

BME Education Program at the EMBS Student Club of Beijing University of Posts and Telecommunications

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Abstract—An extended Biomedical Engineering (BME) education program is designed to help students enhance both technical expertise and communication skills at the EMBS Student Club of Beijing University of Posts and Telecommunications (BUPT). The specific steps of the program cover: raising funds for activity purpose; holding an introductory seminar and a panel discussion; inviting guest speakers; seeking team-based research opportunities; joining in IEEE-EMBS community events; and writing a code of ethics for a student club. The program addressed sets a good example to the EMBS student chapters and clubs all over the world.

Keywords—Education, biomedical engineering, ethics

I. INTRODUCTION

The field of Biomedical Engineering (BME) is changing so rapidly that students should develop multidisciplinary knowledge and communication skills to keep up with the advancements in BME and the related fields. Run by and for students, IEEE-EMBS chapters and clubs offer opportunities to learn more about the field of BME through a variety of IEEE-EMBS activities. IEEE-EMBS chapters and clubs also give the student members access to both printed and electronic resources on biomedical engineering [1]. The EMBS Student Club of Beijing University of Posts and Telecommunications (BUPT) formed in November 2002, is one among the IEEE-EMBS clubs worldwide. Catering for the perceived need of students enrolled in the BME degree program, the EMBS Student Club of BUPT develops a one-year extended BME education program, named “Manna¹,” as a supplement for the regular BME curricula on campus.

II. METHODS

The EMBS Student Club of BUPT is composed of students with diverse backgrounds and experiences. The members are generally categorized into three levels [2]. Most of students at the first level are freshmen and sophomores, wondering whether BME meets their needs. In fact, they should make the right career choice of their own. Level two students, who find BME is a great fit to them,

¹ The word “Manna” cited from Bible means the food miraculously provided for the travelers wandering in the wilderness. The committee of the EMBS Student Club of BUPT names the BME education “Manna” and wishes the participants would benefit from the EMBS activities.

should familiarize themselves with the analytical tools like MATLAB [3], Mathematica [4], Maple [5], etc., in order to solve simple problems. They need to take part in more team-based projects to become veterans. Level three students are able to solve complex problems and do some research structured by faculty. The students in this group need to select appropriate research projects for their future work. The “Manna” program is designed for the students in all three groups. The details of this program are described as follows.

A. Financial Fund

Financial fund is vital for the student chapters and clubs, because EMBS activities could not be possible without any financial support. In December 2002, Yunfeng Wu set up a fund of US\$ 1500 from his scholarships for the student club. From the spring of 2002, the foundation of BUPT starts a special scholarship program to award the student members on campus if their papers indexed in *Science Citation Index* (SCI), *Engineering Index* (EI) or *Index to Scientific & Technical Proceedings* (ISTP). In particular, the student authors would be awarded US\$ 1000/150/50, respectively, for per paper indexed in SCI/EI/ISTP. The local students are now working hard to get their research published in order to get more scholarships and then contribute partially to the club fund. Moreover, the Nokia Co., Ltd, China promises to sponsor local graduate students and PhD candidates to participate in a few international conferences including: International Joint Conference on Neural Networks (IJCNN), International Conference on Image Processing (ICIP), IEEE Conference on Computer Vision and Pattern Recognition (CVPR), International Joint Conference on AI (IJCAI), American Association for AI National Conference (AAAI), International Conference on Knowledge Discovery and Data Mining (KDD), etc. The financial support for each participant should not exceed US\$ 2000 per conference. Although the IEEE-EMBS sponsored conferences are not within the above list, the club committee members will try their best to persuade the industry affiliations to sponsor additional funds for EMBS activities.

On the other hand, at the EMBS Student Club of BUPT, a band of devoted volunteers who truly interests the BME profession at heart, works very hard to provide members with the most useful service for their membership. They keep in touch with each other via e-mail or telephone. The latest e-news and announcements are posted on the student club website instead of ordinary mail, which cuts large

amounts of unnecessary expense. Although the IEEE-EMBS could offer a student club up to US\$ 500 available for the EMBS activities, the club committee would not intend to make our society budget deficit.

B. Introductory Seminar and Panel Discussion

An introductory seminar and an active panel discussion were held at the lecture hall of BUPT on 3 April 2003, with the participation of more than 30 attendees (both faculty and students). A few innovative education tools were utilized for an introductory seminar. The EMBS History Booklet "Charting the Milestones of Biomedical Engineering," based on articles [6]-[8] published in the May Issue of the EMB Magazine, was a great tool to increase the retention rate of freshmen and sophomores with varying degrees of success. The EMB video provided by the IEEE-EMBS was a good electronic resource to inform students about the depth and breadth of career options in the emerging field of biomedical engineering. This 20-minute video was also a recruiting tool with students at the freshman level. The U.S. National Public Radio interviews [9]-[11] with Prof. Metin Akay were used as the perspective of a scientist. The introductory seminar was a big success, because 10 new IEEE student members were recruited then. Two of them (both women students) also joined the EMBS.

In the panel, EMBS Student Club of BUPT Chair, Yunfeng Wu, and Faculty Advisor, Prof. Yixin Zhong, discussed a variety of issues including: making an informed career choice; the necessity of interdisciplinary collaboration; the need for advanced computational methods for bioinformatics [12]-[13]; and the ethical concerns surrounding genomics research [14]. The panel also emphasized the need for recruitment of women, an untapped resource [15], in the field of BME. "When I was a little boy, every time I heard patients died in hospital, my conscience censured my helpless assistance to them. I joined IEEE and began to do research in 2001. The next year, I joined the IEEE-EMBS and Biomedical Engineering Society (BMES), and decided to promote biotechnology to save people's lives and improve their qualities of life," says Yunfeng Wu. "I have a dream that one day human can overcome all the awful diseases." The panel discussion ended successfully again. Some attendees continued talking with the panelists for another 40 minutes behind schedule.

C. Guest Speakers

Faculty members have strong identifications with their subjects and sub-disciplines. However, BME is undergoing dramatic alterations in methodology and potential. Harris *et al.* [16] suggest efforts to reform bioengineering education after reviewing learning science ideas that have potential for improving bioengineering education [17]. Guest speakers are excellent means for introducing expertise that is not readily available from the course instructors. The club

committee plans to direct a special topic session on Neural Systems and Engineering and invite guest speakers from industry and academia to give lectures and address the current work. In addition, the club committee contemplates to invite Distinguished Lecturers internationally recognized for their expertise if the schedule permits.

D. Team Work and Research Opportunities

Graduates entering the real world would find that just about every project is tackled by a team of engineers, scientists, marketing experts, technicians, and other personnel. Actually it is hard for someone to act in full knowledge of all the advancements in the related fields of molecular biology, computer science, tissue engineering, clinical engineering, etc. The local members are encouraged to do team-based projects. Yet, team-based projects tend to be difficult for a student without the basic team-building skills in his or her background [18]. The sophisticated students demonstrate to others the field-independent and field-dependent learning styles [19] in solving complex biomedical problems [20]. The interaction is so pivotal for the team to complete the project, that the communication skills of the participants could be greatly improved during collaboration.

Research opportunities are sought to help skillful students develop the reasoning strategies used by experts when solving real-world problems. Yunfeng Wu has been successfully collaborating with Prof. Juan Ignacio Arribas (Universidad de Valladolid, Valladolid, Spain), on Medical Imaging and Neural Information Processing.

E. IEEE-EMBS Community Events

The IEEE-EMBS has initiated a series of International Summer Schools with the aim to provide the participants the state-of-the-art knowledge on emerging areas in biomedical engineering. The topics cover Biocomplexity from System to Gene, Biomedical Signal Processing, Medical Devices and Biosensors, Biomedical Imaging, etc. Some local members sponsored by the club intended to participate in the 2nd IEEE-EMBS International Summer School on Medical Devices and Biosensors. But unfortunately the summer school for 2003 had been cancelled due to the outbreak of SARS.

The members of the club are encouraged to join in the conferences, workshops and symposiums sponsored by the IEEE-EMBS. The students who are involved in research projects are encouraged to compete for the Student Paper Competition at the Annual International Conference of the IEEE-EMBS.

F. Ethics

Ethics are the soul of science and engineering [21]-[23]. "A Code of ethics functions like a technical standard, only

it's a standard of behavior," says Joseph Herkert (former president of the IEEE Society on Social Implications of Technology and an associate professor of multidisciplinary studies at North Carolina State University, Raleigh, USA). Scientists and engineers should be of highest quality. "A code of ethics is a way of telling engineers it's all right to follow their own sense of values," says Roy E. Harris, ethics officer at NASA Jet Propulsion Laboratory (JPL) of the California Institute of Technology, Pasadena, USA. The club committee approves to develop a code of ethics for all the members involved.

A good code of ethics includes seven basic principles: truth, honesty, trustworthiness, respect for human life and welfare, fair play, openness, and competence, according to Stephen H. Unger, IEEE Life Fellow, in his book entitled "Controlling Technology: Ethics and the Responsible Engineer" [24]. The code of ethics for the EMBS Student Club of BUPT is currently under construction following the instructions of Unger's book. It is quite important to the members because they will be aware of "what would happen if a certain behavior were exposed, what the liability to themselves and the club would be, and if their conscience would allow it," explains Samuel Biondo (IEEE Member and Computer Society Distinguished Lecturer).

III. PERSPECTIVE

The "Manna" program is ongoing. Most of the feedback we have received so far has been positive. We are glad that our efforts have been affirmed by the participants. In the future, seminar series with guest speakers will be held quarterly/annually. And a Mailing List will be set up in order to share much latest information among the local and at-large members. The innovative approaches like Concept Mapping [25] could be utilized as a semi-quantitative measurement tool for evaluation of student understanding of the information content and interrelationships at the different points in senior design courses. Furthermore, we have some plans to motivate more education programs based on the "Manna" program. The future programs would also aim to develop multidisciplinary skills and knowledge of the next generation of biomedical engineers. We confidently believe that this target can be attained, when many people participate and discuss.

The biotechnology will play a major partnership role in medical and life science research and health-care delivery [6]. That is to say, there are still a lot of challenges lying ahead. One among them is said to be successfully integration of the talents of people in BME. We are doing our best to offer chances for students with multidisciplinary background to exchange their innovative ideas.

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