Emerging Needs for Restructuring Biomedical Knowledge and Education System

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1 Introduction

Completion of the human genome project gave deep impacts on the entire field of biomedical research and medical practice as well. These impacts may be summarized as acceleration of biomedical research, rapid accumulation of data and knowledge, increase of dependence on informatics and computing methods, increase of dependence on model organisms and comparative genomics, more personal oriented medical care, realization of preventive and predictive medicine, and sharing biomedical expertise with medical service professionals and clients. As a consequence the knowledge structure of medicine, particularly from the view of education, is also changing drastically. This change forced to remodel the existing educational systems and researcher training systems in wide range of biomedical areas. Such remodeling should be extended beyond education for professionals to the education of public. Thus transforming present educational system and developing new curricula and teaching materials are emerging theme in undergraduate, graduate, and professional postgraduate education. Some efforts for such direction by the Chem-Bio Informatics Society and the special educational program sponsored by JST at Tokyo Medical and Dental University are introduced in this presentation.

2 Basic Considerations of A Course Design

The pace of data and knowledge accumulation is continuously increasing in the post genomic era. The textbooks that are used world wide as standard graduate level reference books have been constantly revised every 2-5 years. Yet they are already out dated immediately after the printing. Thus the contents of lectures must be up dated even during the courses. This means that both researchers and clinical practitioners must revise their knowledge constantly. In particular biomedical professionals are now required to handle vast amount of data and access huge knowledge resources most of which are opened for the public. New emerging expertise required for such professionals are informatics and computing skills not only of molecular biology for structure and function of genes and proteins but also of physiologies and pathologies. We have designed and offered new courses for fulfilling these knowledge gaps. The goal of our education system is to emphasize the importance of informatics and computing expertise and newly opening knowledge domains in biomedicine. Genome, omics, and pathway/network are considered as the new axis of research. The subjects we have chosen

Classroom lectures

![Figure 1: Lecture and its archiving](image)
were (1) impact of genome and omics innovation, (2) pathway/network to disease (systems pathology), and (3) drug discovery and development.

In addition to regular lecturers we invited many specialists from outside as visiting lecturers on ad hoc subjects. The lectures were video recorded and were offered for later remote access by registered class attendants via the e-learning system. A large amount of review articles and original papers from journals were given as reading assignments or background references. These papers are put on the lecture Web site with problems. The problems are so designed that the students must visit various web sites and search them deeply. For problem making we were influenced by a workbook style textbook of Campbell and Heyer (1).

![Figure 2: Examples of problems on the Web site.](image)

3 Implementation of The Courses

These courses were offered as educational programs sponsored by JST at Tokyo Medical and Dental University. Each course was designed for 90 minutes session x 16 sessions within 2 months. Average number of class attendants is 20-30. Attendants consist of both biomedical professionals and IT engineers working for biomedical applications.

4 Results and Discussion

Almost one year has passed since we have started the curriculums. Together the authors covered all pre-planned courses except wet labs and site visits. Systems pathology or pathway/network to disease is one of the most ambitious courses we have offered, but we still need some time and lots of evidential materials for shaping the course. Traditionally even in higher education of master and doctoral levels Japanese (or translated into Japanese) textbooks have been used. Now the original (English) textbooks have revised too often to produce translated textbooks in time. How to overcome this situation is one of the most important themes in the present biomedical education in Japan.

References