

# Biotechnology in Poland in relation to the European Federation of Biotechnology

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## 1. Introduction

The term "Biotechnology" has a different meaning to different people. However in all cases it involves an application of scientific and engineering principles to processing of materials by biological systems. As such it embraces a host of activities ranging from beer making to drug discoveries. The recent development in molecular biology, and bioprocess engineering has open up vast potential in improvement of traditional biotechnology to create the second generation biotechnology and generate the new third generation biotechnology (1). The major impact of the new biotechnology is expected in:

- a) health — an introduction of new pharmaceuticals, vaccines, monoclonal antibodies;
- b) fine chemicals — some food additives, replacement chemical synthesis by biocatalysis;
- c) agriculture — biopesticides, transgenic plants, engineered nitrogen fixing plants, plant health, animal production and health;
- d) food — novel raw materials, flavors, fragrances, dyes, immunodiagnostic;
- e) environmental biotechnology — monitoring, biodegradation, detoxification, biodegradable plastics.

To date most of basic research which underpins biotechnology and most of the product development has taken place in industrialized countries. This is not surprising. Biotechnology more than any other new technology is a science based and highly dependent on the research funding in such disciplines as molecular biology, biochemistry, microbiology, bioprocess engineering and others. In that case it is easy to explain why the USA and Japan are in the lead in the biotechnology field.

The need for biotechnology development in Poland is not questionable. There is a question how to solve this problem at the time of great economical and political changes in Poland, with shortage of money for research, lack of interest from industry, absence of small biotechnology dedicated companies which play an important role in development of biotechnology. In this article

I would like to point out that for Polish biotechnology it is necessary to be involved in an international cooperation within this field, which would in turn allow us to keep pace with the world's biotechnology. One of the ways is the extension of a contact with the European Federation of Biotechnology.

## 2. The European Federation of Biotechnology (EFB)

The EFB was established at a meeting in Interlaken (Switzerland) in the autumn of 1978 as a result of the general perception that biotechnological activities in Europe (i) were increasing rapidly, (ii) were outgrowing older and more restrictive definitions such as fermentation and enzyme technology, (iii) that these activities were substantially multidisciplinary, involving for instance microbiology, biochemistry, chemical engineering, and so they would benefit greatly from these essential skills being brought together and coordinated under single administrative body (2).

Since its foundation, the aims of the EFB have been the integration and representation of biotechnology scientists in all European countries by exchange of scientific and technological experiences, supporting European ac-

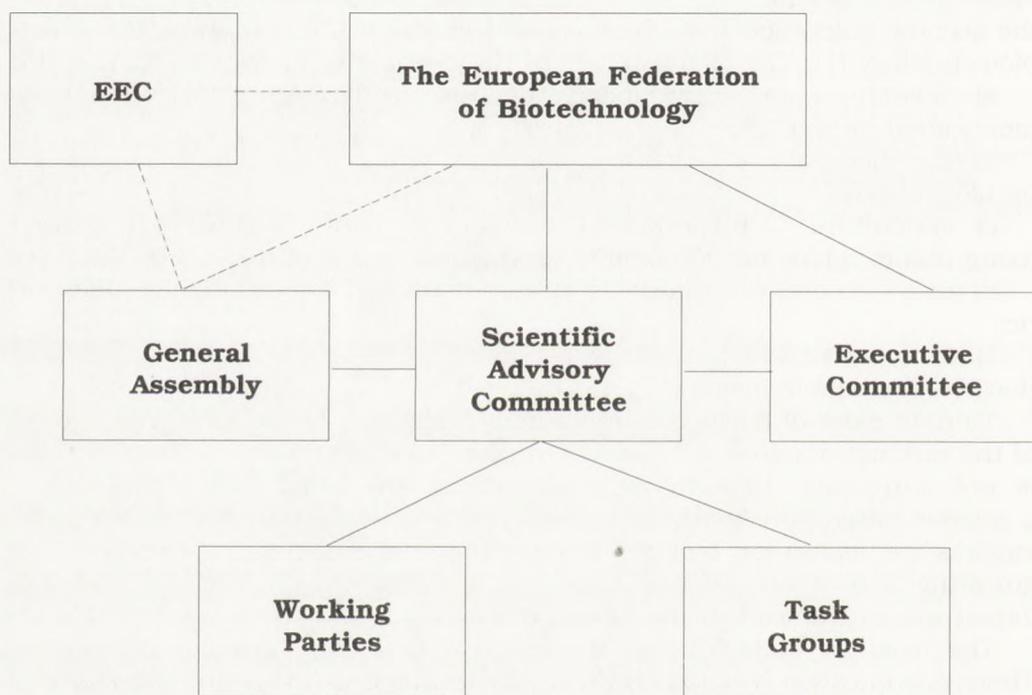


Fig. 1. Structure of the European Federation of Biotechnology.

tivities in R & D, and organizing international biotechnology meetings and congresses. So far, more than 80 biotechnology societies in 23 European countries have become members of the EFB (3).

Biotechnology is defined by the EFB as the integration of natural sciences and engineering sciences in order to achieve the application of organisms, cells, parts thereof and molecular analogues for products and services.

The EFB consists of an Executive Committee, a Scientific Advisory Committee and the General Assembly which consists of one representative appointed by each of the Member Societies. Meetings of General Assembly take place once a year; twice a year there are held Joint Meetings of the Scientific Advisory and Executive Committees as well as of the Executive Committee alone. The Joint Meetings are attended also by the Working Party Chairman, by one representative of the Commission of the European Communities as well as General Secretariat (Fig. 1).

The technical "workhorses" of the EFB are the Working Parties (WP) or recently the Task Groups which were set up to cover various scientific and engineering areas of biotechnology (Tab. 1).

TABLE 1  
THE EFB WORKING PARTIES

Working Party	Number of Members	Delegate from Poland
Animal and Plant Cell Culture Technology	30	—
Applied Biocatalysis	32	S. Bielecki
Applied Molecular Genetics	24	P. Wegleński A. Legocki
Bioreactor Performance	22	H. Michalski
Downstream Processing & Recovery of Bioproducts	32	A. Polanowski
Education	30	Z. Włodarczyk
Environmental Biotechnology	27	J. Chmielowski
Measurement & Control	19	—
Microbial Physiology	26	L. Sedlaczek J. Długoński
Safety in Biotechnology	22	A. Chmiel

The Working Parties have broad stimulatory effect on communication and cooperation between scientists and engineers in the different EFB member countries. The working style of the Working Parties is not standardized or regulated by the EFB. Some of them have been much more productive than others. One of the reason is that no funds for travel to the WP Meetings are made available by the EFB so that individual representatives have to obtain funding either from national scientific societies or from their laboratories. This problem is especially difficult for Polish scientists.

### 3. The Working Party on Applied Biocatalysis

To draw the activities of the WPs nearer I would like to present some works of the Working Party on Applied Biocatalysis.

The objectives of the Working Party on Applied Biocatalysis include:

— To increase the understanding of biocatalysis and in particular its commercial and other applications.

— To take initiatives in areas of growing scientific and industrial interest and importance in the field of applied biocatalysis.

— To foster relationships between interested scientists and engineers in various European countries by arranging meetings on topics related to applied biocatalysis.

— To identify key topics which may be rate-limiting the development of European scientific and technological capabilities in applied biocatalysis and to take appropriate steps to stimulate these areas and/or to make appropriate recommendations to the EFB.

— To propose prospective research topics for EC research programmes.

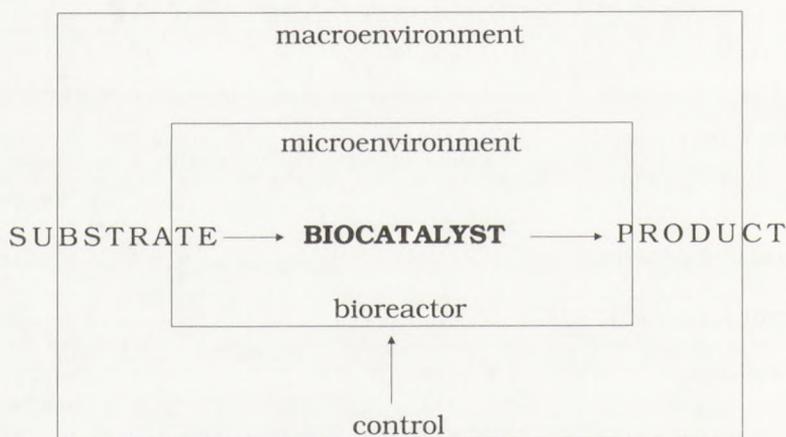


Fig. 2. The role of biocatalysts in biotechnological processes.

Biocatalysis can be defined as the use of biological catalysts for productions of different materials or carrying out useful reactions. The role of biocatalysts in some of the biotechnological processes is presented in Fig. 2. The heart of a bioconversion process is formed by different form of a biocatalyst (cells, enzymes, immobilized enzymes) catalyzing the conversion of substrate to product. In order for the bioconversion to take place, substrate has to get biocatalyst and product has to be removed from it. These processes take place in the microenvironment (bioreactor) of biocatalysts which is to create optimal conditions for a particular bioconversion. In order to optimize the production process, the microenvironment has to be influenced by macroenvironment which involves control mechanisms, ranging from very simple to very complicated ones (4). Applied biocatalysis is especially well suited for transformation of natural compounds such as carbohydrates, proteins and fats. However, many examples show that enzymes having a broad specificity can also be used to transform synthetic substances that cannot be found in nature. Despite some excellent technical features of the biocatalysts like regio- and stereoselectivity, relatively few successful commercial applications have been developed. The reasons probably are that only a small number of biocatalysts are currently commercially available. Besides, they have rather poor stabilities to temperature and organic solvents and very often they are more expensive than comparable chemical catalysts. Therefore, the Working Party activities are directed towards overcoming or circumventing these disadvantageous properties of biocatalysts so as to make better use of their advantageous technical features. The opportunities exist for biotechnological R&D at most stages in a project from an idea to a new biocatalyst (Tab. 2).

TABLE 2  
STAGES IN BIOCATALYSIS R&D PROJECTS

Stage	Disciplines/Methods
Market Needs and Scientific Idea	Information Technology Market Studies Patent Information
Screening for Required Activities (Cells and Enzymes)	Microbial Characterization Genetic Engineering
Fermentation	Microbial Physiology
Bioconversion	Enzyme Characterization Reactor Design and Optimization
Product Isolation and Purification	Analytical Chemistry
Scale-up	Process Control Biochemical Engineering Waste Treatment Process Cost Evaluation and Financial Appraisal
Product Characterization and Applications Studies	Product Safety Testing

In particular, there are further considerable opportunities in the development of biocatalysts with new and/or improved properties by: screening of microorganisms and enzymes; mutation; enrichment culture; protein engineering; covalent modification; development of abzymes; changes in solvent; use of unnatural substrates.

Taking into consideration the significant role of biocatalysts in biotechnological processes and the necessity of multidisciplinary approach in biocatalyst production and performance, the WP took up several actions in order to increase the understanding of the applied biocatalysis (Tab. 3).

TABLE 3  
ACTIVITIES OF THE EFB WORKING PARTY ON APPLIED BIOCATALYSIS

Reports	<ul style="list-style-type: none"> <li>— The characterization of immobilized biocatalysts (5)</li> <li>— Biological status of immobilized cells (6)</li> <li>— Screening for novel biocatalysts (7)</li> <li>— Patent protection (8)</li> </ul>
Symposia	<ul style="list-style-type: none"> <li>— Biocatalysts in Organic Synthesis (1985)</li> <li>— Biocatalysts in Organic Solvents (1986)</li> <li>— Microbial Physiology in Manufacturing Industries (1988)</li> <li>— Enzymes in Food and Feeds (1988)</li> <li>— Physiology of Immobilized Cells (1989)</li> <li>— Biocatalysis in Non-Conventional Media (1992)</li> <li>— Stability and Stabilization of Enzymes (1992)</li> </ul>
Courses	<ul style="list-style-type: none"> <li>— Advanced Course on Applied Biocatalysis (1991)</li> </ul>
Future Symposia	<ul style="list-style-type: none"> <li>— Symposium on Carbohydrates</li> <li>— Symposium on Environmental Biocatalysis</li> <li>— Symposium on Immobilized Cells</li> </ul>
Workshops	<ul style="list-style-type: none"> <li>— European Congresses on Biotechnology</li> </ul>

#### 4. Biotechnology organization in Poland in relation to EFB

At present in Poland only Biotechnology Working Group/Łódź (BWG) is a full member of the European Federation of Biotechnology (Fig. 3). This association is one of the founders of the EFB. The members of BWG are also members of other scientific and professional societies like Polish Biochemical Society, Polish Microbiological Society, Polish Society of Food Technologists. They are active in promoting biotechnology in Poland. They also participate in the activities of the Biotechnology Committee of the Polish Academy of Sciences (PAN) and in the activities of the Section of Bioprocess Engineering of the Chemical and Process Engineering Committee of the Polish Academy of Sciences.

Two national symposia on "Progress In Biotechnological Processes" and three symposia on "Progress in Bioprocess Engineering" were organized by the members of BWG as well as some of the Biotechnology Symposia, organized almost each year since 1978 at the Meeting of Polish Biochemical

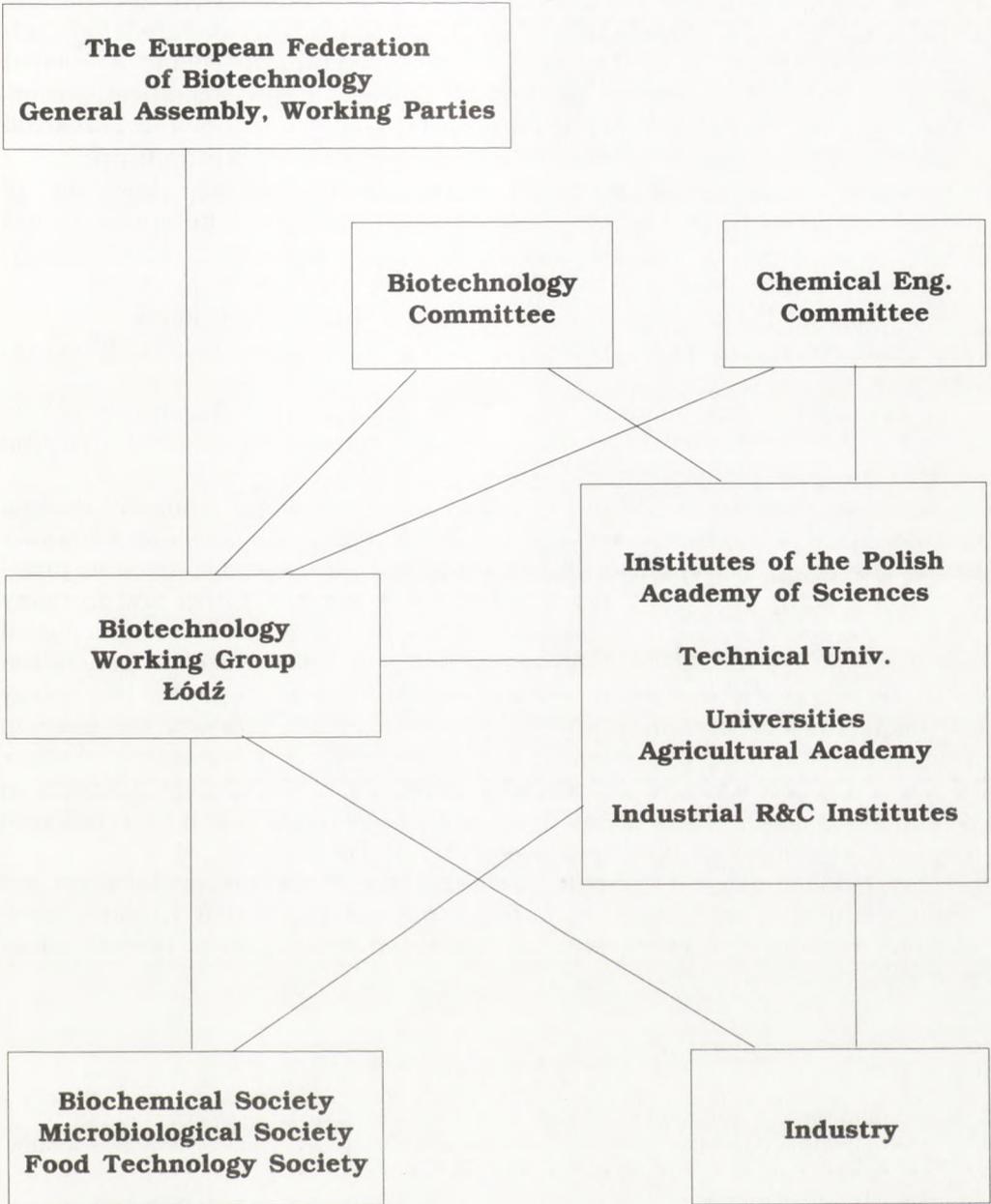


Fig. 3. Polish scientific and professional societies in relation to the EFB.

Society. It is worth noticing that the first Biotechnology Symposium was organized by BWG in the same year the EFB was founded. Activities of the BWG are not limited to the area of Łódź. Representatives of BWG to the EFB WPs are appointed by personal contacts between Polish scientists working in different areas of biotechnology from biotechnologically oriented research centers in Poland (Tab. 1). The biotechnology research in Poland is carried out by Institutes of the Polish Academy of Sciences, (PAN) Technical Universities, Universities, Agricultural Academies, Medical Academies and Industrial Institutes. The centers of the biotechnologically oriented research are:

— Institute of Bioorganic Chemistry, PAN (Poznań); Institute of Biochemistry and Biophysics, PAN, (Warszawa); Institute of Immunology and Experimental Therapy, PAN (Wrocław); Centre for Microbiology and Virology, PAN (Łódź), Centre Molecular of Macromolecular Studies, PAN, (Łódź).

— Technical Universities in Łódź, Wrocław, Warszawa, Gdańsk.

— Universities in Łódź, Warszawa, Gdańsk, Poznań, Lublin, Wrocław, Katowice.

— Agricultural Academies in Poznań, Olsztyn, Lublin, Warszawa, Wrocław.

— Institute of Biotechnology for Agro-Food Industry (Warszawa), Institute of Biotechnology (Warszawa).

As far as industry in Poland is concerned, there is no company dealing with the third generation biotechnology. There is only one company manufacturing enzymes (ZPOW, Jasło). Biotechnological processes are used in pharmaceutical companies like Polfa (Tarchomin, Pabianice, Kutno) and in many firms of agro-food industry. These are mainly the traditional biotechnological processes which should be improved in order to become second generation biotechnology. As we can see in order to benefit from the high level technology like biotechnology and to positively stimulate Polish industry we have to develop research and education in this field.

The range of activities of people involved in biotechnology research in Poland has recently markedly increased. In this year, six meetings in different areas of biotechnology have been organized in Poland (Tab. 4).

New biotechnology — oriented courses and biotechnology faculties are being planned or established by various universities. Moreover, some meetings are organized together with the European Federation of Biotechnology (see Tab. 5).

TABLE 4  
CONFERENCES ON BIOTECHNOLOGY ORGANIZED IN POLAND IN 1993

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|--|
| <ol style="list-style-type: none"> <li>1. 1<sup>st</sup> Conference on Education of Biochemistry and Biotechnology (Łódź)</li> <li>2. Meeting of the Committee of Food Chemistry and Technology, Biotechnology Symposium (Wrocław)</li> <li>3. 29<sup>th</sup> Meeting of Polish Biochemical Society, Biotechnology Symposium (Wrocław)</li> <li>4. 1<sup>st</sup> Conference on Plant and Food Processing (Warszawa)</li> <li>5. Progress In Bioprocess Engineering (Łódź)</li> <li>6. Conference on Environmental Biotechnology (Gliwice)</li> </ol> |
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TABLE 5  
EVENTS OF THE EFB IN POLAND

1. Meeting of the Working Party on Bioreactor Performance (1981)
2. Conference "The Other Face of Biotechnology" (1993)
3. Meeting of the Task Group of Public Perception of Biotechnology (1993)
4. Advanced Course on Applied Biocatalysis (1994)
5. 32<sup>nd</sup> Meeting of the Working Party on Applied Biocatalysis (1994)

Next year the 32<sup>nd</sup> Meeting of the Working Party on Applied Biocatalysis is planned. This meeting will be followed by the Advanced Course on Applied Biocatalysis whose aim is to familiarize postgraduates and young PhD researchers with the integrated, interdisciplinary approach required in modern biocatalytic processes.

The Biotechnology Section of the Polish Biochemical Society starts to organize Working Groups which will gather researchers working in the same area of biotechnology to facilitate an exchange of information and to undertake similar activities as Working Parties or Task Groups of the EFB. Some time ago the section sent a questionnaire and up till now the following number of Polish scientists have agreed to actively participate in Working Groups listed in Tab. 6.

TABLE 6  
THE WORKING GROUPS OF THE BIOTECHNOLOGY SECTION OF THE POLISH BIOCHEMICAL SOCIETY  
(RESPONSES TO QUESTIONNAIRES)

Working Group	Number of positive answers
Animal and Plant Cell Culture Technology	14
Applied Biocatalysis	24
Applied Molecular Genetics	24
Bioreactor Performance	12
Downstream Processing & Recovery of Bioproducts	27
Education	24
Environmental Biotechnology	13
Measurement & Control	5
Microbial Physiology	13
Safety in Biotechnology	4

## 5. Future Activities

In the light of EFB's activities presented here as well as its contacts with Polish scientists it seems that these contacts need to be further developed. Other Polish scientific societies should apply for the EFB membership. Designated Polish delegates to the Working Parties or Task Group of the EFB

should be more active in their work and should convey the information to the scientists in Poland. This is connected with the necessity of organizing Working Groups or Study Groups mirroring the EFB Working Parties. Contacts of Polish scientists and engineers with the EFB WPs could be made through individual applications for the Personal Corresponding Membership. The already formed Polish Working Groups whose organization was started by the Polish Biochemical Society should consider the possibility of proposing research priorities for biotechnology which could then be accepted by grant giving organization. This in turn would lead to a change in the face of biotechnology and attitudes towards it in the Committee for Scientific Research. Right now, the attitude to biotechnology as a multidisciplinary activity directed towards applications is unfavourable. There also exists the need for the integration of scientists and industrialists to make our industry ready for the introduction of biotechnological processes developed in Polish laboratories and to facilitate the diffusion of this high level technology to Poland from more advanced countries. All these actions will result in greater integration of Polish scientists with the community of European biotechnologists.

## References

1. Thomas S. M., (1993), A report for the FAST Programme, Global perspective 2010 The case of Biotechnology, Theme C., 15.
2. Cheetham P. S. J., (1989), *The Biochemist*, 12/6, 14.
3. Kreysa G., (1993), *EFB Newsletter*, 7, 1.
4. Luyben K., (1993), Meeting of GA of the EFB, Florence.
5. van Ginkel L. G., Tramper J., Luyben K. Ch. A. M., Klapwijk A., (1983), *Enz. Microb. Technol.*, 5, 297.
6. Lilly M. D., (1986), *Enz. Microb. Technol.*, 8, 315.
7. Cheetham P. S. J., (1987), *Enz. Microb. Technol.*, 9, 193.
8. Cheetham P. S. J., (1990), Minutes of WPAB Meetings.

## Polska biotechnologia w relacji do Europejskiej Federacji Biotechnologii

### Streszczenie:

Przedstawiono polskie organizacje i towarzystwa naukowe prowadzące działalność w zakresie biotechnologii, szczególnie we współpracy z Europejską Federacją Biotechnologii (EFB); omówiono ich strukturę organizacyjną oraz scharakteryzowano inicjatywy naukowe.

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biotechnology, European Federation of Biotechnology, Poland.

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