

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 Microbiology of the CAS, v. v. i., Prague

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: Jiří Gabriel, substitute observer Helena Tlaskalová

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 - 111 - Laboratory for Biology of Secondary Metabolism; **No. 2 - 112** - Laboratory of Fungal Genetics and Metabolism; **No. 5 - 116** - Laboratory of Enzyme Technology; **No. 13 - 141** - Laboratory of Environmental Microbiology; **No. 14 - 142** - Laboratory of Environmental Biotechnology; **No. 15 - 143** - Laboratory of Fungal Biology; **No. 22 - 131** - Laboratory of Photosynthesis - Algatech Center; **No. 23 - 132** - Laboratory of Algal Biotechnology - Algatech Center; **No. 24 - 134** - Laboratory of Cell Cycles - Algatech Center

A. Evaluation of the Institute as a whole

1. Introduction

The commission members note that the Institute has a rising profile of publications since the last review in 2009, both in quality (as measured by IF) and in number of papers. Income annually is 12M CZK, about half of which is from grant income and only small amounts from industry. The research work that was evaluated is spread over two sites, the Prague site and Trebon site. The commission members evaluated 9 groups, 6 groups are at the Prague site; the remaining 3 are at the Trebon site. The Institute's vision is to do excellent basic science and to have applied research as well. A total of 90 staff (doubled from 2010) works closely with Trebon,

the latter now has 4 departments (groups), because a new group was recently established.

2. Strengths and Opportunities

There is some really outstanding work in the Institute, with some groups having a clear international profile, excellent collaborations, top quality papers and international leadership roles. We would like in particular to highlight Jansa's work on mycorrhiza, Komeda's work on photosynthesis, Baldrian's work on RNA mining of soil to characterize microbes and Cajthami's work on bioremediation of soils.

It is clear that the institute has excellent facilities and support to help these groups.

Trebon has received in the last few years significant income from the CZ funds, these being 90M CZK on instruments, 70 M CZK on infrastructure and 60M CZK in start up grants since 2011. With such a large investment it should be translating to high international profile papers and significant industrial collaboration. That is occurring in Komeda's group, which is generating highest quality international papers and profile. The Bisova's group is still establishing, and needs to gain a strong vision to reflect the exceptional opportunities this investment provides, to exploit too the site's resources and the long history of algal research. The Kopecky and Kyslik group needs much greater drive for external funding and exposure.

3. Weaknesses and Threats

Several groups have clear application to their work, e.g. (i) Janata's work solving antibiotic resistance problems, (ii) Kyslik's work on phytopathogens and phytoremediation, (iii) Kolarik's work on bioprospecting, (iv) Cajthami's on degradation of PCBs, and (v) Kopecky's work on algal culture for industry. However, we feel that industry funding could be given a higher profile by at least some of these groups and we were surprised at how little commercial funding has been won. In particular much greater sums could be sought by Kopecky's group, whose primary focus is to grow algae for commercial use, e.g. animal feed, human food companies, pharmaceutical companies, biofuels. The funding predominantly comes from Czech Republic (CZ), and more international funding streams should be explored. There has also been significant EU money over last 5 years for work on biofuels. That funding should have been sought and won.

4. Recommendations

Continue with a strategy of attracting back and maintaining young groups and subgroup leaders. It is also essential that new appointments are made in areas that will make impact. Some but not all groups had a very clear strategy to build up their international profile and to enhance their competitiveness. Bioinformatics and computational biology is becoming increasingly required for multiple research groups. Consider establishing a group to provide this know-how, or build this expertise within groups that are open to collaborations. At an Institute level, consideration of the value of fundamnetal vs impact needs consideration, to enable impact aktivty to be appropriately assesed and rewarded.

5. Detailed evaluations

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

Overall the groups have a good output, with plenty of international standard publications. There is some really excellent work going on here, and some groups are poised to do better.

Declaration on the involvement of students in research

The involvement of students seems appropriate.

Declaration on societal relevance

Many groups have clear societal relevance, which interfaces with medicine (e.g. cancer), agriculture (e.g. mycorrhiza), and ecological services (e.g. bioremediation).

Declaration on the position in the international and national context

Many groups have clear international status, some need to expand their frontiers beyond the borders of the Czech Republic.

Declaration on the vitality and sustainability

We were pleased by the efforts and pride some of the groups placed on outreach activities, notable in that regard were the Bisova and Kopecky groups.

Declaration on the strategy and plans for the future

The advisory board structure is very limited in its diversity of expertise. There should be some external advisors, including from e.g. industry, local government, ex-ministers of agriculture, experts in outreach, and farmers groups.

B. Evaluation of the individual teams

Evaluation of the Team No.1: 111 - Laboratory for Biology of Secondary Metabolism

1. Introduction

This laboratory has a long tradition in studying biosynthesis of microbial secondary metabolites, in particular the lincomycin group of antibiotics with focus on mode of action and development of semisynthetic derivatives to overcome resistance. This is fundamental research with medical importance.

2. Strengths and Opportunities

This group is known internationally for its work designing antibiotic derivatives and in developing antibiotic derivatives which might overcome microbial antibiotic resistance. They are investigating the molecular mechanisms associated with antibiotic resistance proteins in secretion or ribosome targeting. The first results are pointing towards ribosome targeting and may lead to opportunities for medical applications.

3. Weaknesses and Threats

None to mention; maybe the group could broaden the scope to new antibiotic molecules with different mode of molecular action .

4. Recommendations

The group has recognized the need of a bioinformatics specialist. The Institute of Microbiology should consider this problem in a broader context.

5. Detailed Evaluation

Quality of results and their share in acquisition

The quality of the results is very high, published in journals with high impact factor. It is basic research with prospects for medical applications. The results are produced mainly by the staff in the research group.

Involvement of students in research

There is a positive development for involving PhD students in research during the evaluation period.

Societal relevance

The research has a positive effect on society based on its potential application in the medical field.

Position in the international and national context

The research group is internationally recognized and has national and international collaborations.

Vitality and sustainability

The age structure and professional qualification are excellent. The research area is very attractive for young researchers. The research group has an excellent output and equivalent grants.

Strategy and plans for the future

The research is timely in view of increasing antibiotic resistance in the medical sector. The future plans are adequate and the need of bioinformatics expertise has been recognized.

Evaluation of the Team No. 2: 112 - Laboratory of Fungal Genetics and Metabolism

1. Introduction

Dr. M. Kolarik's group focuses on plant and animal pathogens, as well as on fungi with a potential to produce biologically active compounds. The group has a collection of microorganisms that are plant pathogens (*Claviceps* sp.; ergot fungi) and animal pathogens (*Aspergillus* dermatophytes, *Pseudogymnoascus*). Their objective is to understand ecological evolution of microorganisms by starting from the field

sampling. Their expertise is broad and covers taxonomy, molecular genetics, microbiology, and organic chemistry. Currently the group is composed of relatively young scientists (12 researchers under the age of 40) to pursue the objectives.

2. Strengths and opportunities

They have the world leading collection of *Claviceps* fungi (Culture collection of *Clavicipitaceas*, a member of WFCC). The group enthusiastically carries out taxonomical studies of a wide range of fungi - plant pathogens (*Claviceps*), symbiotic fungi (with endophytic fungi included), genus *Aspergillus*, and other fungi with a unique feature, such as new taxa living in high acidic soils or those with bioindicative value. All these assets give the group a wide spectrum of expertises that are required for conducting taxonomy research.

3. Weakness and threats

Although their scientific research remains active, it was not clear how the group maintains a balance between discovering new fungi and deepening the study of biologically relevant fungi that were already found by the group.

4. Recommendations

They are biotechnology experts in mycology, taxonomy, and applied biotechnology. We recommend that they build on existing strengths.

5. Detailed evaluations

Declaration of quality of the results and share in their acquisition

Over 30 years studying cryptic species of *Claviceps purpurea* gives the group a world's recognized position. During the period they published 94 articles with impact factors, filed 2 patents and have one applied result. Most of their publication appeared in journals in the field of microbiology and biotechnology.

Declaration on the involvement of students in research

Students appear to be integrated in their research appropriately.

Declaration on societal relevance

The *Claviceps* collection is their asset. Their work is featured on Czech radio. Some of the staff are members of journal editorial boards.

Declaration on the position in the international and national context

Their work meets international standard in the field of microbiology. The *Claviceps* collection and its maintenance are valuable resource among *Claviceps* researchers.

Declaration on the vitality and sustainability

They are well-focused on their research topics. Recruiting motivated students will be one of the keys to be sustainable. The group also finds a position in the gap between academic science and clinical trials, particularly focusing on epidemiology and polyphasic taxonomy (i.e. Hubka et al., 2015).

Declaration on the strategy and plans for the future

The group is well-equipped to pursue ongoing research and the objectives are clearly defined.

Evaluation of the Team No. 5: 116 - Laboratory of Enzyme Technology

1. Introduction

The lab consists of 8 researchers and 3 staff members. The age structure is quite spread, most researchers being < 50, one >60. Their multidisciplinary research is oriented on interactive research in microbiology, biotechnology, protein engineering, bioinformatics and biocatalysis. The laboratory success in application-oriented research could be documented by a high percentage of patent transfer into practice (4 patents are listed). There are 4 Ph.D. students, 4 M.Sc. and B.Sc. involved in the work. Cooperation is mostly with Czech institutions, and only with one foreign team (Switzerland) is listed. There are only 15 papers with impact factor (IF); the quality profile show that most papers are in the 3rd category.

2. Strength and Opportunities.

Application-inspired research based on targeted metagenomics. This laboratory bridges the gap between fundamental research and industry. This gives them a chance to make commercial breakthroughs in implementation of their results. The laboratory maintains culture collections, including of recombinant strains. This gives them the opportunity for future collaborations. The group is also focused on bioremediation of pharmaceutical residues in the medical and environmental sector.

3. Weaknesses and threats.

The group should make an effort to publish papers in journals with higher IF: 1* top decile and quartile.

4. Recommendations.

The group should attract collaboration with big pharma industry.

5. Detailed evaluations

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

The quality of the results is very good.

Declaration on the involvement of students in research.

Only 8 students are involved in the research.

Declaration on the on societal relevance.

High impact on economy related to development of biotechnology sector. Lectures on "Recombinant microorganisms in biotechnology" at the *Department of Genetics and Microbiology*, Faculty of Science, Charles University in Prague. Culture collections are maintained and are open to the scientific community.

Declaration on the position in the international and national context.

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

Declaration on the vitality and sustainability.

Age structure is optimal with the majority of young researches.

Declaration on the strategy and plans for the future.

Bioremediation of pharmaceutical residues in medical and environmental sector is an important item for the coming years.

Evaluation of the Team No. 13: 141 - Laboratory of Environmental Microbiology

1. Introduction

The group has a very important research programme using the most modern approaches to characterize the microbiome at the ecosystem level. This has a high degree of novelty, and huge potential for giving new understanding of contrasting habitats as interacting systems with dynamic decomposition-related events. They are examining all parts of the ecosystem, with some focus on roots and rhizosphere, deadwood (carbon cycling) in forests and to a lesser extent ecosystems undergoing successional developments (including post-industrial) and minor grasslands. The work involves biochemistry of natural environments - soil and plant litter chemistry -, the effect of dominant trees; microbial activity and species composition at different scales km to cm, using genomics and biochemical approaches. It leads to understanding of the factors shaping microbial communities in soils. The laboratory has an important niche in understanding the ecosystem level microbiome. They study roots and rhizosphere, deadwood (carbon cycling), vertebrate and invertebrates, with a forest ekosystém focus that is undergoing successional developments (including post-industrial) and grasslands at different scales km to cm.

2. Strengths and Opportunities

Clearly the factors shaping microbial communities is important, and this group has the structure to address this area with both fundamental and applied impact: soil profile and microbial composition, the identity of trees, changes during litter decomposition, the response to ecosystem-wide diebacks, etc

3. Weaknesses and Threats

Various technologies and analytical tools, including DNA and RNA sequencing, is clearly going to change some approaches to microbial communities and understanding interactions between species. The group is well placed to remain at the highest level. Field work and long term observations are required. Extension of work from Czech field sites to international impact will require more work.

4. Recommendations

There can clearly be wide applications for their work, not least in work relating to climate change. There is a need for both field data collection to understand processes in communities. Modelling and informatics expertise is needed. All groups of organisms need to be investigated – including eg phages and oomycetes which may have been limited in study previously.

5. Detailed evaluations

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

Work is at a high level, as reflected in publication profile (4 grade one, 9 grade 2 and 2 grade 3).

Declaration on the involvement of students in research

Students are appropriately involved.

Declaration on societal relevance

This is basic research, but not so much impact-driven. Further impact can be found at in the broader context of environmental conservation and soil improvement.

Declaration on the position in the international and national context

As reflected in the publications, the group has a good international profile. The team members are involved with conferences and editing. These activities could be increased given the quality of research.

Declaration on the vitality and sustainability

The team has a good age structure generally.

Declaration on the strategy and plans for the future

Research plans in ecosystem processes address well current questions in environmental microbiology.

Evaluation of the Team No.14:142 - Laboratory of Environmental BiotechnologyIntroduction

1. Introduction

The Laboratory of Environmental Biotechnology works on microbial degradation and fate of organic pollutants in the environment. Good examples of work with PCBs (banned between 1974 and 1984 but still in the environment) and cadmium were described to the panel with development of bioremediation strategies.

2. Strengths and Opportunities

Future work on breakdown and consequences of soil and waste water samples and new emerging micropollutants such as brominated flame retardants, pharmaceuticals, endocrine disruptors gives huge potential for demand for more work in this area. There are many wildlife consequences for some of these, including hormones etc. There are many opportunities for collaboration with environmental organizations and companies. While there is generic technology, each compound must be studied on its own. A range of interesting organisms and pathways for breakdown have been studied: e.g. ligninolytic fungi, Oyster mushrooms for PCBs proved to be the best. Use of microbiome in waste straw for decontamination was shown and the group has worked out pathways of degradation.

3. Weaknesses and Threats

Systematic surveying of diverse germplasm is being employed but could be based on more diverse accessions/soils. Pathway analysis is likely to be important, not least for regulation of release of degrading microbes.

4. Recommendations

The work is good, but more could be made of the consequences and it is surprising there is not more impact in environmental remediation. More biochemical and gene-based analysis could be helpful. International collaborations and work with companies and waste-specialists (a major and growing sector in the EU) should be initiated.

5. Detailed evaluations

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

An analysis of the publication quality reveals no grade-one publications, and 5 at each of two and three. This could be higher given the considerably potential of the work. Overall, there were 60 papers in period and a rather low total number of 564 citations for a group with 5 staff members. Given the applicability of the work, three patents may also be low, with only one licensed.

Declaration on the involvement of students in research

A satisfactory number of students is included, with undergraduates and PhD from different countries (incl. 4 Erasmus students). Students are appropriately involved.

Declaration on societal relevance

Patents have been issued and exploited with one having been licensed. They are involved with 11 courses at Universities.

Declaration on the position in the international and national context

The work should have a higher profile both nationally and internationally. Involvement in conferences and editorial work is somewhat limited.

Declaration on the vitality and sustainability

The team has a good age structure generally.

Declaration on the strategy and plans for the future

The strategy and plans for the near future were considered, but a larger vision and future would have been helpful. Work with mathematical modelling solutions and understanding of mechanisms of organic pollutant degradation (as inorganic such as nanomaterials, chromium etc), and compounds action on toxicological receptors is certainly needed, especially in work aiming at decontamination of soils.

Evaluation of the Team No. 15 : 143 - Laboratory of Fungal Biology

1. Introduction

Dr. Jansa Jan has been in charge of the group since 2014, heading a young group of 18 staff. In 2010 the group was only 5 staff. Some outputs are published in good journals (New Phytologist, Molecular Ecology). There are four project leaders, and half the positions are funded on soft money. The area of research is mycorrhizal symbiosis, bioaccumulation of heavy metals, and how truffles grow. They have an interest in taxonomy of asco and basidiomycota, and a focus on degraded soils. The work looking at community scale hyphal distributions is particularly cutting edge. The group shows much promise and higher impact productivity will likely follow, e.g their interesting work showing short periods of shade cause plants to alter stored C and P uptake. Field studies showed that mycorrhizal communities were influenced by soil type, but not so much by land management. In 2012 the research focus was moved towards arbuscular mycorrhizal symbiosis.

2. Strengths and opportunities

The group has been successful in grant awards. The research group has many successful projects, and there is much promise.

3. Weakness and threats

Perhaps before the group expanded, too much of their work was rather mundane. However, the current research focus is more cutting edge and relevant. This is a competitive field, but the group will likely cope well with that.

4. Recommendations

The research plans are sketchily outlined, but what is proposed looks eminently sensible. We recommend searching for exchange of small RNAs, as well as isotope-labelled metabolites.

5. Detailed evaluations

Declaration of quality of the results and share in their acquisition

The quality of results is good overall, with a good paper profile. There are collaborations within Czech Republic, in The Netherlands and Germany. They will organise an international conference in 2017. They have some excellent grant funding.

Declaration on the involvement of students in research

Looks appropriate, the group currently supervises 2 Masters and 3 PhD students.

Declaration on societal relevance

Highly-relevant to ecology, with potential applications in crop farming, truffle farming and bioremediation.

Declaration on the position in the international and national context

Community-related fungal work is an excellent research area and highly relevant in both international and national contexts.

Declaration on the vitality and sustainability

The group has excellent prospects, the age structure and professional qualifications are good. The research area is very attractive for young researchers. The research group has a good output and equivalent grants.

Declaration on the strategy and plans for the future

The future they see is in the area of C-N exchange budget between fungus and plants. We support that choice. Interesting insights into interactions of different plant species and microbial communities, and interconnections of all will likely follow.

Evaluation of the Team No. 22: 131 - Laboratory of Photosynthesis - Algatech Center

1. Introduction

This research group is very large (>40) including students: 46 members, 7 senior scientists, 2 junior scientists, 8 post docs, 10 technicians and 19 PhD students, 3 of them finished in the evaluation period. The majority of staff is aged between 25 and 40, and is vigorously active. They have an excellent publication record with large number of top ranking journals, all recognised internationally, and close to a quarter considered world leading. Excellent levels of funding are available to 2018. Dr. Komenda's group focuses on photosynthesis – including the biogenesis of photosynthetic apparatus of photosystem II. A new type of alga, *Chromera velia* is used to pursue the objectives. The group studies diversity in photosynthesis biochemistry, especially non-photochemical quenching (NPQ, published in Plos One), the later involved in transferring energy from PSII to carotenoids. They are interested in membrane complexes, assembly of PSII. They have a review in top journal on PSII (Komenda et al Curr Op Plant Biol 2012). The group takes biochemical and biophysical approaches to their work. A broad spectrum of collaborators appear to complement other aspects of research fields, which could potential be a driving force to publish in peer-reviewed high impact journals.

2. Strengths and Opportunities

There can be no doubt that this group is at the top of its game. Papers in top international subject journals (e.g. Plant Cell, Plant Physiology), also a paper in top generalist journal (PNAS) showing that some aerobic organisms can live without heme, one of many impactful result. They are well focused on the antenna complexes of photosynthetic apparatus in various microorganism. Their results shed light on the mechanisms of non-photochemical quenching, resulting in several publications such as Plant Physiology (Kranz et al, 2010, Kana et al., 2014), FEBS Lett (Kotabova et al, 2011), PloS ONE (Wuigg et al., 2012 and Kana et al., 2012), JBC (Krupnik et al. 2013) and so on. Their research of tetrapyrrole biosynthesis pathway was also very productive, resulting in distinguished journals such as Plant Cell, PNAS

3. Weaknesses and Threats

Photosynthesis is one of the major, competitive research field in plant biology. The group is well-networked with researchers both inside and outside the Czech Republic. The network is the key to sustainability.

4. Recommendations

The group knows exactly where the cutting edge in the field is found and is working there. As long as they employ variety of techniques, such as the development of advanced microscopy, they will be active in the future.

5. Detailed evaluations

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

The fact that they are publishing results in high impacted journals demonstrate the quality of the lab. Excellence, largely driven from within house, using a range of biochemical approaches are dissecting the biochemistry of photosynthesis using imaginative materials.

Declaration on the involvement of students in research

Considering the size of the group, the number of PhD students is quite small.

Declaration on societal relevance

This is societal relevant, original ground-breaking research which could impact food production and biofuels generation. The use of particular Algae-species to study and improve photosynthesis has a great potential to contribute to several applications in food, feed and industrial fields.

Declaration on the position in the international and national context

Well-networked collaborations in the national and international context.

Declaration on the vitality and sustainability

Excellent outcome.

Declaration on the strategy and plans for the future

Exciting, cutting edge and insightful, plentiful future plans. Excellent ideas that will give good new data. They also intend to build on research on algal productivity, especially looking at productivity in relation to CO₂, N and P macronutrient availability. They intend to improve the photosynthetic apparatus using several approaches that seem to be feasible.

Evaluation of the Team No. 132 - Laboratory of Algal Biotechnology - Algatech Center.

1. Introduction

This is a relatively large group with 9 researchers and a relatively flat age structure. The laboratories based at Třeboň have been improved considerably over recent years and facilities are now world-class, with concomitant expectations. The laboratory has an applied focus, looking at bioactive secondary metabolites of autotrophic and heterotrophic microalgae and developing algal growth systems.

2. Strengths and Opportunities

Both their research areas are of major international interest. There are four patents originated from the group. Crude screens of 200 cyanobacteria has led to the discovery of several bioactive metabolites. Cultivation and growth monitoring systems for microalgae have been developed. Hazard analysis and critical control point HACCP certification has been achieved to allow the production of algal biomass for

human food. As noted, there are opportunities for work with new algal strains for new products, and the improved production of high value compounds (HVC), but these opportunities should be developed with close focus on their expertise.

3. Weaknesses and Threats

There is a significant volume of similar work in the area of both algal growth and secondary products, from other research groups in the Czech Republic, and most significantly from academic research groups, start-ups, and multinational companies in the EU and particularly USA. No major collaborations or multinational projects with respect to bio-engineering or metabolites were emphasized, and there was little involvement and drive from potential end-users. To exploit the HACCP certification, there is a major need for an exploitation partner. Overall, the strategy and plans were broadly phrased and lacked targets and specificity.

4. Recommendations

The laboratory needs to collaborate and interacts much more widely with major academic centres and with commercial companies. The panel members were surprised there was minimal work on algae and bioenergy, a major research area in many institutes and companies in Europe, which will have major impact on algal production methods, regardless of the end-use.

Therefore, we recommend that there are clear targets and aims set out to expand research collaborations within the EU and internationally, with academic partners and commercial organizations. It is important that the significant effort available in the group is seen to play a much more international role.

The group needs to define much more specific targets, driven by end-user pull or fundamental questions. These might be in terms of scope of studies (which species, how chosen?), numbers for sampling, and types of analysis to be carried out, and should be clearly using the substantial resources available to the group in terms of both researcher-numbers and facilities.

At the moment, the research is very broad in terms of bioactivity (ranging from pharmaceuticals to nutraceuticals; across the range of algal diversity, although without clear taxonomic sampling; through to closed and open, auto- and heterotrophic engineering solutions); increased focus on coherent and achievable research programmes would be valuable.

5. Detailed evaluations

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

Most of the evaluated outputs were rated a modest 3 (eight out of the 13; with none ranking 1). The group has some collaborations, but not of the scale that might be possible given the importance of this research area.

Declaration on the involvement of students in research

Four, a suitable number, PhD students have completed in the period and there are many currently in the group. The involvement of engineering as well as biology students would be good for some aspects of the programme, given the greatly expanding industry of bioengineering and bioreactor technology. The staff are involved with appropriate teaching.

Declaration on societal relevance

Algal research is of great relevance to society, and the group has produced a number of useful national publications and publicity on its research.

Declaration on the position in the international and national context

As noted above, given the scale of the group, it should have much greater impact internationally. There were also concerns about overlap and limited collaboration with other groups involved in algal research within CAS.

Declaration on the vitality and sustainability

And *Declaration on the strategy and plans for the future*

The plans were somewhat vague and the group needs to have more focused research plans as in Recommendations above. There are some interesting pharmaceutical and nutraceutical products, and of engineering solutions, but the routes to exploitation should be better defined.

Evaluation of the Team No. 24: 134 - Laboratory of Cell Cycles - Algotech Center

1. Introduction

Algal physiology and cell cycle research is one of the traditions in Trebon that goes back many decades and contributed with innovative experimental systems, and ideas to the cell cycle research field to develop general concepts including the commitment point, measuring cell size, counting the number of divisions during multiple fission. They are now well positioned to study these important biological questions at the molecular level, making advantage of transformation systems, RNAi, single cell analysis and collecting and modelling quantitative data in single cells. Another general problem that they started to study is DNA damage checkpoint, which appears to be quite conserved. In addition they run projects that are more applied in principle, accumulation of energy reserves, effects of rare metals, algal cultivations, effect of nutrition. During 2010-2013 this was a small group but 3 new post docs 2013-2014 joined and led to a young age structure. They focus on 3 model algae, *Chlamydomonas*, *Scenedesmus* and *Chlorella*, plus *Physocomitrella*. *Chlamydomonas* grows and then undergoes a multiple divisions. Cell growth and cell cycle progression is accompanied with the build up of a lot of starch, which provides the resource for this strange cell cycle behaviour, that attracted an award recognising the biofuel potential. Effects without N and P got another award of the same.

2. Strengths and Opportunities

Strength is the deep knowledge in general cell cycle control and in specific algal cell cycle physiology in a number of species. The current PI has spent post doc periods in top laboratories in the field in Riken, Japan, and SALK in US, and can now exploit the fascinating algal experimental system with cutting edge molecular genetic techniques. Young vigorous age structure.

3. Weaknesses and Threats

The group tend to follow a narrow line of research that too much follows the yeast and animal field and try to reproduce it in the algal system. Need to be able to get into the genetics more strongly of *Chlamydomonas*, mutants. Branching out to moss might be a distraction rather than a well-justified choice dictated by the biological question. Reverse genetics through homologues recombination is an important technique, but does this justify the change of the experimental system. Going from algae to multicellular organisms might be exciting from the evolutionary point of view.

4.Recommendations

Make maximum advantage of the huge amount of knowledge and know how accumulated in Trebon in algal physiology of the cell cycle. Follow central questions that they coined during the study of this system such as cell size control and commitment point and design experiments with all the molecular and imaging tools and modelling approaches that is now possible to gain a mechanistic understanding how these work, how cells measure the size and count the numbers of cell divisions. They can occupy an underrepresented field and find some fundamental insights into cell cycles. Separating growth from cell cycle is the strength of the system, and these aspects should be exploited . Continue with some more applied programs that feed into other biotech programs in the Institute, but need better exploitation and possible commercialisation of these results. Be more brave than one post doc, bigger vision needed, build on the *Chlamydomonas*. Exploit current technology...cutting-edge genetics. Have an edge in what they do, but they have too narrow vision. However, the future looks good if they develop algae with latest cutting edge technologies.

5. Detailed evaluations

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

The group has a consistent publication record and invited review papers in internationally excellent journals, such as Plant Physiology, PLOS One, and internationally well recognised but somewhat more specialised journals.

Declaration on the involvement of students in research.

The group does have a healthy number of Master and PhD students, and a record of getting them through and remaining in the research field, e.g. the current PI herself.

Declaration on the on societal relevance.

The major drive is the principle control of cell cycle, which is knowledge generation, but other programs can be more directly relevant to society, but they do not seem to be fully convinced in algal biofuel.

Declaration on the position in the international and national context.

The group has good contacts internationally, very strong in Japan but also in US, and they are well recognised internationally and nationally, as documented by the cell cycle workshop they recently organised.

Declaration on the vitality and sustainability.

The group is small but did stabilise and grow. They seemed to go through a smooth change of guard and now well positioned to combine algal physiology and molecular genetics. They attracted regular grants from national funding bodies.

Declaration on the strategy and plans for the future.

The strategy of the group is not fully elaborated. For the commitment point they will need to develop a multidisciplinary approach with novel innovative experimental designs to give the potential for internationally cutting edge breakthrough results.

Date: December 15, 2015

Commission Chair: Emeritus Professor Erick Vandamme