Research Center Project

Host institution name	Kyoto University
Head of host institution	Professor Kazuo Oike, Ph. D., President of Kyoto University
Title of center project	Institute for Integrated Cell-Material Sciences
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Project summary	1. Overview Our new institute, iCeMS, aims to become a world-premier research institute to create interdisciplinary fields, which will be placed within the global career-development flow of young scientists. Leading scientists will gather in Kyoto and work together for the synergistic integration of cell and material sciences, including chemistry, physics and cell biology and focusing on pluripotent stem (ES and iPS) cells and meso-control, based on the notion that the fundamental understanding and control of molecular complexes in the meso-scale of 10-100 nm is critical for creating the science and technology of the next generation. We will take cross-disciplinary approaches to create following new science fields and their applications. We will create 1) new chemistry and physics of meso-space, 2) cellular meso-biophysics, and 3) stem-cell control by meso-engineering. Furthermore, we will contribute to human wellness by developing A) environmentally-friendly chemistry by meso-control, B) detoxication and drug synthesis in the body, and C) regenerative medicine by controlling stem cells with smart materials. Also, we are going to create novel management system and the following new initiatives in our iCeMS, so that it will be able to serve as a model for global premier research centers in Japan. 1) Kyoto iCeMS Fellows (independent superpostdocs): International advertisement and searching will create a global career hub for the best and brightest among very young researchers. 2) Common-use laboratories and open offices will remove physical and mental walls between research groups and enable flexible allocation of research spaces, thus promoting cross-disciplinary research through collaboration of researchers from different fields. 3) Special supports for nurturing and promoting female researchers to top-level scientists. 2. Purpose and Mission of the iCeMS Our project is a response to the Japanese government initiative to found world-premier international research centers, (1) to explore interdisciplinary research fields, and (2) to place themselves within the global career-development flow of top scientists in their own generations.

To address the first point, “to explore interdisciplinary field”, the proposed institute aims to attain a critical mass of leading scientists for the creation of a new research field, “the Integrated Cell-Material Sciences”. This is based on the notion that the fundamental understanding and control of molecular complexes in the meso-space of 10-100 nm is critical for creating the science and technology of the next generation.

Therefore, meso-space is one of the two key concepts in this proposal. Meso-space is greater than the nano-space, which nanotechnology and molecular biology have extensively explored. It is smaller than the bulk space greater than 1 micron, where there are sufficient numbers of molecules for ensemble averaging. Between these two well-traveled lands, there is the vast unexplored land of meso-space of 10-100 nm. Although molecular, atomic, and ionic interactions occurring in nano-space are interesting subject of research, they are generally elementary processes. Non-linear, weakly-cooperative events, which present challenging problems and can be the seeds for the tomorrow’s technology, take place in meso-space.

Using the notion of meso-space, the biological and non-biological worlds can be united to learn from each other, and to elucidate the physical and chemical processes characteristic of meso-space, including the formation and functional mechanisms of the meso-scale molecular complexes in the cell. We envisage that such a study would develop a new realm of science and technology, in the cross-disciplinary field of biosciences, physics, chemistry, and materials science.

The second key concept is the stem cells. Since we will be a group of investigators with a variety of backgrounds, standardized paradigm for studying the cell must be established. This is indispensable for fostering collaborative research, by enhancing the ease of sharing knowledge on cells, biological tools, samples, and communication among researchers working in different fields in this Institute. For this purpose, all of the PIs will use pluripotent stem cells, either embryonic or artificially-induced pluripotent stem cells. These cells grow rapidly; their genes can be manipulated easily, and then with the same manipulated genes, they can be differentiated into various cell lineages. Therefore, using pluripotent stem cells for the research would accelerate the development of regenerative treatments.

To address the second point of this government initiative, “to place itself within the global career-development flow of young scientists”, I would like to express my strong personal belief in Japanese science. The most critical problem with Japanese science is its exclusion from the global career-development flow of young scientists. Without attracting the best and brightest young researchers to Japan, and having some of them stay in Japan, Japanese science would lag behind that in other developed countries. In the first sentence of the call for the application, from the Program Committee of the Word Premier International Research Center (WPI) Initiative, it was stated as “we will need to position ourselves within the global flow of outstanding human resources while creating research platforms that will naturally attract and

amass such human resources in Japan."

3. Administration Programs and Goals

We will run the proposed Institute as a future-model-institute at Kyoto University and in Japan. In the organizational structure of Kyoto University, this Institute will occupy a special position, freed from many binding rules of archetypical Japanese universities, and flexible management rules will be introduced. Although the Director will report directly to the President of Kyoto University, the Institute's autonomy and the Director's leadership in making decisions on the overall operation of the Institute will be ensured.

The followings are examples of our novel administration policy. 1) English will be used as the official language. 2) Swift decisions will be made by the Director. Major decisions will be made by the Director with the aid of the executive board of the Institute. 3) A merit-based salary system will be introduced. 4) Open positions for scientists will be disclosed and advertised internationally. 5) Start-up funds for researchers from other institutions will be provided.

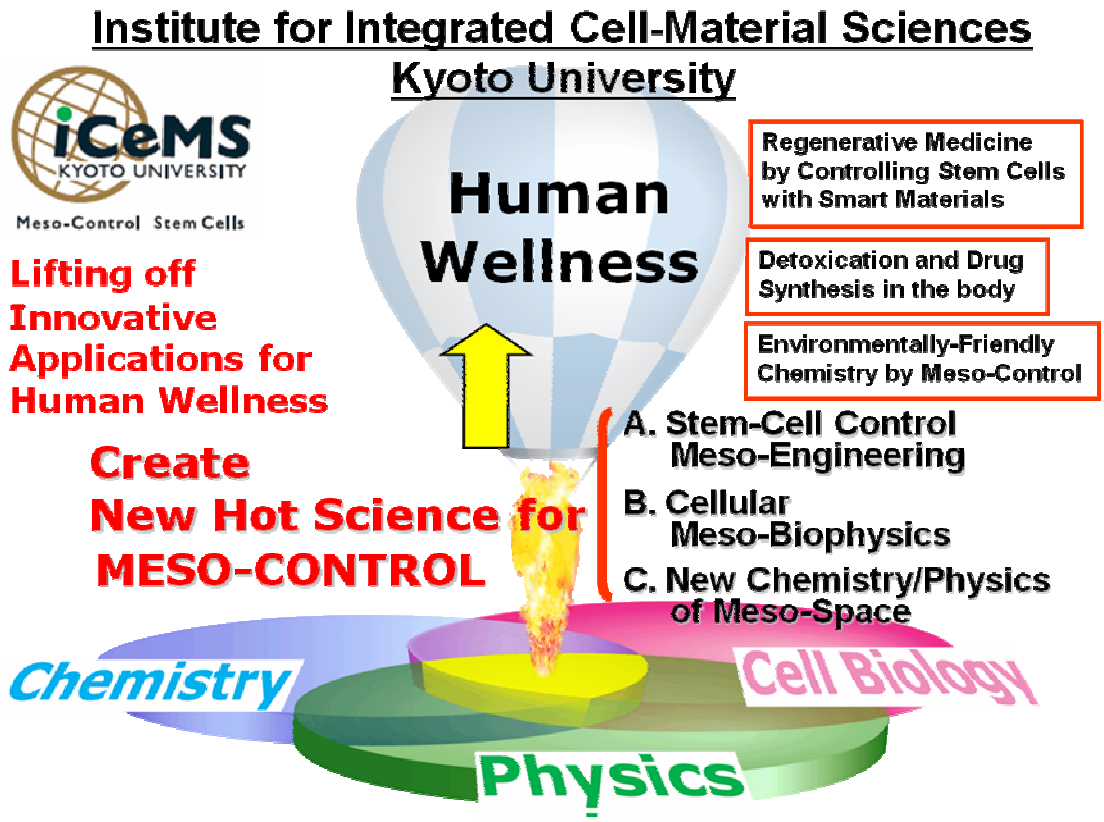
In addition, we are going to create special programs for our iCeMS. Given the geographical, linguistic, and cultural barriers of Japan, even the best institutions in Japan carrying out top-level research may have difficulty attracting scientists from abroad to work at their institutions. To improve this situation, the Institute will additionally implement the following programs and strategies.

1) A career-development superpostdoc system: Kyoto iCeMS Fellow Award : We will create a career-development superpostdoc system, called "Kyoto iCeMS Fellow." This is a program to provide great resources and autonomy for talented young researchers for their scientific development. Candidates will be selected from the international pool of excellent scientists who have recently acquired their doctoral degrees. The successful applicants will be awarded 5 years of salary, together with funds to run small, independent research groups. Since these excellent young scientists will eventually move on to the next phase of their illustrious international careers, the Institute's role and reputation as a prominent global scientific center will be widely acknowledged.

2) Common-use laboratories and open offices: Physical distance among research groups will be reduced to encourage interactions and collaborations on daily basis, which would eventually contribute to making major scientific breakthroughs. To enhance the communication among researchers, the iCeMS will provide common-use laboratories with bench space allocated among all of the research groups, including groups led by the Kyoto iCeMS Fellows. The space allocation to each PI will be merit-based, and this could be instituted more easily with such flexible allocation in the common-use laboratories.

3) Scientific integrity and science communication program: Although science and technology have greatly contributed to the advancement of

	human health and welfare, we are also aware of society's concerns for the inadequate progress of science and technology. Some of these concerns may be groundless, but might have been inspired by the words and deeds of the scientists who lack scientific integrity. Another reason for the public concern may be due to the lack of communication from the scientists' side, to provide informed lay individuals adequate and balanced information about science and technology. We will initiate a program to educate scientists on scientific integrity and ways to communicate with society.



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Contributing to Human Wellness in Three Areas