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Multidisciplinary research and development: The biomedical engineering approach

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The way we do science has tremendously changed. In particular, life sciences and engineering are becoming increasingly complex. Thus, an integrated approach to research and development is adopted to meet the burdens of each challenging problem. Advances in basic science and clinical medicine afford unprecedented opportunities for the conjoining of the life sciences with the physical sciences, mathematics, computer science, and engineering. The multidisciplinary research teams combine scientific talents, and they draw from the resulting blend of knowledge, skills, and experience to generate innovative solutions. Research and development activities range from fundamental science to production engineering of complex systems. The improvement of tools and techniques offers great potential for medical advances, and there is an increasing trend in the biomedical sciences to use an integrative rather than a disparate approach.

The biomedical research community at large does not understand the nature of bioengineering and technology and instrumentation development research. Although the rise of molecular and cell biology has made biology accessible to engineering science, most biomedical scientists are not aware of the contributions engineers can make. In fact, biomedical engineering development has a powerful impact on health researches. Radical changes in biomedical sciences are likely to occur from incorporating the engineering perspectives into the formulation of basic questions addressed in "hypothesis-driven research." On the one hand, the field of bioengineering has evolved by amalgamating with molecular and cellular biology and biochemistry (e.g., tissue engineering, drug and gene delivery, and biomimetic biomaterials), while on the other, it also continues to build upon its early roots in the physical sciences (e.g., magnetic resonance, computerized tomography, ultrasound imaging, and biomechanics). It advances fundamental concepts, creates knowledge from the molecular to the organ systems level, and develops innovative biologics, materials, processes, implants, devices and informatic approaches for the prevention, diagnosis, and treatment of disease, for patient rehabilitation, and for improving health. It is important for biomedical scientists to fully appreciate the ways in which engineers can contribute to the advancement of biomedical science and clinical medicine. Engineers need to learn to devise problems, not just solve them. They necessitate managing complexity and dealing with vagueness. Engineering education thus needs to become more integrative and ground-breaking.

Biomedical engineering, however, has received little recognition in Thailand. Some major funding mechanisms have not kept up with the increasingly multidisciplinary nature of its research and the need to innovate and take risks. An identified organizational structure would help foster biomedical engineering research, preferably an inter-institutional center for biomedical engineering with its own appropriation and platform for growth. Chiang Mai University has created an internal organization, BME Center, to provide a central focus for bioengineering issues. BME Center is composed of representatives from several Faculties. BME Center has a specific aim to improve the current mechanisms for reviewing biomedical engineering grant applications. Meanwhile, private support of biomedical researches is becoming increasingly important. Research collaborations, partnerships, and personnel exchanges should be encouraged to enhance biomedical engineering and other research disciplines.