

Evaluation of the Research and Professional Activity of the Institutes of the Czech Academy of Sciences (CAS) for the period 2010–2014

Final Report on the Evaluation of the Institute

Name of the Institute: Institute of Biotechnology of the CAS, v. v. i.

Fields, in which the Institute registered its teams:

Biochemistry and molecular cell biology, biophysics, virology, ...

Observer representing the Academy Council of the CAS: Karel Aim

Observer representing the Institute: Jiří Neužil, substitute observer Bohdan Schneider

Commission No. 6: Biochemistry and molecular cell biology, biophysics, virology

Chair: Professor emeritus Morten Kielland-Brandt

Date of the visit of the Institute: November 16th, 2015

Programme of the visit of the Institute: see attached Minutes from the visit

Evaluated research teams:

No. 1 - Development of Diagnostic and Therapeutic Procedures;

No. 2 - Structural Biology and Protein Engineering

A. Evaluation of the Institute as a whole

1. Introduction

The institute consists of two large teams, No.1 dealing with Development of diagnostic and therapeutic procedures, formed by 6 subgroups, and No.2 dealing with Structural biology and protein engineering, formed by 4 subgroups.

The teams are composed of young, internationally already well recognized, enthusiastic top scientists, with exciting scientific program and excellent publication record.

Team No.1, (leader Jiří Neužil), is formed by subgroups focusing on a complex approach to the research of human diseases with considerable impact on the population health. The subgroups are the Laboratory of Reproductive Biology, Laboratory of Molecular Therapy, Laboratory of Gene Expression, Laboratory of Molecular Pathogenetics, Laboratory of Tumour Resistance and the Laboratory of Immunopathology and Immunotherapy. The studied topics include molecular aspects at the level of genetic regulation of selected pathologies, to biological, biochemical and proteomic studies that are relevant both to the genesis and progress of the pathologies, and identification of relevant diagnostic biomarkers. Within the evaluated period the average number of employees increased from about 20 to 30, of which researchers were from 10 to 15. The scientific output is impressive, 113 publications, 5 chapters, 1 patent and 12 applied results.

Team No.2, (leader Bohdan Schneider), is formed by 4 subgroups, Laboratory of biomolecular recognition, Laboratory of ligand engineering, Laboratory of structural biology and the Laboratory of structure and function of biomolecules. The number of researchers in this team nearly doubled during the evaluating period; number of other workers increased from 2 to 9. The age structure is very promising for the future. The main objective of the team research effort is to investigate important proteins and nucleic acids from the biotechnological and medical point of view. In spite of the only recent formation of the team and some of its subgroups, the publication outputs reach above 90, mostly in excellent journals.

Unique research approaches and an optimistic attitude of the employees formed a very positive picture of the Institute.

The institute and its future **Core Facility** are generally equipped with top quality, most recent instrumentation and technology. The future **CMS (Centre of Molecular Structures)** at the BIOCEV is well recognized on the national and international landscape. It belongs to Czech Infrastructure for Integrative Structural Biology, CIISB, CEITEC, Instruct-CZ. The build-up of the CMS is performed very systematically, and is well under way to become a state-of-the-art, world-class centre, equipped with the instruments and personnel to carry out cutting edge research.

2. Strengths and Opportunities

The whole institute has a very good scientific output, representing a good balance between high impact papers and many applied results. The majority of the publications were internationally excellent. The research is mainly oriented toward basic research; however, it is open to possible practical applications in the biomedical area. The basic research is well organized and involves mainly structure-function studies of proteins, as well as low-molecular-weight substances as potential drugs, bioinformatics and protein engineering. The research programs of each of the subgroups are good and clear. One of the subgroups, showing low productivity over a longer period, discontinued its activities in 2014.

The institute has a good rate of grant application success at national and international grant agencies. The age structure of the whole institute is promising for the future, consisting mostly of young scientists and a sufficient amount of experienced ones. The number of students is reasonably high.

The future plans of the teams are highly innovative and form a realistic research plan for 2015-2019; most of the projects have already sufficient grant support. Promising is the extensive collaboration with top laboratories in Czechia and abroad, which already produced a lot of good outputs. The activity of the Institute in the area of research and science popularization is very high, as well as in the field of practical applications of the basic research, which resulted in collaboration with the company Novozymes A/S (Analysis of three-dimensional structures of bacterial enzymes) and with the “Institut de recherche Pierre Fabre” (Human glutamate carboxypeptidase II). The Institute has applied for a Czech and international patent.

Institute of Biotechnology is one of the founding institutes of the newly designed and built BIOCEV institute, the potential of which is already now recognized by an international review as the Centre of Excellence in European Science.

3. Weaknesses and Threats

No obvious weaknesses were found.

The main **threat** to the future development is the decrease of institutional funding, the need to focus on insecure mid-term funding schemes, insufficient funding for upgrades and updates of more sophisticated and expensive instrumentation to keep up the excellent competitive edge.

So far, costs of patent and IP issues are taken from the limited budget of IBT, because the office for transfer of technologies and Intellectual Property, planned for BIOCEV, is delayed. Negative trend would also be presented by a fast **growth of administrative overhead**.

4. Recommendations

The excellent strategy to invest resources into talented young researchers (from a not too large Czech scientific budget !), and to send them to spend time in the world's best laboratories (e.g. in US, England, France, Australia), has shown very good results in highly efficient budget spending. Upon return to Czech Republic, they can compete with their peers in the best laboratories, as demonstrated by the highly respectable publication list in international journals. It would be useful for the Direction of the Czech Academy of Sciences to evaluate how efficient is direct budget support on training of Czech scientists and junior group leaders in foreign laboratories (including the contributions to International Research Organizations). Comparing how many scientists are trained with the budget should help find the most efficient way of supporting them.

It may be useful in the future to focus the research on a smaller number of topics. In this way a given project could be possibly studied from several aspects, and thereby increase the depth of the knowledge gained. This may be of even more importance after the institute moves to the BIOCEV location, requiring possibly additional coordination of work with other teams.

5. Detailed evaluations

Declaration on the quality of the results and share in their acquisition

Original research results have been achieved and published in all of the principal research directions.

The scientific output of the Institute of Biotechnology as a whole is very high; results are reported in internationally highly recognised journals, and many papers were published in journals with very high IF. Most of the outputs from Phase I are in the category

“internationally excellent” and the members of the teams have good shares in their acquisition. Number of citations is also high.

The dynamic structure of IBT, in which laboratories are closed, merged, and new are formed, indicates efforts of the institute to maintain and increase quality of the research and teams.

The team of Directors and the managing Board should be congratulated on providing an excellent working environment and motivation for young researchers. The Institute of Biotechnology should continue to participate in the world-class research.

Declaration on the involvement of students in research

Bachelor, master and PhD students are coming from several Czech universities. The number of students involved in the research work is very good. The pedagogical activity of the team is also very wide; the teaching load on the members of the team is high.

Declaration on societal relevance

The results achieved by the teams of the Institute are of significant societal relevance.

Declaration on the position in the international and national context

The achievements of the Institute are recognized nationally and internationally, as proved by the successful collaborations with foreign institutions. These collaborations are very good, and available facilities using state-of-the-art equipment and approaches allow fulfilling the plans.

Declaration on the vitality and sustainability

The age structure of the Institute, together with the gender balance of employees, is promising and advantageous for a long term successful work. In addition, enough students are involved in the research, yielding continuous supply of further young researchers.

Declaration on the strategy and plans for the future

The research plans of the subgroups for the next period are exciting; most of the projects already have sufficient grant support. Additional improvement can be expected from the added value given by the move to the new campus in the end of 2015, providing availability of unique core facilities of BIOCEV and the other teams working there. Future plans are concise and clear.

B. Evaluation of the individual teams

Evaluation of the Team No. 1: Development of Diagnostic and Therapeutic Procedures

Team leader: Jiří Neužil (Institute of Biotechnology of the CAS)

1. Introduction

The team consists of 6 subgroups, focusing on a complex approach to the research of human diseases, with considerable impact on the population health. The subgroups are the Laboratory of **Reproductive Biology**, Laboratory of **Molecular Therapy**, Laboratory of **Gene Expression**, Laboratory of **Molecular Pathogenetics**, Laboratory of **Tumour Resistance** and the Laboratory of **Immunopathology and Immunotherapy**. Studied topics include molecular aspects at the level of genetic regulation of selected pathologies, to biological, biochemical and proteomic studies that are relevant both to the genesis and progress of the pathologies, and identification of relevant diagnostic biomarkers. Within the evaluated period the average number of employees increased from about 20 to 30, researchers from 10 to 15. The scientific output is impressive, 113 publications, 5 chapters, 1 patent and 12 applied results.

2. Strengths and Opportunities

The whole team has a very good scientific output, representing a good balance between high-impact papers and applied results. Majority of the publications are cited as internationally excellent. The Team has applied successfully for several grants, at national and international grant agencies.

Age structure of the team is promising for the future, consisting mostly of young scientists, collaborating in groups with the more senior and experienced scientist.

The Team is in extensive collaborations with top laboratories in Czechia and abroad, resulting in many good outputs.

One of the subgroups with a low productivity for a longer period was discontinued in 2014.

3. Weaknesses and Threats

No obvious weaknesses.

For potential threats, see the remarks in the Evaluation of the Whole Institute above,

4. Recommendations

The number of the research topics in the team could be perhaps in the future somewhat lowered, allowing more in-depth analysis of projects, from several aspects.

5. Detailed evaluations

The scientific output of the team as a whole is significant; many papers were published in journals with high IF. Most of the outputs are in the category “internationally excellent”; number of citations is high.

Number of students involved in the research work is high, the age structure well distributed. Activity in the area of research popularization, and pedagogical activity of the team is impressive; teaching load of the members high.

The national and international collaborations are extensive; available facilities are equipped with the most modern state-of-the-art instruments and techniques.

Future plans of the Team are highly innovative, with a realistic research plan for 2015-2019. Most of the projects planned have already sufficient grant support.

Evaluation of the Team No. 2: Structural Biology and Protein Engineering

Team leaders: Bohdan Schneider , J. Dohnálek

1. Introduction

The team is composed of young, internationally already well recognized, enthusiastic top scientists, with an exciting scientific program and an excellent publication record.

Main activity areas are: **Structure-assisted drug design**, aimed at the development of small-molecules targeting human glutamate carboxypeptidase II (GCPII) that could be used as imaging or therapeutic modalities. **Protein engineering**, combining techniques of *in vitro* protein evolution and of computer modelling for targeted modulation of protein properties.

Structural bioinformatics, as a tool to better understand biomolecular structures of nucleic acids and proteins. **Structure-function studies of proteins**, based on employment of modern methods of structural and biophysical molecular analysis including x-ray crystallography.

2. Strengths and Opportunities

The main orientation of the research team is toward basic research. It also recognizes and realizes any opportunities for possible practical applications in the biomedical area. The basic research is well organized and involves mainly structure-function studies of proteins, as well as low-molecular-weight substances as potential drugs, bioinformatics and protein engineering. There is an exceptional opportunity offered by the ELI facility (unique European Laser Facility near Prague); this may open new directions for research.

Members of the team have participated very actively in **planning and construction of the BIOCEV institute, and should be congratulated for excellent work**. J. Dohnálek, head of the Laboratory of Structure and Function of Biomolecules, provided significant input in the design, planning and realization of the **unique core facilities of BIOCEV**. The Head of the Laboratory of Biomolecular Recognition, B. Schneider, designed biophysical facilities for the BIOCEV, which were the first in operation.

The number of researchers in this team doubled during the evaluating period.

3. Weaknesses and Threats

No weaknesses noted.

For potential threats, see the remarks in the Evaluation of the Whole Institute above,

4. Recommendations

To continue in the planned activities; this will certainly lead to even higher publication activities. Elaboration and execution of joint projects with ELI should be encouraged and supported.

5. Detailed evaluations

The results are reported in internationally highly recognised journals with very high IF, and a Czech and an International patent application, dealing with modelling of targeted modulation of protein properties. The achievements are recognized nationally and internationally, as demonstrated by several successful collaborations with top foreign institutions.

Results achieved by the team are of significant societal relevance. The practical applications of the basic research resulted in collaboration with company Novozymes A/S (Analysis of three-dimensional structures of bacterial enzymes) and with the “Institut de Recherche Pierre Fabre” (Human glutamate carboxypeptidase II).

Activities by the team leaders have been pursued in European research infrastructures, e.g. INSTRUCT and ELIXIR.

Bachelor, master and PhD students from several Czech universities are involved in the research projects.

There are excellent perspectives for further successful research activities and results, future plans are concise and clear.

Date: December 16, 2015

Commission Chair: Professor emeritus Morten Kielland-Brandt