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## Life Sciences and Biotechnology in Poland

Research, Industry and Transnational Collaboration

*BioCon Valley*<sup>®</sup>

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## – Research, Industry and Transnational Collaboration

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## Preface

The present study “Life Sciences and Biotechnology in Poland” was compiled by BioCon Valley, the initiative for life science and health economy of Mecklenburg-Vorpommern, Germany. It was realized as part of the project “Polish-German Biotech-Forum: Science – Network – Business“, funded by the International Bureau of the German Federal Ministry of Education and Research (BMBF). The project was an integral part of the activities during the German-Polish Year 2005/2006.

Mecklenburg-Vorpommern is one of the 16 German Federal States and is a direct neighbour to Poland. Already in 1991, a formal agreement of collaboration was signed between the Polish Voivodeship West-Pomerania (Zachodniopomorskie) and the German Federal State Mecklenburg-Vorpommern, which share a common border at the Baltic Sea. And since then a number of diverse activities reflects the vital exchange across the border.

Modern biotechnologies gain more and more interest as they promise the generation of a new economy, based on the successful developments in the USA and the UK. As a typical example of a knowledge driven industry, a critical mass of outstanding and international competitive basic and applied science in the disciplines of modern life sciences is crucial for successful regional development.

At the border of Mecklenburg-Vorpommern and Voivodeship West-Pomerania, the centres of life sciences are the academic institutions in the cities of Szczecin and Greifswald. Since their geographic location is close, BioCon Valley started to intensify collaboration by making contacts, organising bilateral meetings and collecting basic data as a tool to strengthen critical mass of science and industry in the region.

Assisted by the Kommunalgemeinschaft Euroregion POMERANIA e.V., the Chamber of Industry and Commerce Neubrandenburg, the Regional Government of Mecklenburg-Vorpommern, and the International Bureau of the German BMBF, we were able to conduct this study “Life Sciences and Biotechnology in Poland”. It is based on a first issue we compiled in 2003 for the Chamber of Industry and Commerce Neubrandenburg in German.

We hope this short study may give you a first idea of the activities in the life science sector in Poland, and may serve as a helpful tool to identify partners for successful international collaborations.

We gratefully acknowledge the support and assistance received from the Kommunalgemeinschaft Euroregion POMERANIA e.V., the Chamber of Industry and Commerce Neubrandenburg, the Regional Government of Mecklenburg-Vorpommern, and the International Bureau of the BMBF.

It is our desire to give special thanks to our collaborating partners the West Pomeranian Centre of Advanced Technologies (ZCZT) in Szczecin, the Center of Technology Transfer (CTT) in Gdansk and the Technical University of Lodz.

Formal remark:

„Das dieser Veröffentlichung zugrunde liegende Vorhaben wurde mit Mitteln des Auswärtigen Amtes im Rahmen des Deutsch-Polnischen Jahres 2005/2006 gefördert. Die Verantwortung für den Inhalt liegt beim Autor. - This publication and its underlying project was funded by the German Federal Department of Foreign Affairs as part of the German-Polish Year 2005/2006. The author of this publication is solely held accountable for its content.”

Dr. Heinrich Cuypers and Careen Krüger, BioCon Valley GmbH

## 1. Summary

Modern biotechnology in science and business is a new topic becoming more and more interesting for economic development in Poland. Up to now there are no comprehensive studies about commercial use of biotechnology in Poland. The present study "Life Sciences and Biotechnology in Poland" was compiled by BioCon Valley as part of the project "Polish-German Biotech-Forum: Science – Network – Business" in the framework of activities during the German-Polish Year 2005/2006.

In Poland basic and applied research is related to the broad fields of biotechnologies with focus on medicine, pharmacy, plant and animal breeding and environmental biotechnology. Geographically the centres of research are predominantly located at the universities and institutes of the Polish Academy of Science in the cities Cracow, Gdansk, Lodz, Poznan, Warsaw and Wroclaw.

Contacts and cooperation in the field of biotechnology between Polish and German partners have a long tradition and focus mainly on basic and applied research. Yet an increasing number of Polish experts from science and technology transfer are active partners in regional and international networks to strengthen their power and to successfully mobilize support by the EU National Framework Programmes.

The total number of enterprises amounts to about 200, out of these 20 were identified with own research and development activities. In this study 109 companies involved in research and development, service and production were considered.

Currently, the Polish market is mainly dominated by international enterprises. In May 2004 Poland has entered the European Union and is, with nearly 39 million inhabitants, its largest new member and an attractive market. The establishment of own enterprise culture in biotechnology is still underdeveloped in Poland in spite of its strong base in basic and applied research.

Political efforts to establish special advancement programs for the promotion of start-ups are upcoming at present. However, the economic potential of modern life sciences and biotechnologies become an increasing awareness in Poland. This is indicated by the increasing numbers of patent applications, companies and mobilised money.

Biotechnological research and development is performed on a high level in Poland, although when compared to the USA or the EU comparably little funds are available.

Engaged institute directors traditionally maintain close cooperation with international institutions, guaranteeing the new generation of scientists to be well educated. This fact as well as the present low labour cost (also for scientists) offer good conditions for the future development of biotechnology in Poland.

According to the conducted study Polish biotechnology focuses on following topics which are further elaborated: "The Economic Situation in Poland", "Overview of Biotechnology in Poland", "The Pharmacy Sector" and "The Future of Polish Biotechnology".

## 2. The Economic Situation in Poland

The Republic of Poland covers an area of 312 685 km<sup>2</sup> with a total population of 38,17 million inhabitants (census 2005) and a population density of 124 inhabitants per square kilometre. 63 % of the population are located in cities with Warsaw (1,7 mill. inhabitants), Cracow, Gdansk, Lodz, Poznan, Szczecin and Wroclaw as the largest cities. The country itself is divided into 16 districts (voivodships).

In 2004, the gross domestic product (GDP) of Poland was 241,8 billion US\$ with a per capita GDP of 6,335 US\$. Foreign trade amounted to 87,9 billion EUR for imports and 73,8 billion EUR for exports in 2004. During that year, the country experienced a small inflation rate (consumer price) of 3.5 %. However, a pressing problem for Poles is the increasing unemployment rate (2004: 19.1%).

Apart from food production and energy supply, mining and metallurgy are still important industrial employers in Poland. However, the service sector makes up 66% of the national GDP, whereas 31% are covered by industry and 3% by agriculture. The agricultural sector is shaped by a quite heterogeneous structure with a very high percentage of small enterprises (80% under 10 ha farm size), insufficient infrastructure in rural areas and the large absence of occupation alternatives. However in many regions agriculture fulfils an important social function. The current market situation for almost all fields is described best by an increase in output, but decrease in prices. This development was even more facilitated by the government's market policy. Current intervention methods hardly bring any relief, so that the average farmers' income continuously decreases.

Since Poland entered the EU, an intensive increase of German funds in direct investments could be observed. Poland has therefore drawn from this capital more than maybe any other middle eastern European country. The German investors are highly convinced of Poland's dynamic industrial development, its market size and the potential of outstanding employees, who are furthermore comparatively good value for money.

### ***Commercial Relations***

Poland considers the USA, Germany, France, Great Britain and Italy as its most important Western European and transatlantic partners. As a consequence of their geographic location as neighbours and Poland as one of the largest markets within the EU and therefore taking on a key position in Central and Eastern Europe, Polish- German economic relations are close and diverse. Hence Germany supports the Polish economic catch-up process in various ways. This occurs in a multilateral framework by contributing to international programmes by the European Union, the World Bank, the European Bank for Reconstruction and Development and the International Monetary Funds.

Also, the regional cross-border cooperation is to be pointed out. Regular discussions within a governmental commission, involving the German Federal States and the Polish Voivodships, coordinate these activities. Additionally, a number of bilateral specialised committees are engaged in cross-border cooperation (e.g. the expansion of border-crossing points, environmental advice, problems of the Oder river, inland water and marine shipping).

Together with the Czech Republic, Poland is Germany's most important trade partner in Central and Eastern Europe. With considerable distance to Italy and France, Germany is Poland's most important trade partner, to which one third of Polish foreign trades is allotted to.

The volume of German-Polish trade has developed very dynamically over the past years and reached 34,8 billion EUR (1992: 8,4 billion EUR; 2001: 28,7 billion EUR) in 2004. Thus, for a few years of declining Polish trade deficit with Germany, it slightly rose again and amounted to 2,9 billion EUR (2004) (1998: 3,9 billion. EUR, 2001: 1,7 billion EUR, 2002: 1,9 billion EUR).

After the EU enlargement, Poland is very often considered as a region for their economical success by German companies. In a survey German companies ranked the country with the most successful development of their own activities after the EU enlargement as follows:<sup>1</sup>

1. Poland (38%),
2. Czech Republic (28%),
3. Hungary (13%),
4. Slovakia (8%),
5. Lithuania (5%),
6. Latvia (4%),
7. Estonia (3%),
8. Slovenia (2%),
9. Malta (1%)

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<sup>1</sup> Source: "Polen als Standort für deutsche Investitionen", Polish Information and Foreign Investment Agency, [www.paiz.gov.pl](http://www.paiz.gov.pl), July 2005

**Table 1: Statistical Profile of Poland**(Fact sheet „Economic Data Poland”, 2006; <http://www.auswaertiges-amt.de>)

	2002	2004	2005
<b>Population (In million)</b>	38,61	38,17	38,17
Population density per 1 km <sup>2</sup>	124	124	124
<b>Gross domestic product</b>			
GDP (billion EUR)	199,6	195,2	204,1
Growth rate in %	1,3	5,4	3,2
GDP per head (EUR)	5.169	5.113	6,29
Inflation rate (Consumer prices in %)	1,9	3,5	0,7*/2,5**
Unemployment rate in %	18,1	19,1	17,6
Unemployed one	3.217.000	2.999.600	2.773.000
<b>National budget</b>			
Incomes (billion EUR)	37,3	34,5	44,7
Expenditures (billion EUR)	47,5	43,7	51,8
National budget deficit	-10,2	-9,1	-7,1
National budget deficit in % GDP	-5	-4,7	-3
Gross domestic debt	56,9	70,5	78,5
Gross domestic debt in % GDP	28,5	35,7	
<b>Balance of payments</b>			
Balance of payment on current account (billion EUR)	-7,2	-3	-2,5
Balance of payment on current account in % GDP	-3,6	-1,5	-1,4
Balance of merchandise trade (billion EUR)	-10,9	-4,9	-1,6
Balance of invisible current account transactions (billion EUR)	3,7	2	-0,8
<b>Net capital movement</b>			
Balance of direct investment	4	3,5	4,4
Balance of portfolio investment	1,9	8	10,2
Balance of other capital transactions (esp. credits) (billion EUR)	2	-10,5	-6,9
Reserve holdings (billion EUR)	28,5	27,5	36
<b>Foreign trade in billion US\$</b>			
Import (% change from the previous year)	55,0 (9,3)	87,9 (29,3)	92,3 (14,8)
Export (% change from the previous year)	40,9 (13,3)	73,8 (37,7)	81,8 (21,4)
Balance	-14,1	-14,1	-10,5
<b>Foreign debt</b>			
Gross debt (billion EUR)	55	92,9	105,6
In % of GDP	40,9	47,6	
Currency PLN (to EUR)	3,86	4,53	4,03
(to US\$)	4,08	3,65	3,23
<b>Bilateral relation</b>			
<b>German foreign trade with Poland</b>			
Sales (change in % from the previous year)	30,2 (5,4)	34,8 (7,6)	34,5 (7,8)
Import	14,2 (5,1)	15,9 (0,6)	14,6 (0,0)
Export	16,1 (5,6)	18,8	19,9
Balance	1,9	2,9	5,3
In % of polish total import (of German total export)	24,3 (2,5)	24,2 (2,6)	24,7 (2,7)
In % of polish total export (of German total import)	32,4 (2,7)	29,9 (2,8)	28,2 (2,6)
Position one the trade partner list: turnover	13.	12.	12.
<b>Polish foreign trade with Germany (billion US\$)</b>			
Import (change in % from the previous year)	13,4 (11,0)	21,3 (28,3)	22,8 (16,1)
Export (change in % from the previous year)	13,2 (6,6)	22,1 (27,8)	23,1 (13,5)
Balance	-0,2	0,8	0,3
Position on the trade partner list: Sales (Exp/Imp)	1.	1.	1.

Foreign investments in Poland (according to PAIZ: (Investments from 1 million US\$))			
German effected investments: Number of companies	231	258	
German effected investments: Value in billion. US\$	7,8	10,1	
German effected investments in total: Number of companies	979	1101	
German effected investments: Value in billion US\$	65,1	80,6	
Enterprises with foreign capital in total	47.352	51.503	54.336

\* for the same month of the previous year

\*\* to the previous year (analogue to the period of the previous years)

## ***Poland's Relationship with the European Union***

The entry of Poland as member of the first enlargement group into the EU was decided at the European Summit in Copenhagen on December 12<sup>th</sup> and 13<sup>th</sup>, 2002, and the EU entry agreement was signed in Athens on April 16<sup>th</sup>, 2002. Poland's EU entry itself followed on May 1<sup>st</sup>, 2004. The European Union supports Poland's adjustment efforts both by financial and political counselling. For the time period between 2000 and 2006 the household budgets were as follows: approximately 480 million EUR for a technical aid programme, which prepared for the EU entry (PHARE), about 250 million EUR for investments in environment and transport (ISPA) and 170 million EUR for agriculture and rural development (SAPARD). Population agreement on EU entry was well over 50 %. However, some farmers faced the EU entry with apprehension ranging from scepticism to rejection, who expected radical structural changes with the entry and thereby feared to be on the losing side. This group was afraid of national-conservative circles, cultural and social alienation and uncontrolled economic West European dominance - especially German dominance. They now are represented by an independent party in the Parliament.

A majority of the population feels poorly informed on EU topics. Therefore, the Polish government and the EU Commission are actively working at meeting the public's demand on information about the Polish EU integration process.

The following universities are involved in international cooperation in the field of biotechnology (except medicine):

- Jagiellonian University Cracow
- Technical University Gdansk
- Technical University Łodz
- University and Agricultural University Poznan
- University Szczecin
- University Torun
- Technical University Warszaw
- Wrocław University, Technical University and Agricultural University Wrocław

## ***German Investments in Poland***

According to statistics of the Polish Agency for Foreign Investments (PAIZ), which records investments over one million US\$ only, German enterprises invested 10,2 billion US\$ in Poland until the end of 2004. Germany, France and the USA rank as the largest investors in Poland. Adding the numerous German small and medium-sized enterprises that are involved in activities with Poland, it can be suggested that Germany is the most important foreign investor in Poland not only by the number of investments.

## ***Polish Relations with Mecklenburg-Vorpommern***

Cooperations between Mecklenburg-Vorpommern and the West Pomeranian Voivodship were formally initiated in 1991. An initiative for transnational business cooperation with neighbouring countries is the “Euroregion POMERANIA”. Within the framework of INTERREG IIIA, the Association of Local Authorities Euroregion POMERANIA (“Kommunalgemeinschaft Euroregion POMERANIA e.V.”) has funded 167 transnational projects with Polish and German participation from 2001 to 2004, whereas 30 projects could be realised on Polish funds. It is intended to implement 238 projects with an anticipated budget of 157 million EUR until 2006. For the coming funding period 2007-2013 there will be an added support for technology-related activities, contributing to an improvement of the funding situation.

The Chamber of Commerce and Industry of Neubrandenburg is in charge of the “Dom Gospodarki” (Chamber of Economy) as a contact point for cross-bordering cooperation in ventures, which is located in Szczecin. The first cooperation in the field of biotechnology was initiated with researchers of the University of Greifswald and Pomorska Akademia Medyczna of Szczecin (Pomeranian Medical University).

The relations between BioCon Valley, the network for life sciences and health economy in Mecklenburg-Vorpommern, and the West Pomeranian Centre of Advanced Technologies (ZCZT) in Szczecin were intensified in 2005. The ZCZT is a consortium of three universities in Szczecin, all with a focus on biotech-related research: Pomeranian Medical University, Technical University, and Agricultural University.

One main result of this collaboration was the “Polish-German Networking-Day”, organised by BioCon Valley, ZCZT, VDI Technologiezentrum Düsseldorf and Kommunalgemeinschaft Euroregion POMERANIA within the setting of the Polish-German year 2005-2006. This conference was supported by the German Ministry of Education and Research and the Chamber of Industry and Commerce of Neubrandenburg with the following four workshops as its focus: “Molecular Medicine in Euroregion Pomerania”, “Plant Genomics”, “Sepsis”, and “Transportation and Mobility”.

In addition, Polish regions are strongly engaged in the ScanBalt BioRegion – a network of networks in life sciences and biotechnology in the Baltic Sea Region with 11 member countries which started in Nov. 2001. Involved Polish institutions are e.g. the Intercollegiate Faculty of Biotechnology of the University of Gdansk and Medical University of Gdansk, the Centre of Technology Transfer in Gdansk and the Technical University Łódź, who are especially contributing to two main projects of ScanBalt:

- ScanBalt CompetenceRegion (2004-2006), co-financed by the European Union under the 6<sup>th</sup> Framework Programme and coordinated by BioCon Valley
- ScanBalt Campus (2005-2007), co-financed by the European Union under the Interreg IIIB Programme, coordinated by the University of Gothenburg

### 3. Overview of Biotechnology in Poland

Biotechnological research such as plant breeding has a long standing tradition in Poland. Breeding of plants goes back to 1862 with the formation of Polytechnic Institute of Agriculture and Forestry in Pulawy.

These days, biotechnology is diversely represented in Poland:

- Basic research is conducted at 10 departments and chairs of the Polish Academy of Science.
- Applied research conducted at several “Research and Development” institutions (e.g. biotechnology, biochemistry, microbiology, molecular chemistry)
- Biotechnology and its related disciplines are lectured at 21 universities in Poland, which graduated 1.254 Masters and Engineers in 2004.
- According to scientists, basic research in biotechnology has risen to an internationally acknowledged level. In addition, a majority of the 3.000 scientists has completed internships abroad or is cooperating with foreign research centres.
- 407 Polish research groups received EU funding in the field of biological/ medical sciences under the 6<sup>th</sup> Framework Programme (compared to 321 in FP5).
- 200 patent applications were submitted for the field of biotechnology in 2004. 72 patents in biotechnology were approved in 2002, of which only 7 were based on Polish discoveries, though.

The strengths in Polish biotechnology are clearly in the field of research and development. In addition to its well educated young people and its high level of education in natural and engineering sciences, its legislation system (especially the “gene law”) and its excellent geographic location are big advantages for the development of biotechnology in Poland. However, there are also barriers to overcome. Limited investment, need of biotech specific infrastructure (science parks and incubators), little awareness on Intellectual Property Rights and insufficient technology transfer between science and industry are challenges to be faced as well.

The Polish biotechnological industry is at an early stage of development, especially when referring to R&D companies, production and trade and diagnostic companies. The total income is amountet to 100 million US\$ per year. Focus is placed on the most important fields such as health care products, fermentation technology and products for agriculture (plant protecting agents, products for veterinary medicine, breeding plants and animals).

In the following paragraphs the main topics of modern biotechnology in Poland will be described in more detail. They are based on the diverse sources available at present and supplemented by latest meeting reports and unpublished material from the study, BioCon Valley performs in the frame of the project ScanBalt Competence Region (to be finished in December 2006).

The main topics identified are:

- Agrobiotechnology in Poland
- Biotechnology in Polish Nutritional Science
- Biotechnology in the Field of Environmental Engineering
- Molecular Diagnostics in Medicine
- Education and Research in Biotechnology in Poland

## ***Agrobiotechnology in Poland***

Agriculture is of utmost importance to Poland. Sixty percent of the Polish population aged under 40 are living in rural areas, which amounts to 38,2% of the overall Polish population. In agrobiotechnology main emphasis is placed on three fields :

- Animal biotechnology (transgenic animals)
- Plant biotechnology (virus resistant potatoes, strawberries, crops resistant to herbicide plum, tomato, lettuce)
- Food biotechnology (biocatalysis, pre-biotics, pro-biotics etc.)

Of its approximately 1.000 graduated biotechnologists from universities, technical universities and agricultural universities, about 100 have specialized in agrobiotechnology, demonstrating a great, yet unused, potential for agrobiotechnology. In the nearest future, this number will increase by at least 50%. Therefore the following strategic activities are planned in the field of agrobiotechnology:

- Support of modern research in plant science
- Establishment of a leading coordination centre
- Improvement of research infrastructure
- Initiative for small start-ups in agrobiotechnology (remission of loans for young biotechnologists)

## ***Biotechnology in Polish Nutritional Science***

The linkage of biotechnology and nutritional sciences has generated numerous results in Poland over the last years. Many new technologies were introduced to the food industry (especially products with amino acids and vitamins) and expanded the choice of products for the consumers.

Research based on biotechnology in the field of nutritional sciences focuses on agricultural faculties of the Universities of Technology and suitable institutes of the Polish Academy of Science. Traditional biotechnology, however, is well developed in Poland.

In addition, quite a few research groups are applying modern bio- and genetic engineering methods to the fields of "Transgenic Plants and Animals". Their application is of no concern to the food sector yet.

## ***Biotechnology in the Field of Environmental Engineering***

In Poland many companies are specialised in the fields of biological ground, sewage and water treatment ("bioremediation"). The company *Trigger*, for instance, is the polish market leader in the field of biotechnological environmental engineering. It produces bio-compounds and offers services in the general field of biotechnology and environmental protection. Another company, *Hantpol*, is also specialised in this main tasks.

Numerous products of foreign companies are distributed by their Polish representative in Poland, such as the Italian company *Labiotest*. *Bioarcus*, however, is Poland's largest distribution network, which mainly offers Polish bio-compounds to foreign enterprises.

## ***Molecular Diagnostics in Medicine***

Research in molecular diagnostics is well developed, although the industry itself shows some deficiencies. Some examples for competitive fields are the following:

- Polymerase (Polgen)
- Restriction enzymes (EURx)
- Equipment for electrophoresis
- Primers for PCR (Institute of Biophysics and Biochemistry; Polish Academy of Sciences)
- Kits for microbiological assays (Gdansk)
- Tests for the detection of predisposition to various types of cancer (Szczecin)

Unfortunately there is only limited contribution of research in molecular diagnostics to the international scene. Some of the few examples, though, are patents on molecular tests detecting certain types of cancer and patents on diagnostic fluorogens. So far molecular diagnostics in medicine does not call for significant investments regarding required equipment. Taking the high level of genetic homogeneity of the Polish population into account, one may state that Poland has a chance to develop molecular diagnostic systems of fundamental impact.

## ***Education and Research in Biotechnology in Poland***

Some of the Polish pharmaceutical and biotechnological companies as well as a number of biotechnologically oriented research groups are active at universities and research institutes. The staff for biotechnology is trained mainly at eight medical universities, six classic universities and four universities of technology.

### Medical Universities

First of all biotechnology is taught at the pharmaceutical institutes. Disciplines covered are classical biotechnology (e.g. antibiotics and vaccines) and modern biotechnology (e.g. products of insulin, mono- and polyclonal antibodies for diagnostic and therapeutical applications). Here the students learn about classical fermentation technologies, tissue and cell culture technologies and modern genetic engineering. However, the range of training in modern biotechnology is relatively small in comparison to the training in chemical technologies and methods. A graduate of pharmacy from a Polish University can therefore not be considered a "finished" biotechnologist. Nevertheless, he has basic knowledge in pharmacy and pharmaceutical technology, chemistry, biology, biotechnology, which qualifies him to work with molecular biotechnologists, microbiologists, fermentation biologists, industrial chemists and engineers. In addition, their solid education offers pharmacy students an opportunity to continue their education or specialise in biotechnological disciplines.

### Classic Universities

The curriculum at the classical universities offers courses of molecular and biological biotechnology and students are trained in genetic engineering. In Gdansk the Intercollegiate Faculty of Biotechnology was established as a joint faculty of both, the University of Gdansk and the Medical University of Gdansk.

## Universities of Technology

The main focus of science at the Universities of Technology is covered by industrial biotechnology and fundamental processes in engineering science. However, high value is put also on scientific education in microbiology, biochemistry, classical and molecular genetics.

### *Leading Science Centres*

The leading science centres for biotechnology that have emerged over the past ten years are presented in the following Table 2 and in Figure 1 (details in Annex 2).

**Table 2: Main Research Areas in Poland Listed by Cities and Institutes**

City	Institute	Research Area
Gdansk	TU Gdansk	background knowledge in molecular science; biotechnology and chemistry of antibiotics
	Intercollegiate Faculty of Biotechnology	molecular biotechnology and plant biotechnology
	Medical University	investigation of plant agents in biotechnology
Lodz	Molecular and Macromolecular Research Centre	anti- sense technology; biopharmacy (TNF tumour necrosis factor; interleukin 1 and 2, granulocyte colony stimulating factor; analogues of tissue plasminogen activator)
	Microbiological and Virological Centre	steroid biotransformation
	Medical University	biopharmaceuticals (staphylokinase in combination with other trombolytic factors); investigation of plant agents in biotechnologically produced herbal remedies; production of amino acids with genetically modified microorganisms (L-aspartic acid)
Poznan	Institute of Bioorganic Chemistry	molecular biotechnology, antigens in plants
	Medical University	gene therapy; investigation of plant agents in biotechnology
Warszawa (Warsaw)	Institute of Biotechnology	semi-synthetic cephalosporin; recombinated bioproduction, (e.g. antibiotics, human insulin)
	POLFA Tarchomin	semi-synthetic penicillin and cephalosporin
	National Institute of Hygiene	microbiology and microchemistry, preparation of antibiotics in microorganisms
	Medical University	investigation of plant agents (also of fungus) for the use in biotechnology
Wroclaw	Institute of Immunotherapy and Experimental Medicine	unicellular antibodies as vectors for antiviral therapy; bacteriophages as antibacterial drugs
	University of Wroclaw	chemistry of natural products (immunological active peptides of flax)

Figure 1 Biotechnological Research Centres (Reference: Bio-Tech Consulting, Lodz)



### ***Companies in the Field of Biotechnology and Biomedicine***

At present there is no thorough statistic or study on the business world in biotechnology that has been published for Poland. The number of 180 million US\$ keeps appearing in the media, though, which is mentioned in a report by the Gdansk Technology Transfer Centre and in a report by the Polish Ministry of Science (2004). This corresponds to 0.05 % of Poland's Gross Domestic Product (GDP). About 200 companies were counted to the biotech sector. Representatives of the industry challenge these data and claim that the numbers of biotech enterprises is below 70. Of these only a few enterprises operate the entire production cycle from development and production to sale.

The largest enterprises in Poland are

- *Polfa Tarchomin S.A.* in Warsaw;
- *Polpharma S.A.* in Starogard Gdanski,
- *Jelfa S.A.* Jelenia Gora.

Most biotechnological and biomedical companies (about 30) are diagnostic companies providing services in the field of analysis and control of compounds, cosmetics, nutrition and disease diagnostics. Between ten and twenty enterprises are engaged in the production and sale of products primarily developed by their own research. Also ten to twenty companies are engaged in environmental biotechnology (biotechnological methods of groundwater remediation) with a majority as service providers. Among these *bioArcus* and *Bio-Ecology*, both located in Warsaw, are the largest.

There are two Polish companies involved in biotechnological research, as for instance the production of bio-compounds and cultivation of imported bacteria: *Hantpol Biotechnologia i Ochrona Srodowiska* in Warsaw and *Trigger Wytwarzni Preparatow do Ochrony Srodowiska* in Tarnobrzeg.

Poland's only producer of finished red biotechnology goods is the group *IBA Bioton S.A.* Warsaw which developed recombinant human insulin (Gensulin™).

As mentioned previously, some biotech companies are set up by foreign investors as their Polish branch offices. This mainly applies to the pharmaceutical and cosmetic industry: *Merck Sp. z o.o.* in Warsaw, *FORCHEM* in Warsaw, *Sederma*, *C.K.B Good Clinical Practice Polska* in Grudziac, *INFORM Polska* in Warsaw and *MDS Pharma Services Poland* in Cracow.

An overview of the companies' research fields in biotechnology can be viewed below (Annex 3).

#### **4. The Pharmacy Sector in Poland – A Future Market**

In terms of its population, Poland is potentially the sixth largest market for the pharmaceutical industry in Europe. Statistically seen, Poland ranks last in terms of consumption by the individual consumer. For the year 2004, a Pole spent 67,4 EUR on average for pharmaceuticals. In comparison to current EU member countries (excluding Luxemburg), the average consumption was 390 EUR. For other EU entry countries such as the Czech Republic and Hungary, the average per capita consumption was approximately 128 EUR, 178 EUR respectively – both considerably higher than in Poland. However, the consumption of pharmaceuticals has experienced a three-fold increase in Poland over the past 10 years. In 2004, the size of the Polish pharmacy market was 8,27 billion Zlotys (2,03 billion EUR).

According to the Association of European Self Medication Industry the market of all pharmaceuticals amounted to 16 billion Zlotys (4,1 billion EUR) in 2002. In Poland there are four companies that together hold 22,6 % of the total Polish pharmacy market share: *GSK* (Glaxo Smith Kline) *Pharma* (England), *Servier* (France), *Polpharma* (Poland) and *Novartis* (Switzerland).

The total number of licensed pharmaceuticals is 8.248 in Poland, of which 45% (in total: 3.712) are produced directly in the country.

#### ***Biotechnology in the Pharmaceutical Industry***

Until recently pharmaceuticals were produced in governmentally owned companies. Besides the already privatised company *Polfas*, three biomed<sup>2</sup>- enterprises are part of the pharmaceutical sector offering vaccines and sera, as well as three bioveterinarian institutions for veterinarian products, 13 laboratories, 14 cooperatives, two scientific research institutes, the Institute of Biotechnology and Antibiotics (IBA) and the Institute of Pharmaceuticals (IF).

In addition, the *Herbapol Group* contributes to the Polish pharmaceutical field with ten of its factories specialized in herbal remedies (phyto-pharmaceutical). Five of these factories are being managed by its staff via leasing and one is being managed in close accord with its German investors. The remaining five are still governmentally owned. As for herbal remedies, the group of *Herbapol* companies in Lublin holds a market share of over 40 %. *Herbapol* enterprises in Warsaw, Lodz, Gdansk and *Intrograf* in Lublin are also part of this group.

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<sup>2</sup> The names "Biomeda" and "bioveta" stand for the two state-owned Polish enterprises, producing human and veterinarian medical products. At present, some of their operational areas are in the process of privatisation.

## **Foreign Investments in Poland**

The POLiLZ (Polish Statistics Office) reports 905,5 million US\$ of Foreign Direct Investment (FDI) in the pharmacy sector, corresponding to 1,4 % of the total FDI in Poland. At the same time new investments of 354 million US\$ are planned.

The easiest way for market entry of foreign enterprises was to participate in the privatisation of large enterprises that were a part of *Polfa* previously. Some of the investors decided to absorb small companies and to establish new manufacturing facilities (“*green field*” investments). These companies are, among others:

- *Sender* (absorbed *Anpharm*), French
- *Lek* (absorbed *Argon* in Lodz and created new business facilities for 70 millions Euros in Strykow, near Lodz, which began the production in 2004), Slovenian
- *Krka* (near Warsaw – construction of new business establishments for 25 millions Euros), Slovenian and
- *SanofiSynthelabo* (new business establishments near Rzeszow), French.

Polish business established the multi-corporate enterprises *Glaxo Wellcome* in Duchnice as well as *Schwarz Pharma*, *Lek Polska*, *Solco Basel* and *Rhône-Poulenc Rorer*.

The majority of foreign companies concentrate on the formation of a new distribution network in Poland. Larger corporate groups in Poland are: *Abbott Laboratories*, *AstraZeneca*, *Bayer*, *Bristol Myers Squibb*, *Eli Lilly*, *Johnson & Johnson*, *Merck*, *Pfizer* and *Roche*. As can be deduced from this list of companies, the supply for the pharmacy market is strongly dominated by foreign enterprises.

Only 2 of the largest enterprises in Poland (*Polpharma* in Pomerania and *Polfa Kutno* in Mazovia) are under Polish management, one of them is also among the most significant (*Polpharma*). The other enterprises with highest significance for the Polish pharmaceutical sector are: the British *GSK Pharma*, the French *Servier*, and the Swiss *Novartis*.

Only few enterprises with their production facilities for pharmaceuticals located in Poland, also own their own R&D Department. A company outstanding for its research activities in Poland is *AstraZeneca Pharma Poland*, with its Clinical Research Department. This company has invested in research and development of new pharmaceuticals for several years now (about 20 million Zlotys per year, i.e. 5 million US\$ per year).

In 2002, Poland exported pharmaceuticals amounting to 191 million US\$. According to a report published by the Foreign Chamber of Commerce for 2002, the trade balance in the field of pharmaceutical products was negative with a difference from export to import of approximately 1,6 billion US\$. Such a trend was also observed in 1996 (import: 815 million US\$, export: 218 million US\$); however, the deficit was not as striking as in 2002.

## 5. The Future of Polish Biotechnology

Due to present limiting conditions, the application of modern biotechnology is not strongly developed yet. The tedious cycle of biotechnological research and development and profits to be expected mainly in the long run, delay the establishment of strong and healthy biotechnological industry additionally. To a majority of investors it seems more rational to buy new technologies rather than to develop on their own. New business segments are seen in the production of compounds and basic materials by various experts, though.

On December 13<sup>th</sup>, 2005, a conference on the “Perspectives and Trends in Development of Biotechnology in Poland until 2013” was organized by the Polish Academy of Science. One of the main foci was placed on the development of industrial biotechnology, biotechnological production of pharmaceuticals, molecular diagnostics in medicine and agrobiotechnology.

As a result of this conference, the following trends for the development of industrial biotechnology were placed on the agenda to develop until 2013:

- Microbial genomics and bioinformatics
- Metabolic engineering and modelling
- Biocatalyst function and optimisation
- Biocatalyst process design
- Innovative fermentation science and engineering
- Bioproduct isolation and purification
- Novel enzymes and microorganisms

Actions to achieve the goal of future biotechnological development in Poland are:

- Defining strategic goals in the fields of high technology for the various regions in Poland
- Investing in science parks, financed especially by tapping the structural EU funds
- Building platforms for closer cooperation between industry and academia
- Setting clear guidelines for academia-industry collaboration.

As one instrument to reach this goal Polish experts were active to network science and industry on national level in Poland and on international level, e.g. Polish Federation of Biotechnology, BioMedTech Silesia, Great Poland (Poznan area), Polish Technology Platform for Biotechnology. The “Polish Biotechnological Network” shall serve as a national umbrella for Polish biotechnology. Poland is partner of ScanBalt, the international network of life science networks at the Baltic Sea.

Biotechnological research and development is performed on a high level in Poland, although when compared to the USA or the EU, only poor means are available. Engaged institute directors maintain close traditional cooperation with international institutions, guaranteeing the new generation of scientists to be well educated. This fact as well as the present low labour cost (also for scientists) offers good conditions for the future development of Life Sciences and Biotechnology in Poland.

## 6. Bibliography

The following sources of data were used.

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- Polish Information and Foreign Investment Agency Poland (Paiz): „Biotechnology Sector in Poland 2004”, Warsaw 2004; <http://www.paiz.gov.pl>
- ScanBalt „CompetenceRegion” mappings & databases, collected in 2005; <http://www.scanbalt.org>
- „Directions and Prospects of Polish Biotechnology Development”, Prof. Stanislaw Bielecki, Institute Technical Biochemistry, Technical University Lodz, Presentation at the ScanBalt Meeting Gdansk, March 21, 2006
- Fact sheet „Economic Data Poland”, 2006; <http://www.auswaertiges-amt.de>
- „Centres of Excellence” and „Centres of Competence in Poland”; National Contact Point, Warsaw; <http://www.fp6.pl/>

## 7. Annexes

### ***Annex 1: Hyperlink to the Biotechnology Sector in Poland***

<b>Name</b>	<b>Homepage</b>	<b>Profile</b>
Bio-Tech Consulting	<a href="http://www.biotechnologia.pl">www.biotechnologia.pl</a>	The entrance side to range of topics Biotechnology in Poland, Eastern Europe und Russia, general goals: Bio-Tech Consulting is the leading supplier of business and sciences information from Poland, Russian Federation and other Eastern Europe countries. We are actively engaged in the promotion of biotechnology R&D and industry development in this region. Our services aim at facilitating foreign capital to launch collaboration with the local biotech and biobusiness communities.
Under the patronage of BIO-Tech Consulting	<a href="http://www.biotechnology-pl.com">www.biotechnology-pl.com</a>	See Bio-Tech
Under the patronage of BIO-Tech Consulting	<a href="http://www.bioforum.pl">www.bioforum.pl</a>	Contains information about already accomplished Bio Forums in Poland (2000-2003), and general information about life science fields and biotechnology
II Krajowy Kongres Biotechnologii	<a href="http://kongresbiotech.p.lodz.pl">kongresbiotech.p.lodz.pl</a>	Contains information about second National Congress of Biotechnology in Lodz from 23-27.06.2003, only partly in English, a lot of information in polish
Under the patronage of BIO-Tech Consulting	<a href="http://www.biotechnologia.com.pl">www.biotechnologia.com.pl</a>	Is deemed to be info and news side for the biotechnology sector in Poland with details about enterprises, jobs, news from research and science, scientific laboratory material and equipment, conferences and current appointments
6 Master program of EU	<a href="http://www.6pr.pl">www.6pr.pl</a> ; <a href="http://www.fp6.pl">www.fp6.pl</a>	Information in polish/english, diverse reviews about polish biotechnology
BioInfo	<a href="http://www.bioinfo.pl">www.bioinfo.pl</a>	BioInfo.pl is the homepage of a group of Polish scientists working in the field of Bioinformatics. The site is meant to promote our scientific and academic activity. It contains several useful bioinformatics links and local services focused mainly on the prediction and analysis of the structure and function of proteins or genes.

## Annex 2: Research Institutions in Poland, Focus Life Sciences

Abbreviation	Institution	Internet	Research subjects
ADREM	The Henryk Niewodniczański Institute of Nuclear Physics, Kraków	www.ifj.edu.pl	Advanced Methods of Physics for Human Health; <b>keywords:</b> health physics, environmental physics, detection methods
Agricultural University of Szczecin	Faculty of Environmental Management and Agriculture, Faculty of Food Science and Fisheries, Faculty of Biotechnology and Animal Breeding	www.ar.szczecin.pl	Offers doctoral degree in agronomy, agricultural engineering, Teaching in biology, biotechnology, zoology, instructs in fishery and food technology and human nourishment, <b>keywords:</b> biopolymers, milk technology, meat technology, animal breeding, animal biotechnology, molecular biology
AGRPSAFE	Institute of Soil Science and Plant Cultivation Research, Puławy	www.iung.pulawy.pl	Agriculture Product (Food and Feedstuffs) Quality and Safety; <b>keywords:</b> secondary metabolism, nutraceuticals, mycotoxins, GMO
AGROPHYSICS	Polish Academy of Sciences - Institute of Agrophysics in Lublin, Lublin	www.pan.pl	Centre Of Excellence For Applied Physics In Sustainable Agriculture; <b>keywords</b> sustainable agriculture, soil, food, quality, applied physics, agrophysics
ANIMBIOGEN	Polish Academy of Sciences Polish Academy of Sciences - Institute of Genetics and Animal Breeding, Wólka Kosowska	www.pan.pl	Centre of Excellence in Genomics and Biotechnology Improving Functional Traits of Farm Animals and Quality of their Products <b>keywords:</b> molecular genetics, embryology, biotechnology, farm animals
APIS	Warsaw Agricultural University Department of Agriculture, Department of Agronomy, Department of Animal Nutrition and Feed Science, Department of Applied Entomology, Department of Biochemistry, Department of Botany, Department of Farm Management, Department of Parasitology, Department of Plant Genetics, Breeding and Biotechnology, Department of Plant Pathology, Department of Pomology and Basic Sciences in Horticulture, Warsaw	www.alpha.sggw.waw.pl	Advanced Plant Improvement for Sustainable Agriculture <b>keywords:</b> plant genetics, advanced plant improvement, biologically-based integrated pest management
Bio-Gene	University of Warmia and Mazury in Olsztyn Department of Genetics, Faculty of Biology, Olsztyn	www.uwm.edu.pl	Centre of Excellence in Modern Biotechnology of Plants <b>keywords:</b> genome analysis, molecular and genetic diversity, transgenic crops, sustainable use of genetic resources

Abbreviation	Institution	Internet	Research subjects
BRAINS	Nencki Institute of Experimental Biology, Warsaw	www.nencki.gov.pl	Bringing Research Advances in Neurobiology to Society <b>keywords:</b> molecular and cellular neurobiology, neurophysiology neuropsychology
CEMBM	International Institute of Molecular and Cell Biology in Warsaw, Warsaw	www.iimcb.gov.pl	Centre of Excellence in Molecular Bio-Medicine <b>keywords:</b> ageing, bio-medicine, protein structure
CEMET	Technical University of Gdańsk - Faculty of Electronics, Telecommunications and Informatics, Department of Medical and Ecological Electronics, Department of Sound and Vision Engineering, Gdańsk	www.eti.pg.gda.pl	Centre of MediCal Technologies <b>keywords:</b> health care technologies, networking
CENEXFOOD	Polish Academy of Sciences - Institute of Animal Reproduction and Food Research, Olsztyn	www.pan.olsztyn.pl	Centre of Excellence for Knowledge Transfer, Research and Education in Food and Health for Central and Eastern Europe <b>keywords:</b> food nutrition, bioavailability of nutrients, health
CEPAR	Polish Academy of Sciences - W. Stefański Institute of Parasitology, Warsaw	www.pan.pl	Centre of Excellence in Parasitology for Central and Eastern Europe <b>keywords:</b> parasitology, infectious diseases, parasites, host-parasite system
CERTHIC	Polish Academy of Sciences Institute of Bioorganic Chemistry, Poznań	www.ibch.poznan.pl	Center of Excellence for RNA Technologies in Health Care Improvement <b>keywords:</b> RNA, bioinformatics, capacity building
CICSA	Plant Breeding and Acclimatization Institute, Błonie	www.ihar.edu.pl	Crop Improvement Centre for Sustainable Agriculture <b>keywords:</b> plant breeding, GMO, environmental Stresses, biodiversity
CROPSTRESS	Polish Academy of Sciences The F. Górski Department of Plant Physiology, Kraków	www.cyf-kr.edu.pl	Centre of Research on the Biology of Plants Subjected to Environmental Stress in Sustainable Agricultural Production <b>keywords:</b> environmental stress, plant physiology, plant breeding
CSR	Warsaw University of Technology Faculty of Physics and Faculty of Chemical and Process Engineering, Warsaw	www.if.pw.edu.pl	Centre of Excellence for Complex System Research <b>keywords:</b> nonlinear dynamics, cardiovascular disease, surfactants, evolving networks

Abbreviation	Institution	Internet	Research subjects
DESMOL	Centre of Molecular and Macromolecular Studies Polish Academy of Sciences, Łódź	bilbo.cbmm.lodz.pl	Designed Molecules and Macromolecules, Their Assemblies and Biological Functions <b>keywords:</b> stereospecific synthesis, modified oligonucleotides, macromolecular architecture, degradable polymeric materials
EMBEU	Polish Academy of Sciences Institute of Biochemistry and Biophysics, Warszawa	www.ibb.waw.pl	Centre of Excellence in Molecular Biotechnology, <b>keywords:</b> genes, protein structure, bioinformatics
EPIMOL	Nofer Institute of Occupational Medicine, Łódź	www.imp.lodz.pl	Centre of Excellence in Molecular Biology and Epidemiology of Occupation & Environmental Cancer <b>keywords:</b> cancer, occupation, environment
FRAM	Polish Academy of Sciences, Kraków	www.cyf-kr.edu.pl	Neuropsychopharmacology in search for new perspectives to respond to the demands of emerging European society <b>keywords:</b> addiction, depression, schizophrenia, central nervous System
HEARLOSS	Nofer Institute of Occupational Medicine Department of Physical Hazards, Łódź	www.imp.lodz.pl	Centre of Competence in the field of Occupational Hearing Loss <b>keywords:</b> hearing, occupation, environment
IMMUNE	Polish Academy of Sciences Ludwik Hirszfeld Institute of Immunology & Exp. Therapy, Warszawa	immuno.iitd.pan.wroc.pl	IMMUNE-Centre <b>keywords:</b> immunology, therapy, bioethics
IP Politechnika Szczecińska	Faculty of Chemical Engineering	www.wtiich.ps.pl	<b>keywords:</b> biomaterials, polymers, elastomers
Jan Długosz University of Częstochowa	Institute of Engineering and Environmental Protection	www.is.pcz.czest.pl	<b>keywords:</b> environmental protection, water and sewage technology
MAMBA	Warsaw University Interdisciplinary Centre for Mathematical and Computational Modelling, Warszawa	www.icm.edu.pl	Centre of Excellence for Multi-scale Biomolecular Modelling, Bioinformatics and Applications <b>keywords:</b> biomolecular modelling, genomics and proteomics, metabolic pathways, grids
MolMed	The Medical University in Łódź Department of Molecular and Medical Biophysics, Łódź	www.umed.lodz.pl/MolMed/	Centre of Excellence in Molecular Medicine - Co-operation and Integration of Research and Postgraduate Training <b>keywords:</b> molecular medicine, functional biomolecules, therapeutic substances

Abbreviation	Institution	Internet	Research subjects
NELCARD	Institute of Medical Technology and Equipment, Zabrze	www.itam.zabrze.pl	Centre of Competence for Noninvasive Cardiostimulation Technology <b>keywords:</b> intensive care, rehabilitation, reanimation, non-invasive diagnostics
NUTREPRO	Polish Academy of Sciences The Kielanowski Institute of Animal Physiology and Nutrition, Jabłonna	www.6pr.pl/coe/midi/data/588.html	The Centre of Excellence for Research, Integration and Education in Animal Physiology of Nutrition and Reproduction <b>keywords:</b> physiology, nutrition, reproduction
PAGEN	Polish Academy of Sciences Institute of Plant Genetics	www.igr.poznan.pl	Centre of Excellence in Plant Agrobiolgy and Molecular Genetics <b>keywords:</b> genomics, cytogenetics, plant resistance, crop improvement
PAM Pomeranian Medical University, Szczecin	Faculty of Medicine, International Hereditary Cancer Center	www.hereditarycancer.net	Critical role of genetics in cancer prevention and treatment, <b>keywords:</b> DANN testing, cythogenetics, clinical and molecular genetics, cell genetics, histopathology, cytology
PERFECT	The Children's Memorial Health Institute, Warsaw	www.czd.waw.pl	Paediatric Research Centre - Focusing on Effective Child Treatment <b>keywords:</b> metabolism, genetics, nutrition, cardiology, oncology
POLMARF	Polish Marine Fishery Science Centre Sea Fisheries Institute, Gdynia	www.mir.gdynia.pl	Polish Marine Fishery Science Centre <b>keywords:</b> marine science, fishery
PomoCentre	Research Institute of Pomology and Floriculture, Skierniewice	www.insad.pl	Research Centre of Excellence in Sustainable Pomology <b>keywords:</b> sustainable pomology, biotechnology, food safety
PPTCRF	Institute of Tuberculosis and Lung Diseases, Warsaw	http://www.igichp.edu.pl	Prevention Pathophysiology and Treatment of Chronic Respiratory Failure <b>keywords:</b> COPD, epidemiology, rehabilitation
PROFOREST	Forest Research Institute in Warsaw, Warsaw	www.ibles.waw.pl	Protection of Forest Resources in Central Europe <b>keywords:</b> forest protection, forest resources
ROSREBIOS	University of Łódź Faculty of Biology and Environmental Protection, Łódź	www.biol.uni.lodz.pl	Reactive Oxygen Species Reactions in Biological Systems <b>keywords:</b> reactive oxygen species, oxidative stress, antioxidants, ageing
STEC	Jagiellonian University Medical College, Kraków	www.cm-uj.krakow.pl/	Stem Cell Therapeutics – Excellence Centre <b>keywords:</b> progenitor cells, differentiation, cell therapy, plasticity

Abbreviation	Institution	Internet	Research subjects
SUPERB	Adam Mickiewicz University Institute of Molecular Biology and Biotechnology, Poznań	main.amu.edu.pl	Speeding up Restoration of International Excellence in Molecular Biology and Biotechnology at the Adam Mickiewicz University in Poznań <b>keywords:</b> molecular biology, biotechnology, education
TRAGEN	Institute for Building Mechanization and Electrification of Agriculture in Warsaw, Poznań	www.6pr.pl/coe/midi/data/ 616.html	Transfer of Knowledge in Agricultural Engineering <b>keywords:</b> agricultural engineering, animal production, crop production, gaseous emissions
UG & AMG, Intercollegiate Faculty of Biotechnology, Gdańsk	Faculty of Biotechnology: Department of Molecular and Cellular Biology, Department of Molecular Virology, Department of Biotechnology	www.biotech.ug.gda.pl	
UMCS, Maria Curie- Skłodowska Uni versity in Lublin	Faculty of Biology and Earth Science: Institute of Microbiology and Biotechnology	www.umcs.lublin.pl/?akcja =str&id=114&lang=1	Biotechnological methods in environmental protection, <b>keywords:</b> molecular biology, molecular virology, plant protection, molecular diagnostics
WAMADAIREC	University of Warmia and Mazury, Faculty of Food Science, Institute of Dairy Science and Technology Development, Olsztyn	www.uwm.edu.pl	Warmia and Mazury Dairy Excellence Centre <b>keywords:</b> dairy technology, quality management, food safety & health
Gdansk University of Technology	Chemical Faculty Department of Food Chemistry, Technology and Biotechnology	www.pg.gda.pl/chem/Kated ry/Zywnosc/index_EN.htm	rational design of chemotherapeutic agents, production and application of recombinant proteins; chemical engineering - mass transfer in bubble column reactors, heat transfer, <b>keywords:</b> food technology, enzymes production

### **Annex 3: Polish Companies in Biotechnology and Biomedicine**

<b>Company</b>	<b>City</b>	<b>Web</b>	<b>Profile</b>
A&A Biotechnology	Gdynia	www.aabiot.com	Instrumentation and enabeling technologies for molecular biology
A.G.A Analytical	Warsaw	www.aga-analytical.com.pl	Distributor of scientific reserach apparatus
AB-Electronics	Torun	www.abel.com.pl	Supplier for research, farmaceutical, industrial, microbiological laboratories, universities, environmental protection inspectorates
ABO Grażyna Boreysza	Gdańsk	www.abo.com.pl	Molecular Biotechnology laboratories supplier
Adamed Sp. z o.o.	Czosnow	www.adamed.com.pl	New generation of drugs for cardiology, psychiatry, pulmonology, gynecology and treatment of urinal tract infections.R&D for diabetes, venous thromboembolism (VTE), tumors.
Aflofarm Sp. z o.o. Farmacja Polska	Pabianice	www.aflofarm.pl	R&D and Production of pharmaceuticals
AGROPHARM S.A.	Tuszyn	www.agropharm.com.pl	Contract manufacture of pharmaceuticals
AKOR Laboratories Sp. z o.o.	Gdańsk	www.akorlaboratories.com.pl	Trade company in field of molecular biotechnolgy
AKWAWIT S.A Pharmaceutical Industry Enterprise	Leszno	http://www.akwawit.com.pl	Production of ethanol and lactic acid based on natural biotechnology
ALAB Sp. z o.o.	Warsaw	alab.com.pl	Physicochemical, microbiological, diagnostic laboratories apparatus supplier
ALBA THYMENT Sp. z o.o.	Poznań	www.albathymment.com.pl	The companies aim is developing and manufacturing healing substances from plants. The research area is phytotherapy and aromatherapy.
Anna Drozd Chartered Patent Attorney Chancellery	Wroclaw		Intellectual and industrial property protection for Biotechnology
APON Andrzej Zawadzki	Żyrardów	www.apon.com.pl	The company occupies in wrapping from artificial materials
Atest Sp zoo	Kielce	www.atest.pl	Research, control, technological laboratories supplier
Baxter Terpol Sp. z o.o.	Warszawa	www.baxter.com.pl/	Baxter focuses on help people with illnesses such as: hemophilia, cancers, immunity disorders, kidney illnesses
Bayer Sp. z o. o.	Warszawa	www.bayer.com	Bioscience
Bio Gen	Warsaw	www.biogen.com.pl	DNA testing (paternity)
bioArcus Sp. z o.o.	Warsaw	www.bioarcus.com.pl	Advanced environmental protection methods, bioremediation

Company	City	Web	Profile
Biocheffa	SOSNOWIEC	www.biocheffa.pl	Pharmaceutical Research and Production Plant
Bio-Chic Ltd.	Warsaw	www.bio-chic.pl	Contract R&D, consultation in cosmetic and pharma products.
Bio-Gen Sp. z o.o.	Opole	www.bio-gen.pl	Genetic engineering and biotechnology, animal and plant breeding and environmental protection
BIOGENET	Warsaw	www.biogenet.com.pl	Distribution and service of laboratory and research apparatus
Bioinfo Bank	Poznan	www.bioinfo.pl	Environmental biology (analytics, ground sanitation, enzymes)
BIOMED Institute of Biotechnology, Serum and Vaccines	Warsaw	www.biomed.waw.pl	BIOMED Sera and Vaccines Production Plant for sera, vaccines and other biopreparations indispensable for prophylaxis of infections, medical diagnostic procedures and epidemiology.
BIOMED Sp. z o. o.	Lublin	www.biomed.lublin.pl	Principle of company's activity is production of vaccines, serums, healing and diagnostic preparations
bioMérieux Polska Sp. z o.o.	Warsaw	www.biomerieux.pl	Production and sale of diagnostics reagents and automatic systems for medical analysis in fields: microbiology, immunoserology, clinical chemistry and hemostasis, moreover food, cosmetics and pharmaceuticals quality control.
BIO-RAD Polska Sp. z o.o.	Warsaw		"Bio-Rad Polska Sp. z o.o." is a section of Bio-Rad Laboratories - one of the biggest biotechnological and diagnostic concerns in the world
Bio-Tech Consulting	Lodz	www.biotechnologia.pl	Bio-Tech Consulting is the leading supplier of business and sciences information from Poland, Russian Federation and other Eastern Europe countries.
BioTechMed	Lodz	www.biotechmed.pl/	The company's activities are in fields: health protection, new biomaterials, radiopharmaceuticals, cosmeceuticals and molecular diagnostics
BIOTON S.A.	Warsaw	www.bioton.pl/	Manufacturer of clinically important modern drugs, including recombinant human insulin, cephalosporine, aminoglycoside and macrolide groups
BIOWET Drwalew S.A.	Drwalew	www.biowet-drwalew.pl	Bioveterinarian Industry Plant
Biowet Puławy Sp. z o. o.	Puławy	www.biowet.pl	Producer of veterinary preparations, vaccines and sera (GMP)
BTL Sp. z o.o.	Łódź	www.btl.com.pl/	The company specializes in production of several kinds of biopreparates
C.K.B Good Clinical Practice Polska Sp. z o.o.	Grudziac	www.gcp.com.pl	GOOD CLINICAL PRACTISE Polska is a dutch company which offers service related to clinical analysis.

Company	City	Web	Profile
Carl Zeiss Sp. z o.o	Poznan	www.zeiss.pl	German manufacturer of optical systems, industrial measurements and medical devices
Celon Pharma Ltd.	Lomianki	www.celonpharma.com	R&D and production of Bio Pharmaceuticals
Chema-Elektromet Spółdzielnia Pracy	Rzeszów	www.chema.rzeszow.pl	The company offers 60 various products, principally for dentists and dermatologists.
Clinical Research Centre Ltd.	Warsaw	www.clinicalresearch.pl	Clinical research phase I-III, bioavailability and bioequivalence.
Clinmark Clinical Research	Piaseczno	www.clinmark.pl	CRO type company conducting clinical trials in phases I-IV.
Cyntfarm Sp. z o. o.	Pruszków	www.cyntfarm.com.pl	Polish producer of multiple-ingredient pharmaceutical preparations.
CytoGen-Polska Sp. z o.o.	Ryczów	www.cytogen.com.pl	Representative of manufacturers of medical and biological analysis equipment from many countries
Danisco Biolacta Sp. z o.o.	Olsztyn	www.danisco.com	Microbiological media and cultures
De Ville Biotechnology	Raszyn-Rybie	www.deville.com.pl	Leading supplier of equipment and consumables to microbiological labs all over Poland.
DNA II Gdańsk	Gdansk	www.dnagda.com	DNA-Gdańsk is a research-based company. We deliver reagents, equipment and services for molecular biology, biotechnology, genetics and molecular diagnostics.
Dolisos Sp. z .o.o.	Warszawa	www.dolisos.pl	Dolisos based on modern biology and technology progress, developed effective homeopathic drugs
DONAU LAB Sp. z o.o	Warszawa	www.donau.com.pl	Importer and distributor for stomatology companies
Dr. Irena Eris Laboratorium Kosmetyczne	Piaseczno	www.drirenaeris.pl	R&D Cosmetics and cosmoceuticals
ESPEFA	Kraków	www.espefa.com.pl	Production and sale of medical products that comply with high standards of quality, effectiveness and safety
EurX Sp z o.o.	Gdansk	eurx.com.pl	EURx is a research and development-oriented biotechnology company.
Farmapol Spółka z o.o.	Poznań	www.farmapol.pl	Manufacturing and sale of pharmaceutical products and dietetic products
FATRO Polska Sp. z o.o.	Kobierzyce	www.fatro-polska.com.pl	The company produces powder- and liquid-veterinary preparations.
Filofarm Sp. z o. o.	Bydgoszcz	www.filofarm.com.pl	Cosmetic creams and pharmaceuticals industry
GF MICROSYSTEMS SP. z o.o.	Poznan	www.gfmicrosystems.pl	Distribution of histopathology apparatus, microscopes

Company	City	Web	Profile
HAND-PROD	Warsaw	www.hand-prod.com.pl	Medicines, laboratory reagents and medical equipment for hospitals, pharmacies, Scientific Research Institutes
HANTPOL	Warsaw	www.hantpol.com.pl	Environmental monitoring, bioremediation
Hasco-Lek S.A.	Wroclaw	www.hasco-lek.com.pl	GMP certified contract manufacturing of soft gelatine capsules and tablets for pharmaceutical and nutraceutical industries
Herbapol S.A.	Lublin	herbapol.com.pl	Phytopharmaceutical company
HEXAL POLSKA Sp. z o.o.	Warszawa	hexal.com.pl	Develops, produces, and markets modern generics
HOMEOFARM Sp. z o.o.	Gdańsk	homeofarm.pl	Contract manufacturing, chemical research, medicines registration
Igena (representation of AMRESCO company)	Cracow	www.igena.com.pl	Representative of a company "Amresco"
IMFORM Sp. z o.o	Warsaw	www.imform.pl	CRO Phase I -IV services
Jelfa S.A. Pharmaceutical Enterprise	Jelenia Gora	www.jelfa.com.pl	The Company's main business profile is manufacturing of pharmaceuticals for human and veterinary therapy that constitutes 98% of total sales revenues. The remaining business activities are trading and services related to the main operations, production and sales of energy media, as well as breeding and sales of testing animals, all of which are of marginal importance in terms of generated turnover.
Kendromed Sp. z o.o	Wroclaw	www.kendro.com.pl	Products for medical, laboratory, industrial, analysis design
KIECANA CLINICAL RESEARCH Ltd.	Warsaw	www.kiecana.com	Full Service contract research organization (CRO) Phases I-IV clinical trials to the pharmaceutical and biotechnology industries.
LABO-PLUS Sp. z o.o.	Warsaw	www.laboplus.pl	Laboratory apparatus distributor
Lek Sp. z o.o.	Pruszków k/W-wy	www.lek.com.pl	The company occupies in pharmacy, drugs without recipes (OTC) and veterinary.
LGC Promochem Sp. z o.o	Lomianki	www.lgcpromochem.com	Exclusive European distributor for ATCC cultures and bioproducts, LGC Promochem is also committed to providing the latest research tools to life science researchers across Europe
MDS Pharma Services Poland Ltd.	Cracow	www.mdsp.com	Service provider of innovative solutions in drug discovery and development
Medana Pharma Terpol Group S.A.	Sieradz	www.terpol.pl	Is a leader of pediatric drugs and vitamin preparations
MERANCO	Poznan	www.meranco.com.pl	MERANCO control measuring and laboratory apparatus
MERCK Sp. z o.o	Warsaw	www.merck.pl	Fine Chemicals for life science industry
monipol Ltd.	Cracow	www.monipol.com	CRO Phase I -IV services

Company	City	Web	Profile
MP Biomedicals, Inc.		<a href="http://www.mpw.com.pl">www.mpw.com.pl</a>	Manufacturer of products for life science, fine chemical and diagnostic products
MPW Med-Instruments	Warsaw	<a href="http://www.mpw.com.pl">www.mpw.com.pl</a>	Constructing, manufacturing, selling, and servicing laboratory and medical equipment.
NZOZ Centrum Badań Klinicznych Sp. z o.o.	Warsaw	<a href="http://www.clinicalresearch.pl">www.clinicalresearch.pl</a>	CRO clinical research phase I-III, bioavailability and bioequivalence
Oceanic Cosmetics	Sopot	<a href="http://www.oceanic.com.pl">www.oceanic.com.pl</a>	Cosmetics, dermatology
Osteomed Warsaw Centre of Osteoporosis and Calcium Metabolism	Warsaw	<a href="http://www.osteomed.pl">www.osteomed.pl</a>	Clinical research site and private clinic. Conducting clinical studies Phase II, III and IV
P.P.H. Kosmed	Głubczyce	<a href="http://www.kosmed.pl">www.kosmed.pl</a>	Leading company in the cosmetic and pharmaceutical sector, provides the net of pharmacy wholesalers and pharmacies
PEKTOWIN Sp. z o.o.	Jaslo	<a href="http://www.pektowin.bip.bazy.pl">www.pektowin.bip.bazy.pl</a>	Fruit- vegetable industry, Enzymes (amylases, pectinases, proteases)
PGF Cefarm Sp. z o. o.	Dywity	<a href="http://www.cefarm-olsztyn.pl">www.cefarm-olsztyn.pl</a>	Wholesale trade of drugs, pharmaceuticals, bandages, herbs, cosmetics and medical equipment
POLATOM	Otwock	<a href="http://www.polatom.pl">www.polatom.pl</a>	Radioisotope centre POLATOM is the principal Polish producer of radioactive materials.
Polfa Kutno S.A.	Kutno	<a href="http://www.polfakutno.pl">www.polfakutno.pl</a>	Pharmaceutical company, which focuses on anti-diabetic drugs, urinary tract drugs, cardiac drugs, analgesics, osteoporosis drugs
Polfa Lublin S.A.	Lublin	<a href="http://www.polfa.pl">www.polfa.pl</a>	One of the Poland's biggest manufacturers of infusion fluids and medical materials made of plastic
Polfa Tarchomin S.A.	Warsaw	<a href="http://www.polfa-tarchomin.com.pl">www.polfa-tarchomin.com.pl</a>	Polfa Tarchomin S.A. is the largest producer of antibiotics in Poland and it has 180 years' tradition.
POLGEN S.C. Paweł Machejko, Mariusz Kwiatkowski	Łódź	<a href="http://www.polgen.pl">www.polgen.pl</a>	Laboratory equipment company
POLON Sp. z o. o.	Łódź	<a href="http://www.polon-farm.com.pl">www.polon-farm.com.pl</a>	Apart from the production of medicines used in migraine prophylaxis, in Parkinson and other diseases, "POLON" has been improving its activities on the antiseptics market
POLPHARMA S.A	Starogard Gdanski	<a href="http://www.polpharma.com.pl">www.polpharma.com.pl</a>	Drug and farmaceutical ingredients development
PPH Galfarm Sp. z o.o.	Kraków	<a href="http://www.galfarm.com.pl">www.galfarm.com.pl</a>	Pharmaceuticals
PPHU BIOFARM	Poznan	<a href="http://www.biofarm.pl/en/ogolne.php">www.biofarm.pl/en/ogolne.php</a>	R&D, Production of medical drugs.
PRECOPTIC Co.	Warsaw	<a href="http://www.precoptic.pl">www.precoptic.pl</a>	Engineering company
PROFARM Sp. z o.o.	Lebork	<a href="http://www.profarm.com.pl">www.profarm.com.pl</a>	Pharmaceutical and Cosmetic Production Company

Company	City	Web	Profile
PROSEN NZOZ	Warsaw	www.prosensmo.com	Clinical research company
Prospecta Sp. z o.o.	Warsaw	www.prospecta.pl	Metalurgy and Biotechnology Distributor for chemical substances and biotechnological laboratory equipment for foreign companies.
Proteina	Łódź	www.proteina.com.pl	Production of Collagen, Elastin, Hydrolyzed keratin and Silk
Quintiles Poland Ltd	Warsaw	www.quintiles.com	Contract research organization: clinical trials and registration of medicinal products
Sanofi-Synthelabo		en.sanofi-synthelabo.com	
Scan-Anida Pharmacy Ltd.	Kraków	www.scananida.com.pl	Manufacturing company with a long-term and well-established position on the Polish market
SCHWARZ PHARMA AG	Monheim	www.schwarzpharma.com.pl	Cardiovascular specialist
SULPHUR ZDROJ Exim Pharmaceutical Enterprise	Busko-Zdrój	www.sulphur.com.pl	R&D and Production Plant for pharmaceuticals
SYMBIOS Sp. z o.o.	Straszyn	www.symbios.com.pl	Apparatus and reagents for biotechnology companies
Synteza Sp. z o.o.	Poznań	www.synteza.com	Producer of substances for chemical, cosmetic and consumer industry as well as active substances for pharmaceutical industry
TIB MOLBIOL Sp. z o.o.		www.tib-molbiol.com	Custom synthesis of oligonucleotides
TK Biotech	Warsaw	www.tkbiotech.com.pl	Biotechnology development for medical use
Tominex	Wroclaw	www.tominex.com.pl	Offers systems for cell segregation, agents for breeding, laboratory equipment
Trial s.c.	Warsaw	www.trial.pl	First Polish company specializing in clinical trials.
Trigger	Tarnobrzeg	www.trigger.pl	Environment purification, bioremediation
Tubal Ltd.	Wiazowna		Producing high quality polyethylene tubes for the cosmetic, food, pharmaceutical and pharmaceutical-related industries.
UNIA Chemical Plant Manufacturing Cooperative	Poznań	www.unia.pl	Unia is manufacturing and selling household chemistry products
W.L.Electronics, Bruker – Service	Poznań	www.bruker.poznan.pl	Bruker Optics offers advanced laboratory equipment
Ziololek Sp. z o.o.	Poznań	www.ziololek.com.pl	Pharmaceuticals and Cosmetics

**Notes:**



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