PREFACE

The 21st Century COE Program is a special grant from the Japanese Government (Ministry of Education, Culture, Sports, Science and Technology) aimed at promoting advanced education and research in Japanese universities. The program started in 2002, at which time 113 successful applications were chosen. Our program "Future Medical Engineering based on Bionanotechnology" was unique among those selected because it applied a purely engineering-oriented background to the category of life sciences. No other such applications were selected. The mission of our program is to form a global center of excellence in biomedical engineering by uniting a variety of technologies towards the ultimate goal of prophylactic measures against age-dependent diseases. To achieve this aim we are using tailor-made diagnostic and therapeutic procedures as well as fostering young researchers through advanced research activities and education. Our unique education system enables us to adopt two different educational styles, namely, a "nomadic education system" and an "itinerant education system". In the nomadic education system, students are selected through competition, to participate in cooperative research at universities abroad. Students from universities overseas are also selected and invited to our program. In the itinerant education system, self-reliant students will be selected and trained individually under special apprenticeship programs with individual professors.

Technology is widely expected to provide solutions to medical and other problems faced by people in our aging society. In the past, cooperative research between the engineering and medical schools at Tohoku University has developed new technologies for the life sciences. Examples include an evacuated tubular stethoscope, developed in 1925, and the principle of X-ray tomography, proposed in 1945. More recently, functional stimulation of muscle, sensing devices and equipments based on micro-machining, and a PET system with high resolution and artificial hearts were developed. Advanced research at Tohoku University has led the way in the fields of (1) cell function and biomolecular technology, (2) nanomedicine, (3) imaging and structure of biomolecules, and (4) medical informatics. It is now crucial that we combine these advanced research activities into a systematic approach so that future

biomedical engineering can be applied to sophisticated medical research and practice.

Many electronic diagnostic instruments, equipment and health appliances are used today. Although both biological and medical engineering have contributed to development in this area, these names have so far been unfamiliar to the general public. We are therefore very pleased that the terms "bioengineering" and "medical engineering" grow increasingly popular through the activities of this 21st Century COE Program.

Over the course of this program, the 19 active members have worked to promote research activities in the field of biomedical engineering, have performed some of the world's most advanced research, and have attained many superb results. Our program focused on promoting the advanced education of post-graduate level (PhD) students, supporting them both financially and academically, as mentioned above. In total, eighty-seven COE research assistants of PhD students and thirteen COE fellows were adopted by our five-year program. Most of them are currently playing active roles in universities, research institutes, hospitals and companies.

This final report summarizes the research activities of the program members, the COE fellows and the COE research assistants over the four and half years since this program began in 2002. It is our great pleasure to publish this final report. Unhappily we lost one active member, Professor Hiroyuki Kurino, in an accident. We would therefore like to respectfully dedicate this report to him. Moreover, we would thank everyone for the generous supports and cooperation to our program, especially the members of the assessment committee comprising experts from other universities, related institutions and companies, and the members of secretariat of the bureau.

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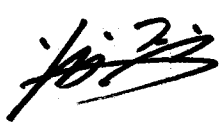

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