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 Physiology 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: Ladislav Vyklický, substitute observer Jiří Pácha

Commission No. 6: Biochemistry and molecular cell biology, biophysics, virology
Chair: Professor emeritus Morten Kielland-Brandt

Date of the visit of the Institute: November 16, 2015
Programme of the visit of the Institute: see attached Minutes from the visit

Evaluated research teams:
No. 2 - Bioenergetics; No. 4 - Membrane Transport Biophysics; No. 12 - Genetics of Model Diseases; No. 14 - Membrane Transport; No. 19 - Protein Structures

A. Evaluation of the Institute as a whole

1. Introduction

The Institute of Physiology (director: Jan Kopecký) with its approximately 400 employees and more than 140 researchers, with long traditions is dedicated to fundamental biomedical research focusing on physiological and pathophysiological processes on the field of neurophysiology, cardiovascular physiology and metabolism. The organization of the Institute follows to a large extent this pattern, i.e. the division of heart-brain-metabolism, but there are intense collaborations between groups belonging to different sections. Also, the central service departments (such as IT, animal facility and radiometry) and some of the teams (e.g. Biomathematics and Genetics of Model Diseases) do not strictly belong to any of the three main sections/departments. The Institute has a very good publication record with 28 and 66 papers in the first decile and quartile journals, respectively; while in the evaluation period the majority of their publications fall in lower category journals, they published a good number of papers in high-profile journals (e.g. Nature, NAR, PNAS). The pedagogical activity of the Institute is also very strong, marked by more than one BSc, MSc and PhD students per senior scientists (many of them giving university lectures) and by 70% participation of the students in the publications; most importantly, the graduate school program in biomedicine is an excellent initiative, which will most certainly have a long-term positive impact. The Institute also organizes successful regular science popularization events for the general public. Via contributing to Strategy AV21, the Institute has the opportunity to influence the strategic development of the country's science policy, with particular attention of health-related questions.
Commission 6 evaluated 5 teams, and had the opportunity to visit several laboratories. In addition to consultations with the director and members of the Institute Board, we had ample time to discuss informally with senior and early stage researchers from different teams.

2. Strengths and Opportunities

The main strength of the Institute is the critical mass of experienced researchers representing complementary expertise. The leaders of the Institute also clearly see the advantage of multidisciplinary approaches and the resulting synergism. This is made possible by modern, up-to-date infrastructure. Collaborations with clinical centers provide excellent opportunities both in identifying important problems and elucidating basic problems related to human diseases. Cutting-edge core facilities at BIOCEV will considerably broaden the opportunities to perform world class research at a relatively close location, with 6 teams directly involved from the Institute of Physiology.

3. Weaknesses and Threats

While the Commission did not identify immediate weaknesses or threats, we agree with the assessments of the director and Board that low salaries and weakening (rather than increasing) grant support sets limits to the productivity and international competitiveness.

4. Recommendations

While advantages of multidisciplinarity and synergism and of the central facilities are well recognized in the Institute, the Commission had the impression, in all institutes visited at the Krc Campus of CAS, that with more efforts and coordination, at the expense of autonomy of institutes, central facilities for the entire campus could be beneficial to all sides: via purchasing expensive top-notch instruments, which can hardly be exploited fully by a single research group or yet alone by one institute, and could be operated most efficiently by highly professional personnel; the Campus could also benefit from joint IT facilities, technology transfer and patent offices.

5. Detailed evaluations

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

The scientific output of the Institute is very good, with substantial shares of the Institute. The production to a large extent stems from many traditionally very well operating research teams.

Declaration on the involvement of students in research

The involvement of students is excellent; and also the PhD school in biomedicine.

Declaration on societal relevance

By nature, biomedical research has high societal relevance. The Institute appears to make all efforts to realize the benefits from this; at the same time, they also pay strong attention to science popularization.

Declaration on the position in the international and national context

The Institute and its research teams are well known and acknowledged on the international scenes – with numerous collaborations with excellent partners and participating in a good number of major international / EU projects. In the national context; they are in privileged position; also participating in the Center of Excellence network in Czechia.

Declaration on the vitality and sustainability

The long tradition, excellent infrastructure and expertise, the involvement of talented PhD students, the international links and the very good output of the Institute warrant excellent vitality and sustainability.

Declaration on the strategy and plans for the future

The strategic plans are clearly determined and follow the Institute's mission.

B. Evaluation of the individual teams

Evaluation of the Team No. 2: Bioenergetics

1. Introduction

This research group – focusing on the physiology of mitochondria – is in a transitional state as concerns the group leader, after Dr. Houstek's retirement and Dr. Mracek's assignment in 2014, and, to some extent, also regarding the research directions. Their primary interests are on the (i) assembly of mitochondrial protein complexes and supercomplexes, (ii) human diseases caused by mutations in assembly factors of these enzyme complexes, (iii) mitochondrial reactive oxygen species production and (iv) the role of mitochondria in the pathophysiological presentation of common diseases.

The Team consists of 6 senior and 1 young scientists, 2 postdocs and 4 PhD and 2 BSc students and 2 technicians. Their productivity on these research areas is very good: 34 papers in refereed journals of high standards. The team also shows very good activity in higher education and outreach to popularize science.

2. Strengths and Opportunities

The main strengths of the team are the long history and experience, along with an excellent infrastructure in the Institute, the steady production and international collaborations, and the presence of enthusiastic and experienced scientists. Choices of fields and projects have been excellent; they reach from very fundamental questions to clinically relevant questions and are at the same time quite coherent, assuring a good critical mass of researchers for each field. This offers good opportunities on this important research.

3. Weaknesses and Threats

As in all cases, transitions pose some threats – although in this case no real threat can be identified based on the written material and the on-site visit.

4. Recommendations

The Team should be supported and helped through any possible difficulties related to the transitions.

5. Detailed evaluations

Quality of the results and share in their acquisition

The productivity of this team is very good (36 papers), with 1/3 and 1/14 papers in the first decile/quartile in journal and citation ranking, respectively, and– what can be deduced from the text - with significant contributions by the team members.

Involvement of students in research

In the past 5 years, 2 BSc, 2 MSc and 1 PhD theses were defended.

Societal relevance

Team members serve(d) in different panels, committees and editorial boards; they were also involved in organizing (mostly national) meetings; and participate in popularization of science.

Position in the international and national context

The position of the team – based on its publication records - is of good standard both on the national and international levels.

Vitality and sustainability

We expect that the new team leader, with the help of the former leader and senior colleagues, will make strong efforts to reorganize the team in a way preserving its qualities. The excellent infrastructure, very good publication records, the invaluable expertise and national and international collaborating partners all suggest very good chances for perfect vitality and sustainability

Strategy and plans for the future

The strategy is divided into short- and long-term phases – essentially suggesting continuity with some new features and emphases, e.g. on cancer research. This suggests to me that the first task is to stabilize the position of the group and to gain some leeway to reshape the research strategy – along the lines of the most successful projects.

Evaluation of the Team No. 4: Membrane Transport Biophysics

1. Introduction

The research group, headed by Petr Ježek, – focusing on biophysical aspects of the role of mitochondria in physiological and pathophysiological processes - is a relatively large one, with very good productivity, also paying attention to applications, and popularization of science.

2. Strengths and Opportunities

Probably the main strength of the Team is in their composition: 13 researchers and 4 non-researchers and an ideal age structure (4 members are older than 40 and 7 members are between 30 and 40). Also positive assets in the hands of the Team: innovative approaches, excellent collaborating partners, the availability and use of outstanding core facilities, and efforts to use technology transfer and to translate their knowledge to oncological therapy. These offer excellent opportunities and warrant the conditions for a very good future.

3. Weaknesses and Threats

The scientific output of the Team is not proportional to their large size. This might be explained by the fact that the majority of the group members are still young.

4. Recommendations

The productivity should be increased in order to offer suitable career plans to the young researchers in the Team.

5. Detailed evaluations

Quality of the results and share in their acquisition

Although it could be larger in number, the quality of the production of this group is very good (31 IF papers, 1 chapter, 3 applied result), with 1 and 9 papers in the first decile and quartile, respectively in journal ranking; the corresponding values in citation ranking are 4 and 2.

Involvement of students in research

Relatively low: 1 BSc and 1 PhD theses were defended.

Societal relevance

Very good activity.

Position in the international and national context

The position of the group – based on their publication records, collaborating partners, the variety of national and European grants, editorial activities - is of high standard both on the national and international levels.

Vitality and sustainability

The excellent infrastructure and publication records, excellent collaborating partners suggest very good chances for perfect vitality and sustainability; nevertheless, the outputs should be improved.

Strategy and plans for the future

Shows clear vision and leadership.

Evaluation of the Team No. 12: Genetics of Model Diseases

1. Introduction

The Team, headed by Michal Pravenec performs genetic analysis of metabolic syndrome using spontaneously hypertensive rats. Their size is relatively small, but the scientific output is impressive. The genetic models created by the Team are attractive and potentially important in medicine, therefore high quality national and international collaborations strengthen their scientific work.

2. Strengths and Opportunities

The research program of the Team is interesting and well balanced. Their scientific output is excellent; many papers were published in high impacted journal. In addition the number of citations is good; the quality of citations is very good.
The modern animal facility using state of the art approaches to derive transgenic rats makes the Team very attractive for extensive collaborations. The Team excellently uses this facility. High quality national and international collaborations produced a lot of very good publications. Also, they have high grant success at national and international grant agencies. The Team has realistic research plan for 2015-2019, most of the projects already have sufficient grant support.

3. Weaknesses and Threats

The age structure of the Department is not optimal, it has a bimodal structure.
The number of students involved in the research is relatively low.
The number of projects is relatively high compared to the number of active members of the Team. Therefore there is a risk of defocusing the research.
Their outreach activity is a bit limited.

4. Recommendations

The age structure of the Department should be changed in order to increase sustainability of the Team. The Team leader should find a deputy. They should attract more young scientists. The activity of the Team in the area of research popularization should be increased.

5. Detailed evaluations

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

The scientific output of the Team is excellent; many papers were published in high profile journals; also the number and quality of citations is very good/excellent.

Declaration on the involvement of students in research

The number of students involved in the research work is relatively low. This could be probably due to the fact that the group has relatively small size. The pedagogical activity of the Team is also limited.

Declaration on societal relevance

Studies in animal models of human complex diseases (such as hypertension, cardiac diseases, insulin resistance etc) are of high societal relevance.

Declaration on the position in the international and national context

The Team has very good and fruitful national and international collaborations because of the attractive modern animal facility using state of the art approaches to derive transgenic rats and the strong expertise in quantitative genetics.

Declaration on the vitality and sustainability

For their strong link to clinical sciences, excellent infrastructure, expertise and international collaborations, the vitality and sustainability of the Team is high.

Declaration on the strategy and plans for the future

The Department has realistic research plan for 2015-2019, most of the projects already have sufficient grant support.

Evaluation of the Team No. 14: Membrane Transport

1. Introduction

The Team, headed by Hana Sychrová, is dedicated to the study of membrane transporters in yeast, along 3 lines of action: potassium and pH homeostasis in yeast cells, transporters of pathogenic Candida species as targets for the development of new antifungal drugs, and transporters from non-conventional osmotolerant yeast species for biotechnology and food industry. A unique collection of yeast mutant strains was created that may serve as a tool for the study of new transporters and their modulators. The Team is internationally well known and has been involved in several European funded projects.

2. Strengths and Opportunities

The Team is strong and very well positioned in terms of international collaborations, as evidenced by the number of international networks and by outputs. Most of the outputs in the evaluation period had (a) member(s) of the present team as the first and/or last author, places in author lists that by convention in the field indicate primary contribution in terms of work, design, ideas or discoveries. The team activity resulted in new techniques and yeast models that attract foreign students and partnerships, and add value for applied research. A specific strength is the expertise in studying fundamentally important biological phenomena with genetic tools in a powerful model organism. Another important strength is the strong involvement in national and international teaching, scientific community activities and outreach to the general public.

3. Weaknesses and Threats

The major threat is the potential decrease of productivity due to the reduction of the team size. However, a team this strong should not have difficulties obtaining relevant grants, the most common bottleneck for increasing their size.

4. Recommendations

We recommend the Team to follow their future plans, which are detailed and well conceived. We also recommend short-term stabilisation of the full-time personnel in the Team by attracting more PhD students and postdocs.

5. Detailed evaluations

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

The number of outputs and quality from Phase I, the citation profile, and the journal impact of the publications are all very good. In addition and in particular, we are impressed that most of the articles in the evaluation period had (a) member(s) of the present team in positions indicating primary contributions

Declaration on the involvement of students in research

There has been supervision activity and thesis defences at all three student levels during the period. The number of PhD theses defended is low (2). However, in the last years several students and postdocs from 5 foreign countries visited the Team to learn techniques. The Team plans enlarging the number of students and post-docs and stabilising the full-time personnel.

Declaration on societal relevance

The basic research is planned to be complemented with some oriented and applied research in health industry and biotechnology. It is expected to have positive and important societal impact, although not immediately and not in ways that are easily foreseen.

Declaration on the position in the international and national context

The Team has an excellent record of partnerships in national and international consortia, and is internationally highly recognized among yeast researchers.

Declaration on the vitality and sustainability

The Team shows initiative and ability to maintain and enhance skills and to attract national and international funding.

Declaration on the strategy and plans for the future

The plans for the future are clear and will develop the Team skills in both basic and applied research.

Evaluation of the Team No. 19: Protein Structures

1. Introduction

During the evaluation period the Team, headed by Veronika Obšilová included 4 researchers and 4 PhD students. They investigate how the biological activity of protein complexes is regulated using various biochemical and biophysical approaches. In particular, they focus on 14-3-3, which recognizes phosphorylation motives of phosphoserine and phosphothreonine such as neutral trehalase Nth1, regulator of G protein signalling 3 and phosducin. Furthermore the DNA-binding domain of transcription factor FOXO4 and its interaction with DNA, the thioredoxin-binding domain of ASK1 kinase and its interaction with thioredoxin and the interaction between cytoplasmic domains of TRP channels and their binding partners were studied.
The publication record of the Team is very good, including all major biochemical journals

2. Strengths and Opportunities

The small Team is well equipped and has access to and uses the state of the art instruments for structural analysis and protein interaction studies, such as steady-state and time-resolved fluorescence spectroscopy; circular dichroism; analytical ultracentrifugation, dynamic light scattering; small angle X-ray scattering (SAXS); protein crystallography; hydrogen/deuterium exchange coupled to mass spectrometry, surface plasmon resonance and differential scanning fluorimetry. Their research projects are very interesting and the available equipments provide a solid base for successfully carrying out these projects. The Team has good age distribution.

3. Weaknesses and Threats

There are no major weaknesses and threats.

4. Recommendations

In the next period, the Team could invest into international collaborations, increasing possibilities of obtaining international support. The group may wish to consider extension of their studies to neutron scattering techniques in European facilities.

5. Detailed evaluations

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

The Team has provided several very interesting findings during the evaluation period. The 14-3-3 protein-dependent activation of yeast neutral trehalase Nth1 significantly contributes to the understanding of the role of the 14-3-3 proteins in the regulation of other enzymes.

Declaration on the involvement of students in research

The involvement of students (PhD/MSc/BSc students: 7/4/1) is remarkably high when compared to the size of the Team.

Declaration on societal relevance

The analysis of FOXO factor and the apoptosis signal-regulating kinase, which plays a key role in the pathogenesis of multiple diseases, have a high societal relevance. This also counts for the Transient Receptor Potential (TRP) channels from which some are directly activated by chemical ligands and/or physical sensory stimuli.

Declaration on the position in the international and national context

The Team is internationally visible and acknowledged.

Declaration on the vitality and sustainability

The broad technical arsenal, interesting projects and plans, and the expertise of the young, talented team leader warrant good vitality and sustainability.

Declaration on the strategy and plans for the future

The future strategy and research plans are clearly outlined and well defined.

Date: December 16, 2015

Commission Chair: Professor emeritus Morten Kielland-Brandt