>University of Nantes / Sorbonne University</th>
<th>University of California Santa Barbara / University of Montana / University of Houston</th>
<th>Indian Institute of Technology Delhi / Indian Institute of Technology Madras / Mahatama Gandhi University / Jawaharlal Nehru University / C.M.S. College</th>
<th>Italian Institute of Technology / University of Turin</th>
<th>Budapest University of Technology and Economics</th>
<th>Politechnica University of Timisoara</th>
<th>Sultan Qaboos University</th>
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Industries

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<tr>
<th>Country</th>
<th>JEOL Ltd. / Shimadzu Co. / Horiba Co. / Oxford Instruments KK. / Elionix Inc. / Nissan ARC Ltd. / Ulvac-Phi Inc. / Hitachi High-Technologies Co. / Sabinsa Japan Co.</th>
<th>Oxford Instruments Asylum Research Inc.</th>
</tr>
</thead>
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**Secretariat of the Graduate School of Interdisciplinary New Science**

**Secretariat of the Bio-Nano Electronics Research Centre**

Enquiries concerning the graduate school

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Enquiries concerning research projects

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Tel: +81-49-239-1375, Fax: +81-49-234-2502, E-mail: bnel@toyo.jp
URL: https://www.toyo.ac.jp/en/research/lab-center/bnel/