

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: Biology Centre of the CAS, v. v. i., Ceske Budowice

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: Vladimír Košťál, substitute observer Jaroslav Vrba

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. 2 - Biochemistry and physiology; No. 3 - Biosystematics and ecology; No. 4 - Ecology and conservation biology; No. 5 - Molecular cytogenetics; No. 6 - Molecular genetics; No. 7 - Plant virology; No. 8 - Photosynthesis; No. 9 - Fish and zooplankton ecology; No. 10 - Aquatic microbial ecology; No. 12 - Soil microbiology and soil chemistry; No. 13 - Soil zoology and soil microstructure; No. 15 - Evolutionary parasitology; No. 18 - Fish parasitology

A. Evaluation of the Institute as a whole

1. Introduction

This is one of the largest Institutes of CAS. Its aim is to conduct research and education at highest international level and in this they are being successful, indeed it is amongst the top institutes in CZ. There are 19 teams with an expectation of 20 teams in near future. The teams work across 5 institutes: **entomology**, **parasitology**, hydrobiology, soil biology and **plant molecular biology**, the areas highlighted were reviewed here. The campus has two sites and a field site in Papua New Guinea.

2. Strengths and Opportunities

The institute is running 131 grant projects (31 funded overseas), contributing to about half of their budget. Amongst these are 15 projects in FPVII, generating □7.35M.

They have groups that are excellent with high potential to get considerable overseas funding.

The Institutes research paper output is impressive, publishing over 300 papers per year in international journals (inc. Science, Nature, Cell and key subject journals). There has been a modest rise in grant income over the last three years.

We were pleased to see that the institute has a management board of 15 members that includes both internal and external representatives.

3. Weaknesses and Threats

The current structure is the result of a merger of 5 formerly independent institutes ; improving interaction and cooperation between these “ institutes” is needed but is an ongoing process, while each research institute develops its own typical research and study area. There is an increasing trend for collaboration (joint publication, project and EU funding). There is a e-annual report available, covering the Biology Centre as a whole entity. It has about 600 employees, of which about 230 are researchers (85 foreigners). The largest part (58%) of the budget is spent on salaries. Mechanisms need to be found to provide the Institute with flexibility in their budget, so it can build in strategic areas, but this is also dependent of the CR system of science funding

4. Recommendations

The Biology Centre has centralised its collections based on the recommendation of the previous evaluation. We applaud that decision, and their desire to make the collections widely available. However we feel insufficient attention has been paid to risk of e.g. fire and flood to that collection, at the very least a risk register and contingency plans need to be considered (see also evaluation to team 3).

5. Detailed evaluations

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

Many results generated by this Institute are excellent. We would like to highlight in particular the exemplary work of the following teams, which are conducting research at the highest international level: No. 4 - Ecology and conservation biology; No. 5 - Molecular cytogenetics; No. 10 - Aquatic microbial ecology; No. 15 - Evolutionary parasitology. There is much excellent work, but some groups can elevate their performance and/or may be isolated (see below).

Great work is being published by the Institute scientists, and some of this could have been placed in the most prestigious of journals. We encourage staff to further their international profile through the organisation of international conferences and arranging sessions at key international events. The Institute could also invite editors of major journals e.g. Nature, Science etc to visit to showcase the excellent activity.

Declaration on the involvement of students in research

The involvement of students is excellent, there are 100 PhD students, in 9 doctoral study programmes, working with much international collaboration.

Declaration on societal relevance

Public engagement is good and covered over many different events, in 2014 there were nearly 300 media outputs, including 19 on TV. We commend the Institute for its technology transfer office. The Institute gets ≈ 0.5 M in contract research, and has generated 3 licenced technologies (2012 – e.g. antiparasitic vaccines). We recommend that the Institute considers generating a policy statement on how to recognise the value of applied research, so it can be appropriately considered alongside theoretical research.

Declaration on the position in the international and national context

The Institute is ambitious and its outputs are excellent.

Declaration on the vitality and sustainability

The Institute is ambitious to maintain and build upon their current position, as evidenced by recent applications to H2020 projects including to a large research infrastructure fund (SoWa), and an ERC advanced grant.

Declaration on the strategy and plans for the future

A clear ambitious strategy for the future.

B .Evaluation of the individual teams

Evaluation of the Team No. 2: Biochemistry and physiology

1. Introduction

Research in this team focuses on the analysis responses of insects to physiological and environmental stresses. Physiological stresses include toxins, insecticides, entomopathogenic organisms, exercise and senescence, whereas environmental stresses are caused by temperature extremes, unfavourable seasons, photoperiodism and global environmental changes. The team consists of four laboratories: insect physiology, insect diapause, applied physiology of insects and analytical biochemistry and metabolomics.

2. Strengths and Opportunities

The strength of the team is the interdisciplinary approach used to analyse these stress responses, the establishment of new techniques to analyse these processes and the employment of model systems, such as *Drosophila*, which allow the analysis of multiple knock-out mutants for functional analyses. The team overlooked the opportunity to include mutants in epigenetically and small-RNA regulated processes, which play important roles in these processes, though recent papers produced indicate this as a major future research topic.

3. Weaknesses and Threats

One weakness is to not have sufficiently considered the importance of epigenetics and small RNAs, we recommend that this direction of research is considered (see 2.)

4. Recommendations

The power of the *Drosophila* system should be reconsidered for more comprehensive genetic and functional analysis; however recently several papers were published in this field , indicating the interest in this topic (see 3) .

5. Detailed evaluations

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

The quality of the results is overall very good. Particular the T-toxin data and the bark beetle modelling system are excellent and have great applied perspectives.

Declaration on the involvement of students in research

The involvement of bachelor, master and PhD students is very good.

Declaration on societal relevance

Highly relevant to applied and basic research in ecology, crop protection and predictive plant protection.

Declaration on the position in the international and national context

The work of the team is nationally and internationally visible. The output is quantitatively and qualitatively very good.

Declaration on the vitality and sustainability

The prospects are good, but the team needs support by younger researchers.

Declaration on the strategy and plans for the future

The plan towards the application of more robust quantitative analytical methodology and bioinformatics is very timely and essential for staying competitive at the international level. The employment of further *Drosophila* mutants for functional analysis needs urgently to be reconsidered.

Evaluation of the Team No. 3: Biosystematics and ecology

1. Introduction

There are five labs in this group and some 21 PIs and postdocs. The research work aims to describe and understand biodiversity through collections and species description, covering molecular, experimental and theoretical/ mathematical approaches. The group is very strong in taxonomy, phenotype research and biodiversity studies on collections. The collections are used for experimental work, which is very important to ensure they are exploited. The group has considered opportunities for experimental areas of biological research, including DNA-based work, behavioural studies and modelling. In this context, the collection is actively used to implement modern research techniques. It was good to see the start of the new lab of Integrative Ecology. There is also valuable international research exchange ongoing.

2. Strengths and Opportunities

With respect to collections and taxonomic investigations, these are internationally important and the group has a world-class programme on collections and conventional analysis of diversity in mayflies (1,000,000 accessions, probably the world's largest, and an appropriate size given the diversity and abundance of this group). This collection is complemented by internationally-important work focussing on the national diversity of moths, spiders, aphids and parasitoids and nematodes, and some bacteria. Such collections and geographical information, along with the

associated, long-term, specialist knowledge, leading to important publications (including monographs), underpin all biological research. The group appreciates current questions in phylogeny and taxonomy, not only with respect to biodiversity sampling, but also co-adaptation of plant-pollinators and co-phylogeny of nematodes and their parasites. They have valuable thoughts and work on the roles of refugia, metapopulation dynamics, and impact of gene inflow from outside.

3. Weaknesses and Threats

The DNA work is not fully integrated into their programmes. The modelling work presented and published is not yet reaching international standards; some of the predator-prey work is well-understood and correct, but follows 50-year old models; this seems to be still the method to follow in theoretical ecology. The research on predator-prey is very innovative and integrates population and behavioural modelling.

4. Recommendations

The collections are not stored in state-of-the-art conditions and seem to have no appropriate fire, water and biotic attack protection given their importance and archival significance. The collection storage conditions should be upgraded as a national project (rather than as funding to the group), and risks to the collection formally assessed and mitigated. It was also felt important that the website for the collections be upgraded to include images and information about the collections, so it is more available; again this is international infrastructure. The population ecology and gene flow work and modelling needs to be strengthened, but not at the cost of the vital systematic and collection work. Integration of work on DNA, including phylogeny, needs further strengthening and integration into the programme.

5. Detailed evaluations

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

There are outstanding publications on taxonomy, particularly of mayflies, supported by detailed collections and analysis. Two monographs (Mayflies of Europe; Peatlands of Sumava), 228 articles, 1 patent. Given the area, the papers are well cited.

Declaration on the involvement of students in research

There is a good numbers of students given the relatively unfashionable research area.

Declaration on societal relevance

Collaborations - about 50 different groups – this seems good. Researchers are on many editorial boards and play a roles in conference organization (2 international conferences and 9 programme committees). Public engagement is wide with local papers and books and there is a good range of teaching.

Declaration on the position in the international and national context

There are many important collaborations across the country, Europe and particularly with the USA.

Declaration on the vitality and sustainability

There is a good age distribution, with a significant peak of people in their 30s, and involvement of students.

Declaration on the strategy and plans for the future

A very modern approach is given in the documentation. The aquatic insect research is very valuable, leading to understanding of complex food-webs, as are topics such as taxonomy of fossil insects and forest pest aphids. Parasitoids are also emerging as both an opportunity and a threat, and an important development for research. The team is considering the application of their research to biological control and Integrated Pest Management. A number of well-focused questions are being asked, each suitable for external grant funding: When do parasites regulate population dynamics? How do spatial and temporal environmental heterogeneity influence diversity at different scales? To what extent is local species composition and diversity controlled by dispersal limitation and regional species pool?

Overall, an excellent range of research based on high quality invertebrate collections and knowledge.

Evaluation of the Team No. 4: Ecology and conservation biology

1. Introduction

This team focusses on “fundamental ecological and phylogenetic mechanisms generating and maintaining biodiversity” and “practical measures and theoretical underpinning for conservation biology”. They are a superb, dynamic group across the full range of activities from research to outreach. This is a relatively small young team (8 staff under 40) but with a large number of PhD students (30). A great deal of the team’s work is centred around the Institute’s field research station in New Guinea, called Wanang, in a country with 5% of global biodiversity. The site includes 50 ha forest plot, part of an international forest plot network, and opportunities to study a gradient from rainforest to mountain habitat. At this site they have developed rich foodwebs, a product of 60 person years of work. They have several themes to their work (1) Tropical foodwebs, (2) ant species interactions, (3) occurrence and distributions of Czech butterflies and (4), conservation activities. The team are doing and planning manipulative experiments, including e.g. studying the influence of ant body size on social insect interactions and species invasion. In this work the team is assembling huge, impressive datasets, with international collaborators, including large-scale databases on tropical plant-herbivore food webs (>250,000 records), on the ecology and molecular taxonomy of tropical ants and moths (>30,000 DNA barcodes), on detailed distribution of moths and butterflies in the Czech Republic (>1,500,000 records).

2. Strengths and Opportunities

The team is doing extremely well across a broad range of activities.

3. Weaknesses and Threats

The team is growing fast, and with that growth, it should make sure that it keeps a coherent focus, that all students remain fully involved. Perhaps it will prove necessary to introduce management structures into that activity.

4. Recommendations

This is a fabulous group, that really needs little advice, but perhaps bringing in metabolites and biochemistry to better understand food web dynamics may prove fruitful. In addition, the team could, perhaps, engage more fully in conservation issues nationally and globally.

5. Detailed evaluations

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

The team has a fantastic paper profile, 10 papers in categories 1 and 2 of paper Quality profile (in category 1 there are 4 papers – published in Science, Nature, PNAS). The group has 127 papers, 1,836 citations in WoS. The Science paper had a commentary from one of the worlds leading ecologists (Professor May), a paper in Journal of Animal Ecology was the Editors choice.

Declaration on the involvement of students in research

There are a large number of students, who are fully integrated into the project.

Declaration on societal relevance

There is much societal relevance. There is much evidence of outreach activities, including regular (averaging to monthly), publications in CZ media, including a documentary film in Czech and English. They have applied research too, looking at biodiversity in e.g. restored limestone quarries. There are also conservation effort in New Guinea as well, work that lead to a United Nations Development Programme (UNDP) prize, from which the local community will receive money.

Declaration on the position in the international and national context

They have a large number of international collaborators and are taking lead roles in the key outputs of this collaboration. They can elevate their profile in the political and international science arena through deeper participation in international science policy forums and key international conferences.

Declaration on the vitality and sustainability

The group's ambition is to double in size in period 2015-2019, to add focuses on e.g. plant –vertebrate interactions, phylogenetic ecology, chemical ecology. The group has an application for ERC advanced grant funding to compare longitudinal gradients of biodiversity and are leading a consortium with GACR funding. The future for this group remains rosy.

Evaluation of the Team No. 5: Molecular cytogenetics

1. Introduction

This is a small team (3 research scientists, 1 post doc and 1 research assistant, 2 technicians and 2 PhD students) that focuses on plant genome structures and plant repetitive DNA. They are expert in the biology of all classes of repetitive element and have additional high levels of expertise in bioinformatics.

2. Strengths and Opportunities

The group are leading in studies on plant repetitive DNA, and their expertise is widely sought by many scientists interested in plant evolution and plant genomes. The group has developed an internationally important bioinformatics pipeline called RepeatExplorer (RepeatExplorer, which currently has over 400 registered scientists running >10,000 jobs/year). This software was developed to analyse the short reads coming from NGS datasets. They published their analytical pipeline in BMC Bioinformatics (2010). The graph-based clustering approach presents repeats in a graphical form, without the need for reference database and it has utility without a reference sequence database. It is this later property which gives the pipeline such wide application.

3. Weaknesses and Threats

The bioinformatics approach of the group is underpinned by RepeatExplorer which they developed. The utility of the pipeline may decline with new technologies as long read lengths become available in high volume. However the group is fully aware of this threat and are indeed pioneering the development of these technologies too (e.g via collaboration with Oxford Nanopore to develop MinION).

4. Recommendations

The group are doing very well and we encourage them to continue working as they are.

5. Detailed evaluations

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

The group is highly productive and publishing prolifically in excellent journals (many in the 1* category, e.g. PNAS, New Phytologist, Plant Cell, PLoS Genetics and others) that are also well received as judged by the high quality of the journals carrying citations. In addition they have generated significant software called RepeatExplorer of high international importance and used widely by many researchers.

Declaration on the involvement of students in research

Appropriate

Declaration on societal relevance

Their work has high societal relevance, impacting in particular agricultural genomics.

Declaration on the position in the international and national context

Due to international demand for access to RepeatExplorer and its associated tools, the group have written the software to be functional through Galaxy, now supported through the ELIXIR-CZ consortium. RepeatExplorer provides a great deal of outreach and services. The team also run annually workshops attended by 35-40 participants from labs around the world, which offer a thorough practical training. We commend the team for all this work.

Declaration on the vitality and sustainability

The outlook for this group appears excellent. Funding levels are currently very good, and are in place until 2018. The Elixir infrastructure funding they have too will enable the group to further develop RepeatExplorer. They are also advertising for students abroad which we commend. The group will also hire a new post-doc in the near future.

Declaration on the strategy and plans for the future

The group's plans are excellent and we confidently predict much further success.

Evaluation of the Team No. 6: Molecular genetics

1. Introduction

The group's work is mainly oriented to the basic research in the non-model plant species, hop, of special economic and cultural importance in CZ; also applied aspects are studied. They propose three distinct topics - 1) Genetic determination of metabolome pathway connected to prenylflavonoid and lupulin production in hop, 2) Pospiviroid diseases and molecular mechanisms of viroid pathogenesis, 3) Bifunctional plant nucleases with anticancerogenic potential. Projects are currently run by 7 researchers, 4 technicians, and 2 Ph.D students. In the presentation the group provided us results mainly obtained from topic 1).

2. Strengths and opportunities

The group engineers prenylflavonoid pathway in lupulin glands by applying knowledge of regulatory mechanism of *Arabidopsis* anthocyanin biosynthesis pathway at transcriptional level and modulates the pathway by over-expressing transcription factors in hop. In theory, the group will have practical outputs, addressing complex real species. With affordable sequencing costs, and enormous amounts of biological molecular genetics for model organisms, there is a great opportunity to apply molecular genetics to hops. The group has elucidated (by transfer from *Arabidopsis* in particular) key pathways for lupulin and some flavonoids. It has developed a transformation pathway, identified various transcription factors, and is studying the molecular genetics of emerging viroid diseases. Since 1991, there has been a pathway to use of new genetics in hops in new varieties. The team gave a useful account of some breeding targets.

3. Weakness and threats

Seven researchers working on three distinct projects does not provide for an effective focus and outputs are not particularly strong for this effort. There is no good genetic map and no mention of a segregating population was made.

4. Recommendations

We recommend to better optimize hop transformation by testing different cultivars and growth conditions to flower hop in greenhouse, if relevant. While a focus on hop is defensible, given the scale of the group it would be good to see it working on the

range of modern methods underpinning plant breeding: testing their transcription factors in transformation systems, large scale genotyping, mapping of traits (including QTLs) with several segregating populations, marker development, tissue culture. These can link to the needs of industry including disease (viroid work was interesting) resistance and quality parameters.

This topic is one where the public will be interested and can be educated about the value of research. It is important that the group becomes engaged with outreach about the team's activities.

Field evaluations, mapping populations and QTL analysis needs to be more integrated so as to extract more information and benefit from such multidisciplinary.

Research with impact can include substantial novelty and give world-class results by characterizing novel features of the studied crop.

Work on the agricultural impact and sustainability of the hop crop (including with viroids and disease related genes) is needed

The range of transcription factors should be fully characterized using the excellent transformation system

The group is isolated and small. It would be much better integrated with other groups working with genomics, orphan crop breeding, metabolomics and molecular genetics.

The genomics and molecular genetics was not targeted enough and was following

It was felt important that the group engage with media and public understanding much more.

5. Detailed evaluations

Declaration of quality of the results and share in their acquisition

During the period they published 20 articles in journals with impact factor, one chapter in book, 9 contributions to proceedings. Since their work is oriented to applied research, their publications appear in specialized journals with relatively lower impact factor. On the other hand they filed one patent and 8 applied results. The team was able to apply modern, but now standard, methods to understand key metabolic pathways in hops. As reflected in the output profile, there have been few publications of major significance. However, other minor crops have more publications of high profile.

Declaration on the involvement of students in research

Currently two Ph.D students are involved in the research. The group invites students from Germany to the group for a short period.

Declaration on societal relevance

They organize international conference -Viroid. Dr. Matousek is not so keen about their hop research being featured in press but it will be beneficial for the group to some extent. The group exploits plant nuclease as anti-cancer drug with lower side

effects. Hop research is of importance for agricultural production and sustainability, the brewing industry and cultural importance in the country. However, the attitude to media enquiries and lack of public engagement was a significant concern of the commission.

Declaration on the position in the international and national context

Their hop work will be able to fulfill the demands from brewer industry. The group has a good number of international collaborations and knowledge of the challenges facing the hop crop, and breeding aims in Europe and the US.

Declaration on the vitality and sustainability

The group has several transcription factors in their hands to induce gene expressions of enzymes involved in prenylflavonoid pathway but not many transgenic hop plants are available at present. Better optimization of condition for *Agrobacterium*-mediated transformation is likely to be the key to be sustainable. With a very small number of staff, and retirements or being on leave, the group is not clearly sustainable in its present form, and as a single-crop project, does not balance alongside other research teams.

Declaration on the strategy and plans for the future

To engineer metabolic pathway in hop they proposed miRNA/degradome approach in the future research plan, however, CRISPR/Cas system appears to be suitable for genome engineering. Or EAR motif-mediated transcriptional repression (Kagale S and Rozwadowski K, 2011 Epigenetics 6, 141-146) would be helpful as repression works in dominant manner. The viroid aspects presented are good and address a need of the industry.

Evaluation of the Team No. 7: Plant virology

1.Introduction

The structure of the current group has changed in 2014, resulting in a change of direction. Currently there are a small number of researchers, approximately 1 Ph.D. student and 1 Masters student focus on plant viruses and phytoplasmas. They established methods to access compounds harboring antiviral activity. They identify viruses, sequence their genomes, analyze and elaborate sequence data based on the evolutionary point of view.

2.Strengths and opportunities

With global movements of crops and other plants, there is an ever-increasing need for pathogen diagnostics, control and resistances. During the course of the work, the team has found plant viruses, rhabdovirus and apple mosaic virus (ApMV), including work with lichen viruses that have not been reported so far. In collaboration with the Institute of Organic Chemistry and Biochemistry they developed improved methods to access antiviral activity of several compounds. They have some public engagement activities and teaching, as well as in the State phytosanitary administration.

3.Weakness and threats

The team has started to change their strategy to focus on plant viruses rather than agricultural crop host plants, which the team thinks gives them an opportunity as other groups focus on particular species. However, we considers this direction has significant weakness as virology (and phytoplasmas) are not independent of their hosts. Several virus genomes are sequenced, however, what are the biological relevances of the sequence results? The publishing of research in subject-matter journals is somewhat unambitious and outputs could be stronger.

4.Recommendations

Reconsider strategies to study only the viruses: plant-virus interactions, signalling, resistance mechanisms and diversity of plant species are all critical to virus studies. The phytoplasma work is also important, but needs to be fully integrated into the biology of the plants studied. Overall, a much more holistic approach is required, which can be done with powerful new techniques. As was noted, by the team, mixed infections are frequent –again indicating to us that the focus should not be on the virus only. More ecologically oriented research will be implemented.

5.Detailed evaluations

Declaration of quality of the results and share in their acquisition

The discovery and analysis of plant viruses resulted in 6 papers in the field of plant pathology and virology (Eur. J. Plant Pathol., Arch. Virol.). Assessing the antiviral activity of compounds in vitro to *in planta* resulted in 4 papers in relatively specialized journals (Antiviral Res.). They developed molecular diagnostics tool for *Clavibacter michiganensis*, *subsp. michiganensis* *Pseudomonas syringae*, *Xanthomonas vesicatoria* species and this resulted in 4 papers.

Declaration on the involvement of students in research

Two students are currently involved in their projects as well as education for transferring the knowledge to younger generation (high school level).

Declaration on societal relevance

Given the fact of difficulties in identifying and culturing phytoplasma, it is important to develop molecular diagnostic tools.

Declaration on the position in the international and national context

Their publications are largely in quality 3 (international) and national (4) positions, with very few publications in higher quartiles. It is not clear as to the number of collaborators.

Declaration on the vitality and sustainability

Currently the group is composed of small number of researchers. Attractiveness and recruitment of motivated students, as well as elaboration of future research strategies, are the key to success.

Declaration on the strategy and plans for the future

It is very likely that they are able to identify and sequence plant viruses and phytoplasmas; however, the group is not able to provide us with a clear perspective of their research. It is also possible that the groups interests are out of line with others in the institute, meaning that the team is somewhat isolated.

Evaluation of the Team No. 8: Photosynthesis

1. Introduction

This group is specialising in Light Harvesting Complexes (LHC). They have a number of topics of focus. They identify three central areas in their presentation: (1) Organisation of photosynthetic pigments, protein complex, evolution and function, (2) Spectral physics of complexes, (3) interaction of plant water regime, stomatal dependence and CO₂.

2. Strengths and Opportunities

They have obtained some important insights into photosynthetic antenna structures and spectra by studying non-model systems, notably from diatom *Phaeodactylum*, the Xanthophyte *Chromera* and photosynthetic bacteria.

3. Weaknesses and Threats

The group, although publishing well, did not present a well articulated vision for future ground breaking research, although we have no doubt that regular publications of quality will continue in the same vein as the past.

4. Recommendations

From the reported write up, we were expecting in the presentation much more emphasis on using phylogenetic approaches to study evolution and diversity of LHC from a more extensive range of algal diversity. We think that the group is well placed to exploit the exceptional good algal resources readily available and recommend that the group gives more emphasis to that direction.

5. Detailed evaluations

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

The group has generated some good papers, both in Quality Profile, and in assessment and Quality of Outputs by Citation Sources, some published in excellent journals (e.g. Phil Trans Roy Soc, PNAS, Nucleic acids research). They have 44 papers and 2 patents in the reporting period. They have a good paper profile (quality 1-3). However some of the work is a little mundane, without enough international lead distinctiveness. The best work is coming through analysis of non-model organisms.

Declaration on the involvement of students in research

Seems appropriate

Declaration on societal relevance

The staff are engaged in teaching, some public engagement at high school, some students have been invited to their laboratory

Declaration on the position in the international and national context

Work is generated of an international standard.

Declaration on the vitality and sustainability

The group age profile is not ideal, all staff are above 35.

Declaration on the strategy and plans for the future

The group are interested in evolutionary diversity of LHC and how these complexes interact and alter spectral properties of the pigments. Evolutionary approaches were not focus of the talk, but are a feature of the write up. We recommend that the group better exploit the algal diversity available at for example Trebon and elsewhere. From the presentation it wasn't so clear about the future prospect of their topic (3).

Evaluation of the Team No. 9: Fish and zooplankton ecology

1.Introduction

The Fish and Zooplankton Ecology team focused on research related to studies (zooplankton and fish) of freshwater ecosystems. The team is divide into two groups: Zooplankton Ecology Group and Fish Ecology Unit. The team has 16 staff (incl 5 post-doctoral fellows). Major subjects studied include, morphological and eco-physiological adaptations of Daphnia, species and size-specific behavioral traits in fish, adaptation of zooplankton and fish to newly formed lakes, and juvenile and adult fish distribution patterns. Average impact factor of journals is rising, achieving 2 in 2014

2. Strength and Opportunities.

Application – inspired research. 70% of team research staff are younger than 40 years old. The majority of funds originate from external sources. A patent for research vessel was granted. The team participates in EU-funded projects, which gives opportunity to link research activity with international groups.

3. Weaknesses and threats.

The scientific methods are mainly descriptive. The group should make an effort to publish paper in journals of 1* top decile and quartile. 20 papers were listed in these categories. However, these papers were ranked by experts of Phase 1 in 3rd category: “Quality that is recognized internationally in terms of originality, significance and rigor.”

4. Recommendations.

The group should incorporate molecular biology techniques as soon as possible. An extra effort is needed to publish results in higher ranked journals.

5. Detailed evaluations

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

The quality of the results is good and relevant to ecology of reservoirs.

Declaration on the involvement of students in research.

Number of students involved in the research is impressive (27 bachelor, 23 master, and 25 Ph.D.). 20 courses are lectured or co-lectured at the University of South Bohemia and Charles University in Prague.

Declaration on the societal relevance.

Very high relevance to important issues related to water management and biodiversity of fauna in reservoirs. Impressive activity in knowledge dissemination to the public – 3 books and 28 papers.

Declaration on the position in the international and national context.

The team is well recognized in national and international contexts. Higher activity in publishing in top world journals is necessary.

Declaration on the vitality and sustainability.

Age structure is good with the majority of staff being young researches.

Declaration on the strategy and plans for the future.

The team has good and realistic research plans for the future. The team is involved in H2020 project related to link between climate change and emerging and invasive species. Moreover they participate in SOWA - soil and water research infrastructure. Methodology of molecular genetics is planned to be implemented.

Evaluation of the Team No. 10: Aquatic microbial ecology

1. Introduction

This group works in the area of limnology, microbial ecology and biodiversity. They examine trophic cascades. They are specialists in food web manipulative studies exploiting exciting new labelling methods to discover the dynamics of food webs at microscopic scales. Their work impacts on the fundamental understanding of ecosystem functioning. Currently the group has 20 members, 4 members from overseas. The group lacks staff in younger age brackets. They divide their work into the following areas. [1] *Bacterial diversity and taxonomy* - Isolation and cultivation of microbes, they have unique collections of some algae, e.g. *Limnohabitans*, where they have 45 strains that are very difficult to cultivate. [2]. *Carbon fluxes to higher trophic levels* - Little is known about bacterial growth, death etc. what is the role of bacterial groups to carbon flow in food chain. They are keen to explore using innovative Fluorescence in situ hybridisation (FISH) methods to label bacteria and protists. They study using FISH bacterial populations (two genera) in freshwaters and reveal predation of these bacteria by protists. This is novel exciting work. [3] *Role of phytoplankton in limnology* - In collaboration with Spanish colleagues, they are looking at hydrodynamics in lakes, work that gives predictions on ecosystem functioning. [4] *Production of cyanotoxins and secondary metabolites in these taxa* - They have a theme looking at cyanobacterial toxicity, exploiting cultures.

2. Strengths and Opportunities

Fantastic ecological work at the microscopic level, which can be scaled to understand global freshwater ecosystem dynamics. This group is really leading pioneering approaches (FISH) to characterise food web dynamics at the microscopic scale, essential work to understand vital budgets, such as C-budget of freshwaters. This is cutting edge, world leading research. Long term data sets. Imaginative, pioneering methods. Food webs being made in the microbial world.

3. Weaknesses and Threats

The group are predominantly publishing in good subject-based journals, e.g. Applied and Environmental Microbiology, Journal of Plankton Research, European Journal of Environmental Sciences, Microbial Ecology, and in Czech journals, the latter not being useful outside of CR. The general journals include Journal of Experimental Botany and PLoS one. But given the international lead in their research, they should consider being more ambitious, journals, e.g. elife, Proc Roy Soc, PNAS, Current biol, PLOS Bio, or even higher.

4. Recommendations

Make sure that the work is getting the international profile it deserves, via conference talks, and higher impact general journals of the best of the work.

5. Detailed evaluations

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

They have a very good paper profile 68 papers in 1st quartile, 35 papers have first authors from team, also major collaborations from around the world. The papers are well ranked. There is 1 professional book and book chapters too.

Declaration on the involvement of students in research

This is appropriate

Declaration on societal relevance

The work on freshwater lakes has direct societal relevance, influencing policy in management of freshwaters.

Declaration on the position in the international and national context

A leading group in their field, that is able to attract significant funding, They have 4 projects and raised ~0.8M underpinning the research

Declaration on the vitality and sustainability

Excellent and sustainable

Declaration on the strategy and plans for the future

Keep going, collaborate with large scale European freshwater consortia.

Evaluation of the Team No. 12: Soil microbiology and soil chemistry

1. Introduction

The group covers a highly important topic, and they have a long-term interest and accumulated knowledge in soil microorganisms. They focus on important and highly relevant societal questions, the role of soil microorganisms in global change, soil ecoservices, Green House Gas (GHG) emissions, biodiversity invading pathogens and acquisition of antibiotic resistance. They also cover the production of bioactive compounds by some of these microorganisms.

2. Strengths and Opportunities

The clear strength of the group is the accumulation of expertise in soil microbiology field. They are well connected in the international scientific community in their field. They have unique and expanding collections of soil microorganisms, and continuing to identify novel species. The team well covers expertise in broad array of soil microbes. They have a young, but experienced scientist with a strong track record as a new leader.

3. Weaknesses and Threats

It is highly important that the group gain experts/expertise in some of the most modern approaches in this field, such as genomics, metagenomics and complement their vast taxonomic expertise with these techniques. They need to increase the visibility of their work, publications. The performances of the team members are variable, two of their top performers are outstanding. Young scientists in the team are promising, but will still need to prove their potential. They are well aware of this and already did the first steps in this direction.

4. Recommendations

Continue consolidating the group and recruit further young scientists with expertise in modern technologies. Considering the importance of the topic at an EU level, it should be possible to integrate their efforts with EU funded larger consortia.

5. Detailed evaluations

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

The outputs of the team are solid and contribute to the knowledge base in an important field of soil microbiology. They will only be able to increase the impact of their studies if they continue to complement these studies with modern approaches and not staying at the descriptive level; this will enable them to address more holistic questions of general interest .

Declaration on the involvement of students in research

They have good involvement of students and that allows them to bring young scientists into the team.

Declaration on societal relevance

Extremely relevant and important topic where the institute has past experience and future potential.

Declaration on the position in the international and national context

The group does have good number of working connections with international groups. They are also actively involved in international conferences.

Declaration on the vitality and sustainability

The group has stabilised during the last 5 years with young group leaders.

Declaration on the strategy and plans for the future

They do recognise the need of complementing their soil microbiology expertise with novel genomics approaches.

Evaluation of the Team No. 13: Soil zoology and soil microstructure

1. Introduction

The focus of the team is on soil fauna and its relation to food web and impact on soil structure. This is a very important topic that informs agricultural practices; e.g. tillage or no tillage. The team needs broad expertise in soil zoology and ecology. They combine field-work with well-designed experiment. They apply their basic research to important practical questions, such as heath land restoration, restoration of mining sites, greenhouse gases.

2. Strengths and Opportunities

This is strong traditional ecological research with a high potential for impact on government policies and reports. The group is writing/editing core reference books. They have clearly defined, open-minded research directions that reflect thoughtful approaches and topics that have wider impact. There is a good balance of fundamental and applied science. There are valuable long term data sets. They have incorporated their research into SoWa, which integrates research efforts and infrastructure, access to facilities and methods, such as stable isotope labelling to track ecosystem dynamics.

3. Weaknesses and Threats

The group has an atypical older age structure, but good number of PhD students. Funding streams are not well defined in their report and plans. Considering the European scale of the problem, there should be more funded collaborative efforts through EU projects. They have plenty of word-wide contacts to realise this.

4. Recommendations

Realise SoWa and seek funding from EU sources.

5. Detailed evaluations

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

The group is clearly internationally excellent, although the team members vary somewhat in their outputs.

Declaration on the involvement of students in research

The team has a healthy number of PhD students. Considering the age structure of the group and the broad zoological, microbial, botanical expertise required to run their programs, it will be crucial that they find talented young researcher to incorporate into their team.

Declaration on societal relevance

There is extremely high societal relevance, with land restoration/post-mining concerns, and to the needs of sustainable agriculture. The group must think ahead - trials of HT crops and zero-till very important.

Declaration on the position in the international and national context

Both having underpinning/strategic research and forward looking knowledge-driven research. The team is well recognised internationally and have key positions in scientific bodies, editorial boards in their field.

Declaration on the vitality and sustainability

They have an older age profile but they have clear leaders within the group that have the potential to bring up the new generation of soil zoologist.

Declaration on the strategy and plans for the future

Open-minded and thoughtful of wider impacts. Clear research plans. Decent balance of fundamental and applied science combined with long term data collection. Some strategy could be more working with farmers, as well as mining companies.

Evaluation of the Team No. 15: Evolutionary parasitology

1. Introduction

On the first view this team deals with a rather complex pattern of research topics, but deeper investigation reveals a team with excellent international collaborations, outstanding outputs and the qualification of the researchers, performance and perspectives are excellent.

2. Strengths and Opportunities

The strength of the team is its standing in the field with top publications in central questions of its research topics. The PIs are internationally very visible and have been involved in top research in the field. They are extremely well linked within the international community and will be able to improve their standing.

3. Weaknesses and Threats

If there are any weakness, then it might be the diversity of research topics. However, on a closer look, this is not significant and considering the excellent qualification of the researchers this will not be a weakening factor.

4. Recommendations

The third laboratory of environmental genomics which is also promising urgently needs support with respect to personnel. The international collaborations should seek for appropriate funding.

5. Detailed evaluations

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

Quality of results is outstanding, international collaborations are excellent.

Declaration on the involvement of students in research

Involvement of students at all levels is excellent.

Declaration on societal relevance

Highly relevant for understanding evolution of endosymbiosis and parasitology.

Declaration on the position in the international and national context

Outstanding position in national and international context as demonstrated by excellent output.

Declaration on the vitality and sustainability

Excellent prospects, age structure and qualification of researchers are very good, group structure and size are appropriate (exception see above). More international funding sources need to be approached.

Declaration on the strategy and plans for the future

Strategic plans are built on the excellent publications of the group and are very promising.

Evaluation of the Team No. 18: Fish parasitology

1. Introduction

The team consists of 16 researchers (including 6 from abroad) and 3 staff members. Age structure: most researchers are < 40, 5 from 40 to 60, two >70. The team consist of a laboratory of fish protistology and a laboratory of helminthology. During the last five years members of the team co-authored a total of 232 scientific articles published in journals with summary impact factor of 463.6 ; it means an average IF around 2,0. They also published 2 books and participated in 6 chapters in other books. The staff including the key scientists and postdocs participate in teaching and research training with the focus on supervising graduate and undergraduate students and training foreign visitors that often come to stay for a couple of weeks or months. Some staff members also give lectures at Czech universities and abroad.

2. Strength and Opportunities.

The internationally recognized and respected team in the field of aquaculture has a broad spectrum of results and publications. Both laboratory groups consist of both experienced researchers and postgraduate students including high number students from abroad on long-lasting stays. They try to extend their work to the applied field by looking for vaccine candidate protein prepared from Myxozoon.

3. Weaknesses and threats.

The team is oriented mainly to the systematic work describing different species, but they need to extend their methodology also to the molecular level using the new methods of molecular biology.

4. Recommendations.

The group should stabilize the permanent research staff (especially in the group of protistology). They should try to increase the number of publications with high impact factor, although average of their publication are already slightly above the median IF of journals in this field.

5. Detailed evaluations

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

The quality of the results is good.

Declaration on the involvement of students in research.

In the team there are a lot of students in different stage of their study including PhD students and including students from abroad.

Declaration on the on societal relevance.

High impact on new knowledge in this field with long lasting tradition. Promising but yet not realized impact of the applied research.

Declaration on the position in the international and national context.

The team is well recognized both on national and international level

Declaration on the vitality and sustainability.

Age structure is good with a majority of young researches with the need of stabilization of the senior researcher, but the situation looks promising.

Declaration on the strategy and plans for the future.

The team has a clear strategy and a research plan including efforts to extend the methodology to the molecular biology level and also to use some of the results in the industry.

Date: December 15, 2015

Commission Chair: Emeritus Professor Erick Vandamme