

# “NEW DISCIPLINES”

## emerging through trans-disciplinary discussions

We, participants of the ERLEP (Emerging Research Leaders Exchange Program) Trans-Disciplinary Forum 2017, gathered in Fukuoka, Japan, on December 5–6, 2017, in the spirit of mutual understanding and cooperation and with the overarching objective to let “new disciplines” emerge through trans-disciplinary discussions on significant technological topics. These topics include (1) the role of informatics for humans and society, (2) emerging materials and technologies for a sustainable society, and (3) the Japan/Australia student exchange program.

We confirmed that the two countries share common social and political problems (such as aging and immigration policies) and possess complementary technological skills (such as manufacturing and resource development) and agreed that, by integrating skills and knowledge of the two countries, we continue to collaborate to tackle common issues and interests that cannot be solved solely by one country. We continuously collaborate between Japan and Australia, in particular, in the frame of “new disciplines” emerging from trans-disciplinary discussions.

We summarize and conclude our discussion with the following statements based on each topic.

### **Statement (1) *The role of informatics for humans and society***

We recognize the importance of addressing the fundamental disciplines of mathematics, physics, and chemistry that form the basis of emerging information technologies about science and technology, such as artificial intelligence (AI) and internet of things (IoT).

We also recognize the need of facing the challenges of the following novel trans-disciplinary research themes:

- AI-based personalized and automated education (massive open online courses, AI, and digitization of academic knowledge)
- Informatics-based biological and medical science (surgical robotics, mathematical modeling, and secure open-access databases)
- Construction and maintenance of information platform for social data management (collection, management, cyber security, and simulation)

We emphasize the necessity of constructing a system to solve problems with the cooperation of experts from various research fields, such as mathematicians, informaticians, engineers, biologists, clinicians, social scientists, politicians, artists or designers, and all stakeholders.

We believe that creative research and development aiming to contribute to humans and the society by making use of informatics is possible if we create a trans-disciplinary environment in which diverse experts can cooperate with each other.

We need to tackle these trans-disciplinary issues through a “trans-disciplinary project” or “joint laboratory” system based on collaboration between Australia and Japan.

### **Statement (2) *Emerging materials and technologies for a sustainable society***

We reaffirm our commitment to the Sustainable Development Goals (SDGs) set by the United Nations to ensure a sustainable and healthy society by focusing on solving energy-related and environmental issues that occur on a global scale.

We recognize the need of facing the challenges of the following novel trans-disciplinary research themes:

- Fabrication of innovative materials (smart materials, self-healing materials, materials for desalination, materials for energy transportation, materials for wearable technology, nanomaterials for drug delivery, radio enhancers, image contrast agents, etc.)
- Cyber physical systems for security including energy security and cyber security and for further developing innovative materials based on materials informatics using IoT for long-term data acquisition (in particular for hydrogen energy, and batteries)

Besides these materials and technological developments, we also confirmed the importance of trans-disciplinary approach including not only materials science and advanced technology but also social science to share the issues with society, for instance, risk-profit managements, ethics, evidence-based consensus, formation of social agreements, which leads to the creation of game-changer to solve the issues by filling the gaps in science, technology, politics, and business.

### **Statement (3) Japan/Australia student exchange program**

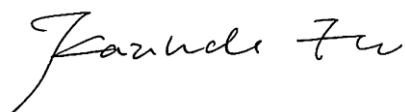
Australia and Japan need to support education in the 21st century by creating a framework that allows graduate students from each country to build networks in trans-disciplinary research. Trans-disciplinary research spans a broad range of disciplines, from fundamental sciences such as maths, physics, and chemistry to engineering, design, social sciences, and philosophy. It is intended to attack the challenges of our society, such as those related to health, environment, sustainability, and smart cities and infrastructure.

It is important to encourage and support student exchange between Australia and Japan for sustainable and long-term scientific collaboration between the two countries. Therefore, we need to look at flexible ways and funding opportunities to enable/support

- student exchange between the two countries;
- research visits of supervisors/researchers;
- joint PhD programs; and
- international student internships in various organizations.

We need to look at initiatives including, but not limited to, mentoring and travel grants focused on gender equity and diversity, at the levels of research exchange and international public outreach activities.

This program will provide the benefit of encouraging international collaboration to generate research output of higher quality, which will then translate into better quality of life.



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