

MODERN EDUCATION OF ENGINEERS - NEW CHALLENGES AND POSSIBILITIES¹

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Abstract

A review is given concerning the present state and recent trends in the further development of the teaching activity of the Department.

Keywords: higher education, food and bio-engineering, trends in development.

As it was mentioned in the papers of Professors Törley and Lásztity [8,9], high level research work in the field of food science has always played an important role in the activity of the Department since its foundation. This high level scientific activity is a crucial prerequisite of the continuous development of the main activity, the education, of the Department and inclusion of new scientific and practical achievements into the teaching process. This is particularly important in the field of engineering and generally in technological sciences, where the changes are very rapid.

At the beginning the teaching activity of the Department started with lectures in Food Chemistry and Food Technology together with some laboratory training in Food Analysis. The content of these topics was continuously renewed in accordance with the general development in food science.

In the sixties a significant increase in teaching activity was realized. First of all, Biochemistry became an independent and basic part of the education and many new facultative subjects were included in the teaching program. Till the end of the sixties a new stabilized teaching program was built up as a section (branch) Bio- and Food Industrial Technology in the framework of the Faculty of Bio- and Chemical Engineering. The engineers who received a degree in bio- and chemical engineering, at this time, had a wide knowledge in basic sciences, but less in practical technology, however,

¹Paper presented at the Jubilee Symposium on the occasion of 75-th anniversary of the foundation of the Department, June 17, 1996.

they had an excellent practice in laboratory techniques. The effectivity and practical value of this form of education may be well evaluated on the basis of the scientific resp. industrial career of engineers receiving degrees from our university. Many of our students received leading positions in food industry (in Hungary and other countries) and research institutions and achieved internationally acknowledged results.

Reacting on the rapid progress in bioengineering sciences, Professor Lásztity, as Vice Rector of the university, initiated the formation of a new form of education: the formation of a separate Bioengineering section [1–3]. The new form started in 1975 in cooperation with the Department of Agricultural Chemical Technology. In the teaching program of branches Biomedical engineering and Environmental engineering some departments of the Eötvös Lóránd University (Budapest) and Medical University (Budapest) were also involved. This cooperation is live also at the present time. The cooperation has had a fruitful effect on the development of thinking and general habit of the students and contribute to the strengthening of interdisciplinary approach in solving technological problems. The last 20 years confirmed the importance of education of bioengineers, the more than 600 students receiving this M.Sc.degree are now working successfully in food industry, biotechnology, agriculture, environmental protection and health institutions [4–5].

In addition to the undergraduate training (B.Sc. and M.Sc. degree) the Faculty of Bio- and Chemical Engineering also organizes postgraduate and Ph.D. courses. The organized Ph.D. courses started in 1991. This initiative of the faculty was practically the beginning of big changes which are decisive in today's higher education in Hungary. In the framework of postgraduate (Ph.D.) programs in every year about 30 young engineers are involved in the research and teaching activity of different departments, after an accreditation procedure, assuring the new generation of university teachers.

The accreditation process mentioned above was paralelly running with the introduction of the European Credit Transfer System (ECTS). The credit system is a new form of teaching system allowing more freedom for the students in the selection of topics to be studied than existed in the earlier system, and measuring the progress in studies by credits. In such a system the rate of progress in the studies is first of all dependent on the student, and only few prerequisites concerning the order of selection of subjects exists in the programs of courses. The system is highly flexible and gives a possibility

- to transfer credits from one university to other,
- to acceptance of credits obtained abroad (ECTS),
- to participate in European integration.

Table 1

Branches of bioengineering education at the Chemical Faculty of TUB

Agricultural and Food Technology
Food Quality Control
Environmental
Industrial Biotechnology
Clinical Chemistry and Healthcare

Concerning the courses for bioengineers it should be mentioned that in the framework of this specialization five branches were formed as seen in *Table 1*.

The introduction of the credit system increased rapidly the number of topics which may be included in the programs and may be chosen by students. At present the number of proposed lectures and laboratory training programs is about 300 [6,7].

In *Table 2* the subjects offered by the Department of Biochemistry and Food Technology are collected. In the programs there are classical subjects, but also new ones required by the present situation in industry, market and modern science. I should like to particularly note the new subjects in food analysis, molecular biology, food quality control and food safety. This fact gives a full international compatibility of our teaching programs. Books, textbooks and many other written teaching aids in foreign languages are used by staff and students.

The introduction of the credit system needs a wider and high level activity of the teaching staff. In addition to the normal duties connected with education, there is a great need for writing new textbooks, to develop facilities required by modern teaching technology. At the present time it is too early to evaluate the results of the new system, nevertheless a growing responsibility and activity of students may be observed.

In addition to parallelly running traditional and new courses in engineering, the Department plays an important role in Ph.D. programs. Some subjects included in the Ph.D. program are shown in *Table 3*.

In the new economical and social conditions the teaching activity of the Department is extended to some completely new fields. The introduction of such programs is influenced by the growing role of interdisciplinary topics and by the specific needs of the market. Among these new forms it should be mentioned that since 10 years we have engineering courses in English. The Department has lectures in English in Biochemistry, Food Chemistry, Food Technology, and laboratory training in Food Analysis. M.Sc. and Ph.D. Theses are prepared at the Department in English language, too.

Table 2
List of subjects at BSc. and MSc. level offered by
the Dept. of Biochemistry and Food Technology

Biochemistry

Biochemistry for chemical engineers, I.-II.
 Biochemistry for bioengineers, I.-II.
 Biochemistry laboratory training
 Bioregulation
 Biophysics
 Nucleic acid in living organisms
 Methods in genetic engineering

Food Chemistry

Food Chemistry and Nutrition, I.-II.
 Food Chemistry and Nutrition laboratory training

Food Technology

Food Technology, I.-II.-III. Unit Operations
 Product Development
 Technology Development
 Food Technology laboratory training
 Feed Production Technology
 Green Technologies in Food Industry
 Raw Materials in Food Industry BSc.
 Food Industry laboratory training BSc.

Food Analysis

Food Analysis, I.-II.
 Food Analysis laboratory training, I.-II.
 Analysis of Microcomponents in Food
 Analysis of Microcomponents in Food laboratory training, I.-II.
 Organoleptic Analysis
 NIR-NIT Methods in Food Analysis
 NIR-NIT Methods laboratory training
 Flow Injection Analysis
 FIA Methods laboratory training

Quality C and A

Food Quality Assurance
 Food Safety
 Food Legislation and Law
 Standardization Methods

The short and long courses for engineers and specialists in food industry are also a part of activity of the Department.

The coworkers of the Department are involved in the programs of Medical bioengineering together with the Medical University in Budapest, Faculty of Electrotechnic of the Technical University in Budapest. A coop-

Table 3

List of Ph.D. courses in the Dept. of Biochemistry and Food Technology

Food Biochemistry
Novel Methods in Food Analysis
Special Chapters of Food Chemistry
Selected Chapters of Food Technology
Interactions in Food Systems
Food Packaging
Application of NIR/NIT Spectroscopy in Food Analysis
Recombinant DNA Technique in Food Analysis
Biologically Active Microcomponents in Food
In Vitro Methods of Protein Evaluation
Food Rheology and Microstructure

eration exists also with the University of Horticulture and Food Industry in Budapest, and the Eötvös Lóránd University in Budapest.

A new course is started at the faculty of Bio- and Chemical Engineering with the topic: New product development. Also a new course is in preparation dealing with the protection of environment.

In addition to university level courses, some specific courses were also organized, such as

- courses for teachers in secondary technical schools,
- special courses for technicians,
- other special courses required by industry.

The list is not complete, nevertheless it demonstrates the volume and the diversity of the activity of the Department.

Unfortunately the plans of further development of the activity of the Department are not synchronized with the financial possibilities. Although this occasion is not the best for such statements, it should be stated that the governmental support of higher education is not satisfactory. The drastic reductions in the budget hinder the process of highly needed development. Only 40% of our financial needs is covered by the state budget. Under such conditions the only possibility of development is to find new external financial sources, to increase the incomes of the Department. The possible sources might be projects financed by industry, different foundations such as OTKA (Foundation for basic science), OMFB (National Committee for Technological Development). International projects such as PHARE, TEMPUS, COST, COPERNICUS, etc. and projects financed by the World Bank. The participation in these projects needs a high level research and so the circle is closed, the only way is high quality effective work.

Despite the difficulties, I think our future is in our hands, it depends on our responses to the present challenges. I hope that as a result of good

responses the bio- and chemical engineers of the future will be so successful as were the engineers in the last 75 years.

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