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 Animal Physiology and Genetics of the CAS, v. v. i., Libechov

Fields, in which the Institute registered its teams:

Biological sciences including biotechnology and agricultural sciences

Observer representing the Academy Council of the CAS: Vladimír Mareček

Observer representing the Institute: Michal Kubelka

Commission No. 7: Biological sciences including biotechnology and agricultural sciences

Chair: Emeritus Professor Erick Vandamme

Date(s) of the visit of the Institute: November 2 - November 11, 2015

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

Evaluated research teams:

No. 1 - Team of Anaerobic Microbiology; No. 5 - Team of Evolutionary Biology; No. 6 - Team of Developmental Biology

A. Evaluation of the Institute as a whole

1.Introduction

The Institute of Animal Physiology and Genetics has more than 50 years of history. At present they have about 150 workers in six teams, three of which (No. 1, 5 and 6) were evaluated by Committee No 7. Annual income amounts to about 100 M CZK, about 50 percent is from Czech grants and about 8 percent derives from foreign grants There are both very experienced researchers and a lot of PhD students and young postdocs in the personnel structure. The age structure decreased from average 40.2 to 37.5 years during the evaluated period. They have published yearly 50 to 60 papers in scientific journals and the cumulative IF doubled from 109,6 to 209 during the evaluated 4 year period

2. Strength and Opportunities.

This is a nationally and also internationally recognized Institute with some excellent well-recognized researchers among the team leaders. They have some unique units – collections of anaerobic bacteria, anaerobic fungi and a range of *Bifidobacteriaceae* strains. There is also an experimental animal model facility that was significantly extended during the last period through the biomedical center PIGMOD. Their international collaboration is well granted. There were some structural changes introduced during last period and four new laboratories have appeared. They increased the impact of their research results, especially the cumulative IF of the papers. The rodents and fish research projects of the Evolutionary Biology team are proving good models; they are being used to address current general biological questions, and they have impact on applications of the reserach. We did not look at PIGMOD (Presumably Experimental Animal Models, but it has an average publication well below Evol Biol (mostly 2 and 3).

3.Weaknesses and threats.

The research groups are spread in three localization – Liběchov, Prague and Brno and work relatively independently which is a complication not only for the organization of the work but also to consolidate a research institute. Therefore they provide a picture of several individual teams rather than a uniform institute with one common goal. As estimated by the committee and based on the presentations, the overall performance fluctuates a lot between the teams from good (No.5) to average (No.1) to poor (No. 6) .

4. Recommendations.

The Institute have achieved significant positive changes during the last 4 year period: in the organization of the research, in the infrastructure and in the quality of the results. They should continue with this effort and maximize the effect of their research, especially utilizing the new experimental pig facilities and other new infrastructure. Recommendations: Need to continue investment in the rodent and particularly the fish programmes, not only the very expensive pig facility which should not be allowed to drain either financial or management resources from other groups. Need to continue to revise group structures, particularly looking at the weaker Developmental Biology. There is a need to improve student (PhD) recruitment.

5. Detailed evaluations

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

The quality of the results is good and have increasing metrics during the last 5 year period. Detailed evaluations: Evol Biol has a much better profile than other groups.

Declaration on the involvement of students in research.

There are a lot of students at different stages of their study including PhD students. The principal researchers are very well engaged in the teaching in different Czech universities. Students: Better recruitment of students should be looked at.

Declaration on the on societal relevance.

They have many activities for promotion and publicity of their research work. One of the most important is the project Mendelianum. They are also engaged in the Natura 2000 and other nature conservatiion programs.

Declaration on the position in the international and national context.

The work presented is well-recognized both nationally and internationally although it is more the sum of the impact of individual teams and researchers than a common image of the institute.

Declaration on the vitality and sustainability.

The Institute has a good personnel structure. They made some structural changes providing opportunities for a new young group leader. The average age decreased during the last evaluated period. Vitality: Structure is good, but imbalance in research strengths of the groups is a problem .

Declaration on the strategy and plans for the future.

They have a good strategy plan for the future based on their best available research results. They should need to increase their exploition of the new infrastructure, especially the new pig experimental model facility.

B. Evaluation of the individual teams

Evaluation of the Team No. 1: Team of Anaerobic Microbiology

1.Introduction

The team consists of 5 researchers with permanent positions, some technicians and other workers. The senior researchers are between 45 – 65 years of age, the other 5 workers are below 40 years of age. The research work is mainly oriented towards gastrointestinal anaerobic microbes and fungi using a broad spectrum of methodological tools: cultivation of anaerobes, their biochemical characterization and the genomics and proteomic analyses. The main host species of interests are humans, ruminants but also bumblebees and other insects. During the last five years members of the team increased their publication activity as compared to the last evaluation, nevertheless they published a total of 50 scientific articles journals with average IF from 2 to 3 over different years; these are mainly within in the second quartile. The main researchers participate in teaching at different universities and supervised research work in their lab, with M.Sc. and Ph.D. students. They also maintain a collection of anaerobic bacteria and fungi.

2. Strength and Opportunities.

This is a nationally and partly also internationally recognized team in the field of GIT anaerobic microbiology with good international collaboration. They use a broad spectrum of methods and have recently expanded into genomics. They hve produced a sufficient number of scientific publications with increasing quality level.

3. Weaknesses and threats.

There is a need to continue introducing novel methodologies and to aim at higher quality scientific results.

4. Recommendations.

The team should complete and integrate their data of the individual species into the GIT microbiome and study their interactions with the host and its changes under different conditions (age, diet, environment changes). They should make a continuous effort to improve their publication activity and also to increase the IF level.

5. Detailed evaluations

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

The quality of the results is good especially towards the end of evaluated period.

Declaration on the involvement of students in research.

In the team there are a lot of students at different stages of their study including PhD students.

Declaration on the on societal relevance.

High impact of new knowledge in this type of research field with international recognition, that have the potential for practical application.

Declaration on the position in the international and national context.

The team is well-recognized both nationally and internationally.

Declaration on the vitality and sustainability.

The team has a good age structure but they need to integrate some of the PhD student or postdocs into the permanent staff of researchers.

Declaration on the strategy and plans for the future.

The team has a clear strategy and research plan including efforts to study the complex microbiome and their interactions with different hosts. They should maintain their efforts to be member of international grant consortia.

Evaluation of the Team No. 5: Team of Evolutionary Biology

1. Introduction

There are three laboratories involved in the team, one in Brno and two in Liběchov. Their research work deals with the fish genus *Cobitis* (loaches) and with rodents (voles and mice). They are working on genetics and genomics in hybrid zones (loach and mouse) and on adaptive phylogeography; these are all research topic areas of international interest. They have a role in the national biodiversity strategy for fish genetics including carp. (i) mammalian evolution (Macholoan, House Mouse Brno), (ii) fish genetics (P. Rab, clonal hybrid systems, sturgeon, Libechov), (iii) molecular ecology (Kotik, Bank vole and snake phyogeography, Libechov).

Particular programmes are:

(i) Hybrid zones of the house mouse (*Mus musculus musculus* and *M. m. domesticus*) group using SNP analysis across >1000 SNP loci, differential gene flow between alleles on autosomes and X chromosomes alleles on autosomes and the sex chromosomes, looking for speciation genes.

(ii) Fish group shows that CGH and GISH are valuable, though technically demanding methods to discriminate chromosomes of parental species in hybrids of sturgeon. They study whether coexistence of sexual and asexual spiny loaches is mediated by parasite load in hosts, but found no relationships. They study auto and allopolyploid evolution of sturgeons and paddlefishes using an impressive range of techniques from cytogenetic to next generation sequencing approaches. The group won an award for their work in successfully cloning a fish system .

(iii) Bank Vole phylogeography group, looking for adaptive genes and building phylogenies, including in snakes and frogs. In Proc Roy Soc, they looked at profiles of genes in last glacial refugia and demonstrated in the UK two colonisations, one has now nearly replaced the other, and they link this with haemoglobin activity, and show physiological adaptive difference between the two.

2. Strengths and Opportunities

The work on clonality and polyploidy in vertebrate animals by hybridization between two sexual loach species is clearly excellent with other important projects including both fundamental outcomes and practical impacts (eg. haemoglobin types with adaptive significance; hybrid zones; producing clonal fishes). The chromosomal work is interesting, particularly with respect to the evolutionary position and genome organization on evolutionary basal fish (gars), and should be published in high profile journals.

3. Weaknesses and Threats

The fields of population genetics and gene ecology have been revolutionized in the last five years by DNA sequencing and new analysis approaches with huge volumes of genotype data. Some of this work is included in the programme, but there should be consideration of expanding the DNA analysis side of the fish work: currently there is only one post doc engaged in an area that is proving very fruitful elsewhere. There is good NGS-based SNP work done at Libechov via bank vole work; synergy with other institutes and groups in Czech Republic (eg Brno; it is unclear if there is cross over between several groups which will strengthen at least three projects). The biodiversity accessions are critical, along with phenotyping and time courses of genetic changes, and the groups here can exploit their knowledge to develop such resources. It is also important that the group extends collaborations internationally within the EU and elsewhere.

4. Recommendations

The group has excellent publications and this record must continue. They need to ensure that graduating students and younger post-docs have suitable opportunities to present their work at conferences and to be involved in collaborations, with the change to move to permanent positions in Czech Republic and internationally.

5. Detailed evaluations

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

Excellent paper profile (with 9 papers rated in research publication quality in both of grades 1 and 2), papers published in a good range of good subject journals, in e.g. Chromosome Research, Molecular Phylogenetics and Evolution, Biology Letters, Evolution, Ecology and Evolution, J Evolutionary Biology, Proc Roy Soc, Evolution, Heredity). They have a book called“Evolution of House Mouse”, which represents an excellent output of a standard reference work. The profile is good for a group of about 12 researchers, with nine grade-1 publications (plus 15 at 2 and 3; total of 120 publications).

Declaration on the involvement of students in research

Seems appropriate. Reasonable number with 0.5 PhD finished per researcher in period. Staff do plenty of teaching. 5 students in the group have deservedly won prizes for their work.

Declaration on societal relevance

The team has plenty of activities of societal relevance. Their work is most practically applied in fish farming. Income generating between 200,000 to 1,500,000 CZK/year. They have written popular texts too, including on evolution in humans. They promote their work through two Czech journals (in Czech). The provide genetic analysis to fish farms – an expert activity required by law, bringing in up to 50k EUR/yr and supporting legal framework: this is an example of good applied research.

Declaration on the position in the international and national context

There contribution in the book Fish cytogenetics (5 out of 20 chapters) is clear recognition of the lead the group is taking in fish genetics. Their work on adaptive genes is also cutting edge. They have internationally shared projects too. MPI Plon, Portugal, US are significant collaborations, and clearly in contact with wide range of the fish community workers, and also the rodent population work is in an international context, although it would be good if the group were seen to bring leadership in some areas.

Declaration on the vitality and sustainability

There is a good age profile with both young and senior staff. They have plenty of research funded through national and international funded. They also have money raised through screening fish for breeders (using markers and ploidy level analyses). *Good that many younger scientists have been recognized by prizes.*

Declaration on the strategy and plans for the future

Generally, there are opportunities being followed to advance the research in the same vein which has been highly productive and is of great current interest: phylogenomics, speciation genes, and application of their findings to adaptation in terms of eg climate change or domestication. The work on emerging asexual vertebrates is a novel and important area. Some parts of the plans for using genomics and other tools to study the role of evolutionary adaptations need to be better defined as some seem generic in nature.

Evaluation of the Team No. 6: Team of Developmental Biology

1.Introduction

Developmental Biology is focused on *in vitro* studies of maturation of pig-oocyte-cumulus cell complexes and genome activation during pre- implantation bovine development. The team is small (3-4 researchers and 3 other workers). The group published 13 articles with total impact factor 46.64 (average impact factor is 3.54 per article). The majority of their articles was published in journals ranked in the 2nd quartile. The group publishes in journals related to reproductive biology of farm animals

2. Strength and Opportunities.

The group established itself in studies of female reproduction of large farm animals. This gives them original scientific perspective, as other teams mainly focus on mouse models. Studies of farm animals may result in good applied research. Pig oocyte and bovine preimplantation embryo research offers better models of human development than mouse embryo research.

3. Weaknesses and threats.

The team lacks a broader perspective oriented towards more complex studies integrating transcriptomics and proteomics. Several Ph.D. students are active in the team (0,66 per researcher) ; scientific workers were also active in basic, applied and contract research, and lectured at Charles university. The leader did not show passion during presentation of results and future plans.

4. Recommendations.

Reorientation towards complex studies is ongoing, based on collaboration with other teams in particular participation in a ERC Consolidator Grant, representing top molecular genetics research. This should result in publishing in top journals with high impact. Attracting more students is essential to increase the critical mass. Stronger leadership is highly encouraged.

5. Detailed evaluations

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

Their works appear in journals related to reproductive biology.

Declaration on the involvement of students in research.

Moderate involvement (2 Ph.D., 2 M.Sc., and 1 B.Sc.)

Declaration on the on societal relevance.

High relevance to important issues related to farm animals production.

Declaration on the position in the international and national context.

The team is well-recognized in national context and is well recognized on international context.

Declaration on the vitality and sustainability.

Age structure is good with both young and experienced scientists. Transition in the leader position may be necessary.

Declaration on the strategy and plans for the future.

The team provides feasible future research plans. However, ambitious objectives originated from the group are missing.

Date: December 15, 2015

Commission Chair: Emeritus Professor Erick Vandamme