Micro Robotics Advances Bio Science

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**Abstract:** Micro Robotics provides manipulation, control, sensing, skills, intelligence and automation in the micro/nano scale world. We have been working on micro robotics including dexterous high-speed micromanipulation, micro assembly, cell characterization, and 3D cellular system construction. The basic idea is to devise and to utilize dexterous two finger micro hands, and to achieve total micromanipulation system with high-speed vision and interfaces for bio applications. Our system is multi-scalable and can manipulate micro object with the size ranging from one to hundreds micron meters seamlessly. Our constant system improvements and refinements have achieved wide range of workspace with real time 3D information, simple finger setting-up procedure, fine force sensing capability as well as automated calibration, automated picking-and-placing, etc. Based on these activities and our collaboration experiences with biologists and medical doctors we carried out 5-year national project on “Bio Assembler” in 2011-2016, whose target is a challenge of constructing artificial 3D cellular system in vitro. The major topics are high-speed cell characterization & sorting, 3D cellular system construction, and cell functionalization analysis. Now we are looking at more advanced researches and developments in new bio application fields, such as causality of various stresses in differentiation, proliferation, generation, development, and disease. Mechano biology is the example of such research topic and currently so active in biology and medical. We are looking at more than that, not limited to only mechanical matter. We will try to collect as many precise physiological data as possible corresponding to various multi-modal stresses and to clarify novel biological findings by applying the system science principles.

**Biography: Professor Tatsuo ARAI** received B.S. M.S. and PhD degrees from the University of Tokyo in 1975, 1977, and 1986, respectively. He joined the Mechanical Engineering Laboratory, AIST in 1977, and was engaged in research and development of new arm design and control, mobile robot, teleoperation, and micro robotics. He stayed at MIT as a visiting scientist in 1986-1987. He was an adjunct lecturer at Chiba University and gave a course on robotics. He moved to Osaka University in 1997 as a full professor at the Department of Systems Innovation, Graduate School of Engineering Science. In April 2017, he moved to Beijing Advanced Innovation Center for Intelligent Robots and Systems, Beijing Institute of Technology, as a State 1000 Talent Program Professor. His current research topics are mechanism design including parallel mechanisms, legged working robot, micro robotics for bio application, human robot interaction. He has published more than 500 journals and reviewed conference papers on robotics, 5 books, and has 37 patents including foreign 8. He is IEEE Fellow, IAARC (International Association of Automation and Robotics in Construction) Director, RSJ (Robotic Society of Japan) Fellow, and JSME (Japan Society of Mechanical Engineers) Fellow. He is a deputy editor-in-chief of the Robomech Journal. He worked for the Cabinet Office as a chair of the Technical Advisory Committee of the Destruction of Abandoned Chemical Weapon in 2000-2007. He was a project leader of National Project on Hyper Bio Assembler in 2011-2016.