

Evaluation of research and professional activity of research-oriented institutes of the Czech Academy of Sciences for the period 2015–2019

Final Report

Name of the Institute: Institute of Experimental Botany of the CAS, v. v. i.

Evaluated teams and their leaders:

1. Centre of Plant Structural and Functional Genomics (Jaroslav Doležel)
2. Laboratory of Cell Biology (Martin Potocký)
3. Laboratory of Growth Regulators and Isotope Laboratory (Miroslav Strnad)
4. Laboratory of Hormonal Regulations in Plants (Jan Petrášek)
5. Laboratory of Plant Biotechnologies (Tomáš Vaněk)
6. Laboratory of Pollen Biology (David Honys)
7. Laboratory of Signal Transduction, Laboratory of Pathological Plant Physiology, and Laboratory of Biologically Active Substances (Jan Martinec)
8. Laboratory of Virology (Tomáš Moravec)
9. Plant Reproduction Laboratory and Station of Apple Breeding for Disease Resistance (Helena Štorchová)

Part A: Evaluation of the institute

Strengths:

Overall the Institute of Experimental Botany (IEB) is a leading international research organisation that contributes fundamental and important knowledge at a mostly very high and internationally competitive level. Most of its research teams have built strong international reputations in terms of both publications and technical capacity. Taken together, it now has a good age structure and has increased its complement of foreign staff. IEB has excellent equipment resources and general facilities consistent with the requirements of a modern research organisation.

Weaknesses:

In common with most other institutes in the Czech Academy it has identified issues with dependence on grant income for a high proportion of its activities and resources. However, it needs to come to the realisation that this situation is unlikely to change in the short to mid-term and to develop a funding strategy which acknowledges the reality of this position. Research institutes should receive a balanced funding by basic budgeting and third parties. Some key parts of its international reputation are founded on a limited number of highly successful research scientists. Due to online evaluation, the committee was unable to visit the sites of IEB. But the evaluation committee likes to draw the attention to the previous evaluations recommending improvements in facilities, particularly in Olomouc.

Opportunities:

The strengths of the IEB in in modern Plant Science provide a strong foundation to continue to develop in a number of ways. Some of the units have already established strong linkages to the crop sciences sector and further activity in this area will help to provide a route to practice and access to additional funding resources. The development of modern high throughput molecular and imaging technologies has reduced reliance on model systems and opened the opportunities for more fundamental science utilising economically important species directly.

Threats:

The main threats to the IEB over the next few years are:

- The need to access sufficient funding to maintain and develop its equipment and accommodation base
- The replacement of two heads of department who have strong well-established international reputations
- The need to broaden the funding base of departments to include the international sector. A key element to target here will be ERC grants. This will not only serve as a valuable source of funds but will help enhance the international reputation of the IEB.
- The huge rise in quantity of research output is impressive. The increasing length of lists of authorships and the number of authorships of individual scientist (30/year) requires attention as to the justification of co-authorships beyond bibliometric benefit.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
	The output is impressive both in terms of content quality and quantity. During the evaluation period the IEB has increased its research in journals with impact factors by nearly 40% with a significant number of these in high or extremely high impact publications. With 14 significant contributions in Nature and Nature-related journals such as Nature

<p>Communications, Trends journals, 31 papers in Plant Physiology, 9 in the Proceedings of the National Academy of Science USA and many others, IEB is a very heavy weight in the international plant science and cell biological community.</p>	
H1.2	Contribution of workers on the outputs reached
<p>More than a third of publications had IEB staff as the corresponding author and more than two thirds were based on international collaborations.</p>	
H1.3	Quality of all outputs and results
<p>A significant number of the publications were in major international broad appeal publications with high impact factors, including Nature journals and PNAS as well as in the highest impact journals in Plant Sciences such as Plant Cell and Plant Physiology. There is a good balance here. Groups of highest international reputation (see evaluations of the teams) shape the cutting edge of current knowledge gain in certain research fields.</p>	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
<p>The highest quality work from the IEB has included the key role its scientists have played in crop plant genomics through the development of cytological and molecular techniques for dealing with large crop plant genomes; the work on the development of methods for the detection and quantification of plant hormones; the progress in understanding the molecular and cell biology of pollen tubes; the successful scientific approaches to the development of new apple varieties.</p>	
H1.5	Contribution of the participation of the authors in large collaborations
<p>The success of many of the teams within the IEB in large collaborations is evident from the number of joint publications with international authors. It is also apparent from the development of the role of the IEB in the development of the Application Laboratory for Agricultural Research which represents a valuable approach for the IEB to capitalise on its expertise and facilities as well as provide more generically a sensible return for the investment by funding agencies. This is an appropriate strategy for efficiently utilising resources and broadening the collaborative base and funding opportunities that could be adopted by other units within the IEB as well as by other Czech Academy of Science institutes.</p>	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
<p>The institute clearly has a broad portfolio of work that has the potential for societal relevance. This ranges from the development and tools which have been fundamental to the sequencing of large crop genomes to the development of technologies to detect and quantify plant hormones. While it is good to see these successes it would be interesting to see how well many of the junior researchers are encouraged to identify the potentially wider relevance of their work and the choice of projects they develop.</p>	

H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute´s activity on proper practice in society in the area of social sciences and humanities
<p>The IEB has established a commercialisation committee to identify and capture results that have potential practical implications. This a welcome development. However, this appears to be rather narrow in its focus on more formal IP capture towards the end of the research cycle. It would be of value to IEB to ensure that all its staff are encouraged to develop an awareness of the wider value of their work and potential routes to impact.</p>	
H2.3	Relation to practice
<p>The Apple Breeding Station within the IEB has a well-established record on the development of apple varieties supported by PVR in many countries. Their model works well and the group is transitioning to modern plant breeding strategies in a methodological and thoughtful way. Other practical developments include the development of substances for both cosmetic and agricultural applications and several activities in relationship to environmental protection or remediation.</p>	
H2.4	Participation in AV21 strategy
<p>The IEB has played a leading role in the successful AV21 research programme „Food for the Future“. It is in its second 5-year funding cycle which is a mark of its continuing success. The wider aspect of the participation in the AV21 Strategy can be seen from the IEB’s participation in the Biotechnological Centre for Plant Genotyping and in the project for the development of breeding methods in cherries. Both of these represent a valuable aspect of reduction to practice and for Czech society in general to efficiently capitalise on its investment in the CAS institutes.</p>	
H2.5	Cooperation with regions of the Czech Republic
<p>The IEB is one of the founders of the Centre of the Hana Region for Biotechnological and Agricultural Research which is a regional centre based on two institutes and one university partner. It brings together some 200 researchers focused on both basic and applied research. Though it currently has a regional focus it also has international ambitions with a focus on solving the problems of breeders and farmers. The IEB also has other, albeit smaller scale regional cooperation projects largely focused on pollution and water quality.</p>	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the teams and the institute with similar international and national institutes
<p>The majority of the work of the IEB is highly competitive at a national level and indeed most is internationally competitive as is reflected in the quality of its published outputs and its more general international impact.</p>	
D1.2	Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation
<p>Many of the teams within the institute have demonstrated that they are able to act as valuable collaborators at both the national and international scales. This is evidenced by the successful development of local and regional joint organisations and the participation in major successful international collaborative projects.</p>	

D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
This is reported in the contribution of individual teams.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
Successful grant funding has enabled the IEB to further develop closely in line with its previously planned research directions.	
D2.2	Assessment of the previous research objectives and their achievement
The IEB has been able to fulfil virtually all its strategic objectives and research goals largely as the result of its success in gaining significant research funding both for larger collaborative projects and more targeted project funding. This success has been distributed across most of the research teams and has laid the foundations for the future development of IEB.	
D2.3	Assessment of implementation of recommendations from past evaluation
The institute has made some progress in the successful replacement of the leadership of one of the three teams identified coming close to the period of necessary transition. This transition is still awaited in two other teams although there are possible internal as well as external options for recruitment. It is important that this transition is not simply achieved by the replacement of a single staff member but should be planned in a strategic manner. The transition may benefit from a more widely managed process that requires the mentoring by other senior staff to increase their national and international profiles through acting in various representational capacities.	
D2.4	Success in receiving grants
The IEB has been successful at institutional and individual research teams' level in obtaining both larger structural grants and grants focussed on individual research projects.	
D2.5	Adequacy of instrumental equipment
Overall the IEB is well endowed with instrumentation as the result of both institutional and project-based grant funding success. However, maintaining and further developing this equipment resource will continue to be central to the success of the institute. This may require further development of centralised and managed large equipment resources along the lines of the imaging facility. Similar approaches have been adopted elsewhere for such facilities as HPC computing and mass-spectroscopy.	
D2.6	Effectiveness of management
Overall the IEB appears to be well managed with a reasonably sensitive balance applied to the management of research teams of very different scales and resources. One key to future success will be to have in place a suitable mentoring and support schemes to ensure some of the smaller groups can gain from the experience of others in grant applications, in particular applications to schemes such as ERC and other international funding initiatives.	
D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth

<p>At an institutional level the report indicates that care and thoughts have been given to the support structures necessary for career development. However, from the individual team reports it is not always clear that this has translated in practice to all teams. This may be the result of difference in reporting rather than disparities in implementation. One particular issue that many scientific organisations are now facing is to ensure that a suitable career support structure is in place not only for scientists but also for the technical experts, such as computer scientists, which are required to develop and maintain the equipment resources in the laboratory facilities on which large scale biology is increasingly dependent.</p>	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
<p>The IEB has clearly given care and attention to the support of parenthood and return to work procedures for its staff. The report indicates that breaks for maternal or paternal leave are options as well as the facilitation of return to work on a flexible or part-time basis. It will be interesting to see if the current Covid-19 crisis will result in more widespread use of working from home through internet connectivity.</p>	
D2.9	Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.
<p>Nothing extra to add here.</p>	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
<p>The IEB is one of the partners in the Laboratory of Growth Regulators. This is funded both by the IEB and by Palacky University in Olomouc. Most staff members have joint positions. This laboratory in turn is part of the Centre of the Hana Region for Biotechnological and Agricultural Research.</p>	
D3.2	Effectiveness of joint research centres
<p>This joint model appears to be successful in that it allows staff to gain the advantages of both institute and university resources and opportunities.</p>	
D3.3	Success rate in supervision of PhD students
<p>In the reporting period some 56 PhD students have successfully defended their thesis. This is a relatively small number given the size of the IEB and the breadth and the quality of the expertise of its scientific staff and facilities. However, this may be simply a function of funding opportunities.</p>	
D3.4	Participation of PhD students in the outputs
<p>For most teams PhD students have had good opportunity to participate in outputs in work which is focussed on their thesis topics. In many cases this occurs as primary author which plays an important part in their career development.</p>	
D3.5	Participation of the institute in master or bachelor studies
<p>Overall, staff of the IEB makes a significant contribution in providing lectures, seminars or even entire courses to universities. They also contribute significant numbers of project supervisory roles. It would be useful in future reporting to identify what role in course</p>	

development IEB staff plays and what value the IEB institute and staff receive in return. Clearly, these linkages can play a role in IEB staff development and should be of value in future recruitment. However, there is clearly a resource cost involved.	
D3.6	Assessment of cooperation intensity with universities in the form of teaching
See above.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
The IEB recognises the importance of media activities and the popularisation of its work. This has been recognised by the employment of three dedicated experts in the PR field. In a typical year more than 300 media outputs are generated based on the IEB activities. In addition, a range of infotainment articles are produced. Though the IEB is active on both Twitter and Facebook, judging by the numbers of followers IEB is not yet using either to its full capacity. This may be a lost opportunity to advertise its strengths and capability and attract international interest.	
D4.2	Publishing activities and its quality
The IEB publishes 2 well established journals which have increasing impact factors though which are marginal in terms of profitability. As is the case with many such organisations owned and managed journal, some thought should be given to what role they play in the organisation's mid to long term strategy.	
D4.3	Participation in professional organisations in the area of research and development
This is reported within individual team contributions.	

Other comments of the commission:

The commission would like to make the following recommendations for the IEB:

- Improved targeting of international funding opportunities and mentoring of junior staff in applications to ERC funds.
- Continuing to manage the transition to the leadership of the Centre for Plant Structural and Functional Genomics and the Laboratory of Growth Regulators. In both cases it will be important to mentor existing staff in developing an international profile and when making new appointments to explore opportunities for associating the recruitment with new research streams or funding opportunities.
- Exploring the opportunities for developing further the concept of centrally managed equipment such as HPC capacity and mass spectrometry facilities to promote more efficient use of resources and broader opportunities for access.
- Developing a career development pathway and peer group structure for technical and support staff such as computer scientists, biomathematicians and laboratory technicians with particular expertise. These roles will become of increasing importance for the future success of the IEB.
- While the science quality of a major part of the output is well-recognised IEB faces a number of significant challenges. Two of the teams will most likely go through a change of leadership in the next evaluation period The Laboratory of Plant Biotechnology is recommended to focus much more directly on testable hypotheses

and to develop an improved linkage to environmental microbiology. In the case of the Laboratory of Virology it is recommended to terminate the group as in independent team and reassess the virology portfolio of CAS. In the case of Team 9 a reduction in resource is recommended though this should not be at the expense of the Apple Breeding Station which is both in tune with current best practice and successful in its main focus of apple cultivar production.

Part B: Evaluation of teams

1. Centre of Plant Structural and Functional Genomics

Strengths:

This group is defined by a research combination of chromosome techniques and genomics technologies that is unique in the plant world. It also has a very good working atmosphere and a very strong track record of delivery.

Weaknesses:

Despite an excellent international reputation and visibility, the team had difficulties in attracting good students and early career researchers.

Opportunities:

The combination of a unique capability in extracting high quality HMW DNA from a wide range of plant species together with an excellent combination of cytological technique and technology ensures that this laboratory will continue to be a major player in plant genomics. Their recent expansion into 3D chromatin structure and its role in gene expression is a highly topical area and represents an important development in terms of their research focus.

Threats:

The major threat is the need to manage the transition required by the retirement of the team leader who has been the major factor in the international reputation of the group and is the one person identifiable in playing a key role in many international plant genomics projects.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
<p>This group has a very good publication record and is developing a good balance between its role as a technology provider and a more broadly-based research laboratory. The average rating from the first phase evaluation gave a 2.31 which is average, however the fractional count with first author position is very good in these selected items. The productivity in excellent outputs in the 1* and 1 sectors was far above average. The intensity of re-citations as indicator of visibility could be improved.</p>	

H1.2	Contribution of workers on the outputs reached
Though not always the primary research leader or lead authors in many of the highest quality publications from the group, they have nevertheless played a key enabling role. There is also a good series of primary outputs.	
H1.3	Quality of all outputs and results
The output from the group is critical to most if not all the publication. Their work is internationally acknowledged as being of the highest quality.	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
The development and implementation of technologies for chromosome sorting and the production of good quality high molecular weight DNA have played a central enabling role in almost every major crop plant genomics project. They are also the leading players in the development of plant optical maps which are critical in dissecting the complex repeat structure of plant chromosomes.	
H1.5	Contribution of the participation of the authors in large collaborations
The group has a good balance between acting as primary authors in cytological publications and leading the cytological section of large multiauthor genomics ones.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The group has major national and international visibility based on their reputation for high quality and relevant science which has direct societal value	
H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team's activity on proper practice in society in the area of social sciences and humanities
The work of the group has had and is continuing to have a major impact on the genomics and genetics of major crops plants including wheat, barley, and banana.	
H2.3	Relation to practice
Their work is based on practical excellence and they have trained many other researchers in the technologies and approaches they have developed.	
H2.4	Participation in AV21 strategy
Not discussed	
H2.5	Cooperation with regions of the Czech Republic
This group has been a major contributor to the Hana region joint project.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the team with similar international and national institutes
This group has a unique major international presence and reputation in their area of expertise.	
D1.2	Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation
This team has played an enabling role in crop genomics and has provided expertise and technology which has been of fundamental importance for plant genomics and genetics. This is based not only on the technology they have developed but also their reputation for delivery.	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
The team has an impressive list of international roles and invitations. However, it should be noted that this largely focussed on the team leader and his international reputation. It will be important to ensure that he is able to mentor other members in the group and possibly his successor in these areas. This is becoming urgent.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
The work is well focussed and directed and builds sensibly on their previous work. They have also taken account of the need to balance their role as a technology provider with the need to develop independent research areas based on their skills and expertise	
D2.2	Assessment of the previous research objectives and their achievement
All the groups have made excellent progress along their submitted workplan which has matured to the level of excellent publications	
D2.3	Assessment of implementation of recommendations from past evaluation
The previous evaluation highlighted the issues about the replacement of the team leader and the focus on a small number of key technologies which may have a limited window of opportunity. They have well reacted by developing a broader portfolio of work focussing more on solving fundamental biological questions such as the promising development of their work on the 3D structure of the nucleus and gene regulation. The replacement of the head of department within the next few years will still be a major issue.	
D2.4	Success in receiving grants
The team has been extremely successful in receiving funding from international projects	
D2.5	Adequacy of instrumental equipment
The team has an excellent set of equipment which is state of the art for the support of molecular cytology.	

D2.6	Effectiveness of management
This group is well managed and has been restructured to improve its resilience	
D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
The team has a good youthful age structure except for the group leader. Despite their reputation they have found it difficult to recruit and retain international staff. This is despite the fact that they often host international visitors and have a unique international reputation.	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
Little information was provided	
D2.9	Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
They have good links at both the national and international levels.	
D3.2	Effectiveness of joint research centres
The team is one of the three partners in the Centre of the Region Hana for Biotechnological and Agricultural Research. This is a well establish and productive partnership.	
D3.3	Success rate in supervision of PhD students
Twelve PhD student have graduated in the evaluation period.	
D3.4	Participation of PhD students in the outputs
Students have made a major contribution to the outputs from the department. Many of the important papers in excellent journals have PhD students as first authors which is an admirable practice reflecting good mentoring practice and support for career development.	
D3.5	Participation of the team in master or bachelor studies
The team has supported 36 students at this level which is very good.	
D3.6	Assessment of cooperation intensity with universities in the form of teaching
Many members of the team have university teaching roles. This is mainly at the level of masters training.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Several members of the team have given popular scientific lectures or contributed articles in Czech science popularisation journals.	
D4.2	Publishing activities and its quality
Members of the team have acted as either guest or subject editors for mainstream journals as well as contributing as reviewers.	
D4.3	Participation in professional organisations in the area of research and development
Though the team is well represented across this area of activity gain it is almost entirely focussed on the team leader. There is a need to extend experience of members of the team by suitable mentoring.	

Other comments of the commission: n/a

2. Laboratory of Cell Biology

Strengths:

Cell biology is an important discipline in biology and the research of the team relies on sophisticated methods of cell imaging and molecular biology. The topic of regulation of plant cell polarity and morphogenesis, including e.g. pollen growth and xylem differentiation, is of fundamental importance for our understanding of plant growth. The group contributes significant knowledge to mechanistic understanding of cell morphogenesis and exocytosis. The second focus is the contribution on lipid properties and dynamics to cell polarity. Thirdly the contribution of cytoskeleton organizers in cell shape dynamics is an important research area. The strengths are the highly successful implementation of research in an important field of cell biology and the mastering of up-to-date methodology. It is highly significant fundamental research. The group even in the transition phase starting in 2018 kept a worldwide recognized expertise with a set of excellent papers.

Weaknesses:

The topical focus is rather narrow. The cooperation network is quite focused and could be expanded. One wonders whether a widening of the focus could be implemented or expanded next to the core topics. How do environmental threats affect the processes under investigation?

Opportunities:

The recruitment of the new head of the team opens up possibilities to refocus the research direction and shape the future. This transition should be used in a more proactive manner.

Threats:

This evaluation did not take place on site. But the described limitations in lab and office space constrains the development of the group. Some of the research questions which are very important to ask but may be difficult to answer, e.g. the function of the large set of exocyst subunit isoforms, the mechanisms of exocyst formation and the selection of cargo. These pose a great challenge for the near future. But the team should prepare strategies beyond this specific aim for the intermediate future.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
The research of the group is published in the highest level of plant-specific journals (Plant Physiology, New Phytologist and Journal of Experimental Botany) and in first ranked general Journals like Developmental Cell and the Proceedings of the National Academy of Science USA. The number of papers is limited to 35 in journals with impact factor, witnessing a targeting of high-quality outlets, but also some limitation in project acquisition. The achieved high average rating of 2.29 in the first phase of evaluation testifies this success. The quality of output is very good.	
H1.2	Contribution of workers on the outputs reached
The fractional counts of output related to full time equivalents and corresponding author position held reached 0.5 and 0.39, respectively. These quantitative measures bring the lab in the top 20% across all teams under evaluation. In the category of evaluated tailored output, no publication ranked in the third or fourth quartile.	

H1.3	Quality of all outputs and results
The Laboratory of Cell Biology (LCB) ranked above average in the evaluation of both the productivity per full time equivalent in the first (world leading) and first plus second category (internationally excellent).	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
The group identified main mechanistic molecular components involved in driving the exocytotic process. Explicitly should be mentioned the EXO70 protein, a subunit of the exocyst complex. This supramolecular assembly contributes to many important processes in development of many/all cells. The group advances our understanding in a particular cellular process with world-wide leading contributions. A future focus on the role of the complex in stress acclimation is indicated and reasonable.	
H1.5	Contribution of the participation of the authors in large collaborations
The cooperation activity is average. The research focus is less suitable for large consortia but rather can be accomplished by methodologically tailored cooperations. The group mentions cooperations, e.g. with Mike Blatt (Glasgow, UK), Shaul Yalovsky (Tel Aviv University, Israel), Till Ischebeck (University of Göttingen, D), and Daniël Van Damme (PSB VIB Ghent, Belgium).	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
LCB conducts basic research and contributes fundamental understanding on important plant processes.	
H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team's activity on proper practice in society in the area of social sciences and humanities
LCB trains PhD students at a very high level. This gives the students scientific and organisational skills for a career in academics or industry.	
H2.3	Relation to practice
Relations to practice are not apparent.	
H2.4	Participation in AV21 strategy
Apart from the contribution of the research to our basic understanding of growth and development of plants as a decisive component in a healthy environment, for food and feed, pharmaceuticals and biotechnology, there is no particular contribution to the Programmes of Strategy AV21 of the CAS.	
H2.5	Cooperation with regions of the Czech Republic
The team cooperates with groups at Masaryk University in Brno. This interaction targets our understanding of the role of the Exocyst complex in stress acclimation.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the team with similar international and national institutes
Within the narrow focus of their research, the group has an excellent internationally recognized standing.	
D1.2	Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation
The engagement in international networks could be expanded if profitable for the research goals	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
Team members participated in scientific panels, e.g. of the Czech Science Foundation or of ANRS or in accreditation processes. They act as editors for <i>Frontiers in Plant Science</i> , <i>Plant Biology</i> and for the highly prestigious plant journal <i>Plant Physiology</i> (monitoring editor). They gave 19 lectures on national and international meetings or in colloquia. Journal editorship for <i>Plant Physiology</i> and <i>Frontiers in Plant Science</i> is greatly acknowledged.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
<p>A new head of the group, Dr. Martin Potocky (>1900 citations in Google Scholar, strongly increasing), has been appointed in 2018. The group structure is vibrant with PhD students, postdocs and senior advisors such as the former head Dr. Viktor Zarsky (<5000 recitations in Google Scholar).</p> <p>The proposed research plan aims for consistent continuation. This may be straight forward in this particular field and a good strategy to keep the high level of research output, but some new directions from the new team leader should be implemented as additional pillar for future development.</p>	
D2.2	Assessment of the previous research objectives and their achievement
As outlined above, the research group successfully followed the previous research plan and achieved the proposed milestones.	
D2.3	Assessment of implementation of recommendations from past evaluation
The recommendations concerned the development of the imaging platform. This was achieved. Another point was to connect the exocytosis process to cell signaling. Again this recommendation was implemented.	
D2.4	Success in receiving grants
The grant acquisition was moderate to reasonable, which may be due to the change in research group leadership.	

D2.5	Adequacy of instrumental equipment
The group runs a cell imaging platform. The spinning-disk setup was updated and a new laser-scanning confocal microscope could be acquired.	
D2.6	Effectiveness of management
The group is rather small and managed by tight interaction between the group members.	
D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
The age structure is vibrant, a new team leader has been appointed, however the limitations in office and lab space restrict the expansion of the team.	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
Not applicable	
D2.9	Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.
Not apparent	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
LCB cooperates with the Laboratory of Cell Morphogenesis at the Department of Experimental Plant Biology (Charles University) with many joint publications. Cooperation with the Dr. Lukasz Cwiklik (JHIPCH CAS) and Dr. Pavel Jungwirth (IOCB CAS) in the field of computational chemistry includes a joint postdoc Dr. Roman Pleskot). The cooperation is methodologically and topically justified, e.g. phospholipid signaling	
D3.2	Effectiveness of joint research centres
The cooperative relations are functioning well and effective as evidenced by joint publications.	
D3.3	Success rate in supervision of PhD students
The group successfully and regularly supervises PhD students which after completion of their PhD move on to international labs as postdocs. This indicates the high international recognition of the group. 6 PhD students received their PhD in the reported period.	
D3.4	Participation of PhD students in the outputs
The PhD students author papers from work carried out during their PhD training, including first authors position, according to their relative contribution.	
D3.5	Participation of the team in master or bachelor studies
The group has been involved in teaching and in 6 BSc., 7 MSc.- and 6 PhD-research projects. This is a good engagement considering the limited office and lab space.	

D3.6	Assessment of cooperation intensity with universities in the form of teaching
The teaching activity comprised regular lectures, seminars and courses and appears entirely sufficient and adequate.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Members of the group gave radio interviews and made other smaller contributions to public outreach and public understanding of science. The group regularly participates in the Day of Open Science of IEB.	
D4.2	Publishing activities and its quality
Not applicable	
D4.3	Participation in professional organisations in the area of research and development
The former and present team leader participated in evaluation panels and serve as review editor of Frontiers and monitoring editors of Plant Physiology and other journals. The team organized the 20th European Network for Plant Endomembrane Research (ENPER) meeting in Prague 2017.	

Other comments of the commission: n/a

3. Laboratory of Growth Regulators and Isotope Laboratory

Strengths:

The Laboratory of Growth Regulators and Isotope Laboratory (LGR – IL) has established an excellent worldwide reputation and publishes first level publications. The aim is to understand plant growth regulatory substances and to develop novel growth regulatory compounds for application, in plant science, agriculture and medicine. The experimental and synthetic skills offer a unique perspective for the future. The team has an international spirit and recognition.

Weaknesses:

It did not become clear why LGR and the Isotope Laboratory were combined in a single team. Rather it appears recommendable to split the LGR team into two units to avoid imbalanced structures and complex organisational procedures. The LGR structure in the IEB structure appears challenging, e.g. with the study programs at BSc.-, MSc.- and PhD-levels anchored in the LGR.

Opportunities:

The activities of the LGR were highly successful and hold a lot of promise for important future discoveries. Presently the further development is limited by constraints in infrastructure. The presentation developed some outlook for reorganization in the intermediate future.

Threats:

The granting of bonuses for publications represents an interesting strategy but should be accompanied by measures to assure compliance with good scientific practice. The limited office and lab space restrict the development of this promising and efficient research unit.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
47 publications from a total output of 374 between 2015 and 2019 were evaluated in the first phase. The research conducted in the Laboratory of Growth Regulators and Isotope Laboratory receives an excellent reachout. The publications appear in journals like the Proceedings of the National Academy of Science USA, Molecular Cell, Plant Cell or Journal of Experimental Botany. 13 publications were rated as (1) world leading, 27 as (2) internationally excellent. They receive an ever-increasing attention by recitation indicating high recognition of the results. The Isotope lab focuses on medicinally important cytotoxins of plant origin and the development of purine-based compounds for possible use in positron emission radiotherapy and tomography.	
H1.2	Contribution of workers on the outputs reached
The average rating of the team was 1,91 which is an exceptional high rating in the compared group. The output increases yearly reaching 100 in the near future and receiving more than 3000 recitations. The team has implemented a system for motivation of the researchers to receive grants and publish in high impact journals. The granting of rewards for acquired projects and bonuses for publications represent an interesting strategy to motivate for successful outreach in the future.	

H1.3	Quality of all outputs and results
The overall output in quantity and quality is very good to excellent. The intensity of publications was enormous, 374 publications for the evaluated period, which represents 13.7 publications of FTE.	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
The team produced a large number of results, both in basic research and potentially practical applications. Especially in the field of implementation of results in practice, the team within the CAS institutes is one of the exceptional ones. The teams have generated novel tools, e.g. the aromatic cytokinins topolins and the olomoucine- derivative which nowadays are used in cancer treatment. But there are many other innovative compounds tested for clinical activity, e.g. being in phase 2 of clinical testing. The team has generated novel plant growth substances and provided resources for their testing, e.g. OPDA-IIe or aromatic cytokinins. They have identified novel targets for the regulatory compounds and characterized their interaction. Importantly, the investigations use a broad panel of crop and pasture plants like winter rape, <i>Lotus japonicus</i> and maize. The establishment of a hormone analysis platform using novel technologies allows for detailed investigation of the hormonal status in species and stress conditions. The output is very high and cannot be covered here, e.g. also in the fields of medicinal chemistry with a group of kinase modulators.	
H1.5	Contribution of the participation of the authors in large collaborations
The team is involved in large international networks and consortia, e.g. in COST actions of the EU.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The results of the team, namely the development of novel compounds for agricultural and medical application, are important contributions to the future benefit of the society. They significantly contribute and perfectly match the mission of IEB. The team has „launched new research programs to exploit the knowledge of metabolomics, hormonomics, genomics, and biotechnology to improve production, yield, harvest, stress tolerance and quality of major EU crops.“	
H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities
The team has implemented proper strategies for translational research and final implementation into practice. The management is excellent.	
H2.3	Relation to practice
As outlined above, various results from the screening for bioactive compounds find their way of application in research, agricultural and medical testing. The team has filed several patents in the time period of the report.	

H2.4	Participation in AV21 strategy
The development of environmental-friendly growth regulatory is important for a safe and sustainable future of agriculture and forestry.	
H2.5	Cooperation with regions of the Czech Republic
The team cooperates successfully with many companies and universities to exploit the potential of their developments.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the team with similar international and national institutes
The productivity of the group is outstanding and certainly among the leading institutions in the field.	
D1.2	Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation
The report mentions 29 international cooperation partners from diverse countries around the world. The cooperation has resulted in joint high-level publications.	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
The team and team members organized multiple workshops and international meetings, e.g. Biotechnology of Phytohormones and Natural Substances in 2015, Growth Regulators on The Way in 2016, Chemistry and Biology of Phytohormones and Related Substances in 2017, Event name: Chemistry and Biology of Phytohormones and Related Substances in 2018, Current Progress in Gibberellin Research in 2019 and more. The report lists many recognitions, lectures and awards. This is somewhat overdone. But the activity overall is very impressive.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
The teams consist of 49 researchers at present. The age structure is favourable, the average age is around 40. A large group of PhD students and postdocs is complemented by senior scientists. The plan for the next time period proposes promising activities in the four areas of previous successes, namely new phytohormones, bioanalytical chemistry, medicinal chemistry and plant molecular physiology. Despite all the positive evaluations, the team is too big and when changing managers, one can expect a division into several smaller units.	
D2.2	Assessment of the previous research objectives and their achievement
The previous assessment encouraged the continuation of the previously successful research strategies. The four research areas (new phytohormones, bioanalytical chemistry, medicinal chemistry and plant molecular physiology) were expanded and have advanced our understanding in an impressive manner.	
D2.3	Assessment of implementation of recommendations from past evaluation

The team has implemented the recommendations of the previous evaluation, namely to include omics technologies in their analytical portfolio.	
D2.4	Success in receiving grants
The team has received considerable funding of about 4.4 mio in 25 grants according to the 3-2_list_of_grant_and_programme_projects of IEB.	
D2.5	Adequacy of instrumental equipment
The team presently manages a surplus and divests part of this budget into improving the infrastructure, e.g. by building a technology platform.	
D2.6	Effectiveness of management
Incentives to publish in very good or excellent outreach journals motivate the team members to consider such options. The team has established efficient measures to ease career development. The co-workers are coached and receive guidance in career development.	
D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
The entire team is well structured but leaves the team members significant freedom to operate. Authorships require significant contributions to the work. Cooperation is encouraged. Dr. Ondrej Novak is a highly cited researcher (2018, 2019, 2020), Clarivate Analytics) indicating the successful support of team members.	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
The gender balance is not explicitly mentioned in the report.	
D2.9	Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.
The entire work has a link to sustainable bio-based economy.	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
LGR participates in scientific programs of 4 Research Centres with universities. The members of the LGR team deliver a large number of various teaching activities. There exists a tight interaction with university. The teams of LGR and IL combined supervised 81 BSc.-, 67 MSc.- and 18 PhD-students who graduated in the report period. Again, this is a strong indication of intensive interaction at the teaching and training level in addition to research.	

D3.2	Effectiveness of joint research centres
LGR participates in four research centres at universities. There exist joint grant applications in larger consortia.	
D3.3	Success rate in supervision of PhD students
18 graduated PhD students. This is a very good activity.	
D3.4	Participation of PhD students in the outputs
The PhD students co-author publications according to their input and should be first author on at least one publication.	
D3.5	Participation of the team in master or bachelor studies
There exists intensive interaction as outlined above.	
D3.6	Assessment of cooperation intensity with universities in the form of teaching
The tight interaction with universities and in teaching is obvious and successful as indicated by the existing joint study programs. The team has implemented together with the Faculty of Science, Palacký University in Olomouc, the independent biological BSc.- and MSc.-study programs „Experimental Biology“. In addition, the consecutive program continues with a PhD study program.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
The team was involved in research popularization with more than 15 actions and participates in the Open Days of Science.	
D4.2	Publishing activities and its quality
The team is engaged in research outreach, e.g. by 15 popular lectures,	
D4.3	Participation in professional organisations in the area of research and development
Members of the team served on multiple panels, committees, editorial boards (e.g. Plant Growth Regulation, Phytochemical Analysis and Phytochemistry Letters).	

Other comments of the commission:

The team, but essentially the IEB, needs new facilities, in the best case new buildings with state-of-the-art laboratories and offices to expand the highly successful research and development (R&D) activities. The work of the team Laboratory of Growth Regulators & Isotope Laboratory should be continued in the near future, however there should be re-thinking of structure and research direction when the executive director is going to retire in the intermediate future. The indicated allocation of the clinical research direction to the university might be a good measure to fit the research activities of the team better to the scope of the institute.

4. Laboratory of Hormonal Regulations in Plants

Strengths:

Plant hormones shape the plant during development and enable acclimation to the environment. The topic pursued by the team is of highest importance. The team is dynamic and consists mostly of young and intermediate career scientists. The labs implement the use of up-to-date methods like CRISPR/Cas with high efficiency. The team has also adopted methods of computational biology and established an analytical unit and an imaging facility for high end dynamic microscopy.

Weaknesses:

The team members should attempt to increase the quality of output from research responsibly managed at the Laboratory of Hormonal Regulations in Plants, and consequently with researchers from LHR as first, senior or reprint authors.

Opportunities:

With the change in team leadership, the group can possibly redirect some efforts from established routes to novel directions such as mechanisms of hormonal crosstalk. This is in fact a classical topic, also addressed by the team, but receives now new attention with the availability of better methods and tools. The team has the chance to close up to the international leaders in the field.

Threats:

The costs for the analytical and imaging units are mostly covered by grants or single investments. For such analytical units, an adequate balance between basic and third-party funding is needed and recommended. The computational approaches need to reach the next level of mechanistic prediction. The efforts for equal access to the technologies in the group should be maintained and expanded. The report mentions the good conditions in the lab as barrier to motivate young researchers to perform postdoctoral stays abroad. This kind of mobility should be taken as a must prior to advancement in the group and institute.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
<p>The Phase I evaluation of the team included 31 publications of a total output of 102. The average rating was 2.52, which is surprisingly lower than expected in the light of several excellent to very good publications (Nature Plant, Plant Physiology, New Phytologist, Journal of Experimental Botany). This is due to a bulk of target journals in the good range like BMC Plant Biology, Plant Science, PloS One, Annals of Botany or Plants. Nevertheless, the output is very good with significant contributions as discussed below.</p>	
H1.2	Contribution of workers on the outputs reached
<p>The team often is collaborator in international cooperations where they do not take the lead. This is apparent by the fact that in the quality group 1, the fractional count is low and reprint function is missing, and this also accounts to the second quality group of outputs (4 reprint positions out of 11 items). And this is even seen in the third quality group (10/15).</p>	
H1.3	Quality of all outputs and results

The observations described in H1.2 and H1.2 combined with the view on the entire output add up to the conclusion that the overall output is good to very good, but somehow lacks the highlights originated from LHR.	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
The major focus was placed on „auxin transport and homeostasis, metabolism and physiological functions of cytokinins and the interaction of phytohormones with the environment“. The function of auxin carriers previously predicted in mathematical models was validated. In collaboration, they showed a role of PIN6 during lateral and adventitious root organogenesis. In the cytokinin field, the modulatory function of this hormone was expanded to many plant processes, and additional elements of cytokinin homeostasis were elucidated. The research aims were also directed to the role of phytohormones in stress acclimation, both concerning abiotic stress like salinity and biotic stress like infestation with nematodes.	
H1.5	Contribution of the participation of the authors in large collaborations
Not applicable.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
Secured biomass and yield production for food, feed and bioeconomy is central to humanity and for any society. The topic of hormonal regulation of plant growth and acclimation is highly significant in terms of the sustainable development goals. The team contributes important results pursuant to the mission of the institute and CAS.	
H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities
Understanding mechanisms that control plant acclimation and development is fundamental to plant science. The team advances fundamental science with implications for agriculture and climate change, the latter in form of stress research for improving resilience of plants.	
H2.3	Relation to practice
The team generated three outputs related to application for example on the role of 2,4-dichlorophenoxyacetic acid in horticulture. Another interaction with more general significance is the capacity for hormone profiling which is of interest also for companies, but the throughput is limiting.	
H2.4	Participation in AV21 strategy
Team members participate in the project Strategy AV21 (VP 06 Diagnostic Methods and Techniques) aiming for establishing and publicizing novel imaging technologies for studying plant hormones.	
H2.5	Cooperation with regions of the Czech Republic
The team participates in the Centre of Experimental Plant Biology. The group collaborates nationally (e.g. with Masaryk University Brno, CEITEC and Mendel University, Agronomical	

Faculty, Brno). The application for joint grants was successful. The team participates in establishing a national imaging platform.

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the team with similar international and national institutes
<p>The team is internationally recognized partner in cooperative projects indicating the ability for significant contributions to the field and in research consortia. They also participate in a European Network on imaging named Eurobioimaging. The output from these international and national collaborations is very good, but mostly as contributing partner and not as main motor.</p>	
D1.2	Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation
<p>The team continued its established collaboration with Montpellier (France) showing the auxin-transporting activity of NRT1.1 (Bouguyon et al., Nature Plants). Work with the University of Warwick (UK) developed a concept for the role of uptake carriers in auxin herbicide action (Hu et al., Journal of Experimental Botany). Other international collaborations included work with Gent (Belgium), Vienna (Austria), Szeged (Hungary) or Louvain (Belgium). The group is well integrated in many international cooperations and a functional network. Participation in larger international consortia is not apparent.</p>	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
<p>The group members served on various national and international research evaluation panels or evaluated single proposals (DFG Germany, FWO Belgium, ISF Israel, BARD Israel, ANR France, NWO Netherlands, ERC EU, NRD, OTKA Hungary, GAUK, Czech Republic, MEYS, Czech Republic and CSF, Czech Republic), functioned as referees for about 150 paper submissions, and organized smaller workshops and meetings. E.g. with the support of the AV21 project, the team organized in 2019, two one-day workshops focused on new technologies in studies of plant plasma membrane proteins. Team members gave invited lectures. They organized the conference on Auxins and Cytokinins in Plant Development in Prague 2018.</p>	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
<p>The LHR consists of five subgroups focusing on various aspects of plant hormone synthesis, function and analytics. In 2017 Jan Petrášek started as new head of the team. His publication record as taken from Google Scholar is excellent and increases. The future plan comprises 18 bullet points which aim to advance our understanding of auxin and cytokinin signaling and their role in stress acclimation. The latter includes other phytohormones. These aims are logical continuations and developments of the previous activities. Here some more hypothesis and explanations of the particular high significance would have been helpful.</p>	
D2.2	Assessment of the previous research objectives and their achievement

<p>The team followed the directions described in the previous research plan and fulfilled the expectations, namely establishment and modulation of auxin and cytokinin homeostasis, signaling of auxin and cytokinins and understanding hormonal control of physiological processes, including interactions with other phytohormones. This included the implementation of mathematical models.</p>	
D2.3	Assessment of implementation of recommendations from past evaluation
<p>The previous report essentially motivated the team to advance along the successful research pathway of auxin and cytokinin signaling. The previous panel suggested to take measures for better cooperation within the team. Particularly since the change in leadership, this harmonization was successful.</p>	
D2.4	Success in receiving grants
<p>The team received an impressive number of project grants both from local/national sources and from international programs.</p>	
D2.5	Adequacy of instrumental equipment
<p>The analytical platform was strengthened in 2017 hiring a new expert. The core analytical system is a LCMS system consisted of UHPLC 1290 Infinity II (Agilent Technologies) coupled to 6495 Triple Quadrupole mass spectrometer (Agilent Technologies). Such a unit of central importance should receive a balanced support by basic and third-party funds. The imaging platform of the team is also of high significance for the team and beyond and is of high technical standard. Such machinery tends however to require continuous input for repair and replacement.</p>	
D2.6	Effectiveness of management
<p>With the new team leader, several issues concerning the type of interaction, easiness of cooperation, equal access to technologies, balancing resources and equality of salaries were settled between the five laboratories of the team.</p>	
D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
<p>The team has managed to keep strong postdocs and integrating other researchers to assure vividity and competitiveness.</p>	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
<p>The team supports return of researchers from maternity leave as early as wished.</p>	
D2.9	Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.
<p>No information available.</p>	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
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There exists an intense cooperation with universities in Czech Republic. The cooperation includes teaching where lab members offer a series of lectures at all levels of university education.	
D3.2	Effectiveness of joint research centres
The team participates in the Centre of Experimental Plant Biology.	
D3.3	Success rate in supervision of PhD students
The team supervised 5 PhD students who finished in the report period. In addition, at least 5 PhD projects are ongoing.	
D3.4	Participation of PhD students in the outputs
The PhD students participate in publishing according to their contribution to the work. First and shared first authorships are routine in the publishing plan of each PhD student.	
D3.5	Participation of the team in master or bachelor studies
Students are increasingly integrated into the experimental work. The team was involved in one MSc.- and 5 BSc.-theses during the period of the assessment.	
D3.6	Assessment of cooperation intensity with universities in the form of teaching
The team is engaged in teaching at universities and supervises projects as part of BSc.-, MSc.- and PhD.-theses. The group is involved in public outreach and welcomes secondary grade scholar from schools for experimental lab work. The report assembles a long and convincing list of teaching activities at universities.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Nine secondary school students stayed in the team for conducting experiment lab work. The team participates in the activities in the frame of "Week of Science and Technology" of CAS, in the Fascination of Plant Day and in the Science Fair.	
D4.2	Publishing activities and its quality
Original results produced by the laboratory were also publicized in Czech Television and Czech Radio broadcasting.	
D4.3	Participation in professional organisations in the area of research and development
No information available.	

Other comments of the commission: n/a

5. Laboratory of Plant Biotechnology

Strengths:

This group has recently acquired a state-of-the-art instrumentation for metabolite analysis that should give them a unique opportunity to analyse the fate of toxic compounds within plants.

Weaknesses:

Despite a recommendation from the previous evaluation, they have neither recruited, developed, nor collaborated in order to access microbial expertise. This is a major gap in the ability of the group to understand the biological dynamics of environmental contamination or provide practical, viable solutions. There appears to be a lack of focus on the core activity of bioremediation.

Opportunities:

The assessment of the role and effect of organic and other environmental contaminants is an area of major and growing importance.

Threats:

The development of this area in isolation from the role of microbiome activity is a major gap in developing an understanding of the processes involved and to find efficient solutions to environmental contamination. The research appears technology- rather than hypothesis-driven. There appeared a lack of focus. The team functions as technology provider to projects outside of the core activity of the group.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
This group does not have a strong publication record in high impact journals, rather they have a solid portfolio of outputs. The rating in the first phase of evaluations was outstandingly low.	
H1.2	Contribution of workers on the outputs reached
Members of the group are either first authors or corresponding authors in their most important publications	
H1.3	Quality of all outputs and results
The low output from the group is critical to most if not all the publications. The low activity is reflected by far below average rating in excellent outputs in 1 + 2 section.	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
Though the group has a whole series of publications on the uptake of environmental contaminants by plants it is not clear that they have made major contributions to the fundamental mechanisms involved. As much of the work is in model plant systems it is not clear if their studies offer a route to either the utilisation of plants as environmental cleansers or prediction of the actual danger of environmental contamination. Much work is devoted to the evaluation of plant responses to toxic compound by transcriptomics or e.g. root growth measurements but this work lacks the appreciation of the importance, mechanisms and practical applications.	

H1.5	Contribution of the participation of the authors in large collaborations
Not applicable	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The work of the team in the elucidating the role of environmental contaminants in plants has the potential to be of societal relevance. However, little efforts are done towards assessing how plants can be utilised for decontamination. More work should be devoted to demonstrate the uptake and metabolism of toxic compounds within plants.	
H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities
Though the group works in an area which has potential for transfer into practice it is not clear that a clear route for this either directly or through collaboration exists. If this work is to continue it is of importance that such linkages are developed. This has to be based on collaboration with soil scientists and environmental microbiologist and there is no good reason for most of their work being performed in Arabidopsis.	
H2.3	Relation to practice
There is evidence that the group holds a series of patents and licenses, but it would have been important to provide evidence as to the impact of these in terms of uptake and utility.	
H2.4	Participation in AV21 strategy
Not evident	
H2.5	Cooperation with regions of the Czech Republic
Little evidence	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the team with similar international and national institutes
It is not obvious that this group has a major international standing.	
D1.2	Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation
This group has played highly active roles in numerous COST actions and similar networking initiatives. However, as the primary role of these initiatives is to develop and foster collaboration it seems strange that this has scarcely resulted in collaborative projects, international funding or publications. The group needs to focus on, nurture and develop a subset of their activities.	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)

Members of the group have been engaged in the management committee of several COST actions.

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
Despite the group possessing a useful set of skills and a good equipment base the work seems to lack focus and in most cases it led neither to an elucidation of mechanism nor provided a route to practice.	
D2.2	Assessment of the previous research objectives and their achievement
There has been some progress.	
D2.3	Assessment of implementation of recommendations from past evaluation
The previous evaluation highlighted the need to focus on the validation or rejection of specific hypotheses and the need to extend the work to include the role of the microbial component of the ecosystem. Though there has been some movement regarding the former, the research still lacks in depth studies for any detoxification route, or mechanisms how plants respond to environmental contaminants. The group still lacks microbial expertise. In the absence of recruitment or development of such expertise it is important that the group at the very least establishes collaborative linkages to this area.	
D2.4	Success in receiving grants
The group has been regularly active in COST actions. However, these do not provide research income. There is a need to focus more clearly on research grants application rather than COST actions and comparable networking funding. Significant grant income together with good publications provide a balanced measure of a successful research group.	
D2.5	Adequacy of instrumental equipment
The group has an excellent set of equipment resources. It should be considered by the IEB to develop a core facility of mass spec instrumentation. This would free the group to be involved in too many projects unrelated to their core activities, such as looking for metabolites in wine.	
D2.6	Effectiveness of management
This group is well managed and has been restructured to improve its resilience	
D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
The team has not reported a clearly documented HR policy.	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
Little information was provided	
D2.9	Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.

N/a, despite the fact that plant biotechnology could be very active in this challenge.

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
There is no major evidence of collaborative projects	
D3.2	Effectiveness of joint research centres
n/a	
D3.3	Success rate in supervision of PhD students
Four Ph.D. student have graduated in the evaluation period which may be reasonable for such a small group.	
D3.4	Participation of PhD students in the outputs
Students have 'participate' in outputs from the team, but it is not clear which role they have played or how they have been mentored in contributing to the production of the publications	
D3.5	Participation of the team in master or bachelor studies
They have had some involvement mainly at a support level.	
D3.6	Assessment of cooperation intensity with universities in the form of teaching
Three members of the team have university teaching roles. This is mainly at the master's level.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
Several members of the team have given popular scientific lectures or contributed articles in Czech science popularisation journals. They have also played a national role in the "Fascination of Plants" initiative from EPSO.	
D4.2	Publishing activities and its quality
Members of the team have role on editorial boards of several journals.	
D4.3	Participation in professional organisations in the area of research and development
One member of the team has played an active role in EPSO and was the main organiser of the EPSO 2016 meeting in Prague.	

Other comments of the commission: n/a

6. Laboratory of Pollen Biology

Strengths:

Pollen Biology is a young and international team with many PIs. It has a balanced age structure that includes both experienced and early-stage researchers. Strong national and international cooperation are developed. The team has a high success rate in obtaining local grant support.

Weaknesses:

The main weaknesses are the limited space and funds, as well as poor level of interest in long-term and cutting-edge science.

Opportunities:

The team has all of the qualities required to consider long-term European and international support for improved sustainability. Another opportunity consists in connecting the expertise in pollen biology and DNA damage

Threats:

The main threat could be the necessity to maintain a high success rate in obtaining grant support.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
<p>The quality of output is very good to excellent.</p> <p>The average rating of the selected outputs of the Phase I was 2.46. But the distribution of quality is excellent since among the twenty four outputs evaluated, 37.5% are in the first decile (Q1*) and 45.8% in the first quartile (Q1* or Q1).</p> <p>Compared to the field, the productivity of the Pollen Biology team is below the range for the productivity of teams in excellent outputs (per FTE) rated as world-leading, but clearly above the productivity in excellent outputs (per FTE) rated as world-leading + Internationally excellent. This indicates a clear strategy of the team to focus on excellence and quality rather than quantity.</p>	
H1.2	Contribution of workers on the outputs reached
<p>The contribution of the team members is very good. For an important part of these outputs, the research studies were conceived, designed, conducted and/or finalized almost exclusively by members of the team.</p>	
H1.3	Quality of all outputs and results
<p>The quality of all outputs and results is very good with 29% in the first decile (Q1*), 35.5% in the first quartile (Q1* or Q1) and 29% in the second quartile, therefore 64.5% of all outputs are within the first/second quartiles, among the 31 outputs. The quality is clearly prioritized over quantity.</p>	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
<p>The team has a world-leading role in the field of plant reproductive development, in particular in genome organization and stability, transcriptional regulation during male gametophyte development, translational regulation and mRNA storage in pollen and pollen</p>	

<p>tubes and male-female communication preceding double fertilization. The most valuable discoveries were on the SOG-1 role in DNA repair, on pollen -omics studies with a special emphasis on transcription with important results on bZIP transcription factors as well as on translational regulation with eIF3 and ALBA functions, and on tube pollen secretomic. The majority of these results of the team were published in Q1* and/or Q1 journals. The team has a clear leading position on all these aspects.</p>	
H1.5	Contribution of the participation of the authors in large collaborations
<p>The team has developed many national and international research collaborations (France, Germany, India, Israel, Japan, UK etc.) within the research area of pollen biology and DNA repair. Some of the outputs are produced in the frame of these collaborations. In most cases the team's authors have a key contribution.</p> <p>The team has participated in two large collaborative networks, Centre for Experimental Plant Biology EXBIO and ERA-CAPS project EVOREPRO.</p>	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
<p>In many aspects, the outputs have or may have societal impact, both directly and indirectly, relevant to CAS and the IEB mission.</p>	
H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team's activity on proper practice in society in the area of social sciences and humanities
<p>Members of the team have important activities in the Academy Assembly, Economy Board of the CAS, and science popularization for the Institute.</p>	
H2.3	Relation to practice
<p>More applied results could be expected, in particular from the implication of the team in the large collaborative network Centre for Experimental Plant Biology EXBIO as WP3 leader.</p>	
H2.4	Participation in AV21 strategy
<p>No clear information about this point. The activities of the team are, however, relevant for some of AV21 programs such as Food for the Future.</p>	
H2.5	Cooperation with regions of the Czech Republic
<p>Beside the large collaborative network Centre for Experimental Plant Biology EXBIO, including active cooperation with the city Prague, in the region of Liberec, Olomouc and South Moravia, the team also has a strong collaboration network within Czech Republic (CEITEC MU Brno, IBP CAS Brno, University of Chemistry and Technology Prague, Biological Centre České Budějovice, ...).</p>	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the team with similar international and national institutes
<p>The team clearly emerges as an international leader in different fields of pollen biology and DNA repair. The connection of these two themes (pollen biology and DNA repair) can be an obvious added value compared to similar international and national institutes. Although the field of pollen biology is very competitive at the international level, the approaches developed jointly in this team on both transcriptional and translational regulation as well as secretomics, have originality and are a true asset for this team which places it as a unique internationally unit and could give it a certain advantage.</p>	
D1.2	Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation
<p>The large international cooperation (Germany, United Kingdom, Israel, Japan, France, India, etc.) of the team and its involvement in two large collaborative networks, the Centre for Experimental Plant Biology EXBIO and the ERA-CAPS EVOREPRO project are clearly a strength of the team. Thanks to this, the team collaborates with some world leading groups and is positioned as one of the leaders at the international scale. This should help to continue the marked improvement observed in terms of quality of the team's publications compared to the last evaluation, and as also observed during the team presentation.</p>	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
<p>Members of the team are very actively engaged in a wide variety of scientific community activities, including scientific commissions, panel committee, editorial board, organizing and coordinating conferences and/or seminars. Members of the team were also invited speakers at a number of major research centres and organisations. Several prizes, such as the Czech Society of Experimental Plant Biology Award and PhD student awards, are also noteworthy.</p>	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
<p>The team has continued to pursue experiments in its main research areas, with a solid track record and visible progress toward both publication quality and quantity. The team also retained strong international collaboration and integrated its activities in two large collaborative networks. Several young international researchers have reinforced the current team and stimulated scientific innovations. All these points should encourage the team to consider long-terms European and international funding for more sustainability.</p>	
D2.2	Assessment of the previous research objectives and their achievement
<p>Almost all of the previously identified objectives were achieved, and the team produced high-quality results.</p>	
D2.3	Assessment of implementation of recommendations from past evaluation
<p>The team has successfully considered and addressed all of the prior evaluation recommendations.</p>	
D2.4	Success in receiving grants

<p>During the evaluated period the team has been regularly successful in funding with 16 projects awarded: 9 projects by the Czech Science Foundation and 7 projects by the Ministry of Education, Youth and Sports of the Czech Republic. This is excellent and a necessary prerequisite for the sustainability of the team but it can also be problematic in the long term if success is not achieved for too long a period. A higher proportion of institutional support would boost team stability and allow team members to be more focused on research and less on obtaining funding.</p>	
D2.5	Adequacy of instrumental equipment
<p>It seems to be right based on the evidence given, however, more lab space is needed. The widespread use of high-throughput technologies may result in substantial data storage and analysis requirements in the future.</p>	
D2.6	Effectiveness of management
<p>The management is effective. Members of the team are encouraged to apply for grants and to develop their own projects. As a result, the team has an unusually high number of PIs. However, it should be avoided that this results in a sense of instability in the team's core thematic in the future. Young researchers are encouraged to travel for research stays abroad.</p>	
D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
<p>The Pollen Biology Lab is a medium-sized, young and international team with multiple principal investigators. The balanced age structure of the team includes both experienced and early-stage researchers as well as students.</p>	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
<p>It is noted that young talented foreign researchers have been integrated successfully, and that there is a fair gender balance among researchers.</p>	
D2.9	Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.
<p>No information provided on this aspect.</p>	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
<p>The cooperation with Universities on both national and international level is very effective for research. Also already pointed in this report, there is active participation in two large collaborative networks including universities.</p> <p>A high degree of cooperation is also observed at the level of lecturing and student supervision, especially with Charles University, as well as for foreign student supervision from other international universities.</p>	
D3.2	Effectiveness of joint research centres

The team's active presence in two large collaboration networks, the Centre for Experimental Plant Biology EXBIO and the ERA-CAPS EVOREPRO initiative, is noted and obviously a strength.	
D3.3	Success rate in supervision of PhD students
They were reasonably successful considering the size of the team: 3 PhD thesis were defended during the evaluation period. This point could be strengthened by pursuing deeper engagement with national universities on the teaching level, as well as by exploiting on the team's international partnership and ability to attract international students/researchers.	
D3.4	Participation of PhD students in the outputs
The participation of PhD students on the Lab outputs is obvious. During the evaluation period, PhD students were involved in 47% of the outputs, and held the first or joint first author positions of 10 of these outputs.	
D3.5	Participation of the team in master or bachelor studies
Participation is active, with a variety of lectures offered as well as supervision of Master (8 supervision during 2015-2019) and Bachelor (6 supervision during 2015-2019) students.	
D3.6	Assessment of cooperation intensity with universities in the form of teaching
During the evaluated 2015-2019 period, 43 semestrial lectures, lectures, and/or courses at the Bachelor, Master, and Doctoral levels were delivered illustrating the effective cooperation of the team with the universities in the form of teaching. This implication, however, was limited to Charles University. Diversifying collaboration in the form of teaching with other universities may be a good way to attract more students.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
The team has been instrumental in popularizing their research through seminars for the professional and general public, involvement in many popularization activities, writing papers for popular science magazines, and frequent participation in biology courses/supervisions for high-school students and/or children. This endeavour must be maintained, if not augmented, in the future.	
D4.2	Publishing activities and its quality
On this aspect, the publishing standard is good. Several team members contributed to popular science publications (including Nova Botanika, Botanika, Botanika Special...).	
D4.3	Participation in professional organisations in the area of research and development
Active participation in various workshops and public presentations of the scientific Activities of the teams.	

Other comments of the commission: n/a

7. Laboratory of Signal Transduction, Laboratory of Pathological Plant Physiology, and Laboratory of Biologically Active Substances

Strengths:

The team is comprised of three experienced subgroups and continues with studies on established research topics of plant cell signal transduction. Predominant topics concern phospholipid signaling, a particular plant pathosystem and somatic embryogenesis. The research relies on established national and international cooperation and grants. The subgroups make partly use of the excellent environment, e.g. on phytohormone research, at the IEB. The output has been improved and the received recitations increase at present.

Weaknesses:

The team consists of three subgroups dealing with highly diverse research topics. The visibility could be improved. The competitiveness is somewhat restricted by size and topic. The significance of this particular research in a broader context for the IEB, for solving particular problems or addressing hypotheses of outstanding timeliness remains somewhat elusive. The financial situation appears risky and the access to measuring times for microscopy limiting. The plant growth capacity is described as being limiting as well.

Opportunities:

One wonders whether topics after 25 years of research on phospholipid signaling and somatic embryogenesis should undergo a more profound rethinking. The rather novel topic of flotillins which mediate stress-specific responses and participate in plasmamembrane-cell wall interactions and microdomain formation possibly opens up such an opportunity.

Threats:

The acquisition of funding supporting the main research questions appears challenging to the first group. Likewise, the phytopathology group may be too small to compete with other international institutes. The other novel topic „Noble metal nanoparticles and their effect on plant physiology and immunity“ lacks fundamental novelty but follows to some extent the current mainstream in this direction of nanotoxicology. Further reduction of funding as possibly suggested by the output parameters would endanger a loss of resources due to complete failure. Therefore, the strong entities of IEB might help with methodology such as RNAseq or profiling to enhance the ongoing research.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
<p>The team comprises three small laboratories Laboratory of Signal Transduction ((LST), Laboratory of Pathological Plant Physiology (LPPP) and the Laboratory of Biologically Active Compounds (LBAC) with divergent research topics. The selection of 20 output items in phase I received an average rating of 2.8 which is at the lower end of the scale encountered among the teams under consideration. Overall the output was good, with very few highlights such as the publication on flotillin 2 in Plant Journal.</p>	
H1.2	Contribution of workers on the outputs reached
<p>The three subgroups have 13.92 full time equivalents. The fractional count normalized for full time equivalents was 0.15 and the fractional count normalized for corresponding author positions 0.22. which is well below average. The comparison of all teams in the entire</p>	

group evaluated in panel #6 assigns the team under consideration to the lowest quartile of all teams in terms of productivity in excellent outputs.	
H1.3	Quality of all outputs and results
The total output comprises 44 items. The quality is good and should be improved.	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
<p>The research of the team centres to the response of plants to abiotic and biotic stresses with focus on phospholipid signaling and hormones. The characterization of non-specific phospholipase C (NPC) was continued. NPCs and phospholipid signaling play a role in acclimation to aluminium stress. Knock outs reveal, e.g., impaired thermotolerance. The subgroup contributed to 9 of 29 articles that appeared on this topic in web of science.</p> <p>The investigation of the Brassica napus-Leptoshaeria maculans pathosystem may have merits, but one wonders about the competitiveness of such a small group in phytopathology. The group therefore devotes attention to the role of cytokinins and other phytohormones in this interaction making use of the excellent research environment at the IEB.</p> <p>The third subgroup studies somatic embryogenesis, the function of polyamines, phenolics and phytohormones and stress responses. The major output are hormone profiles during somatic embryogenesis in Norway spruce.</p>	
H1.5	Contribution of the participation of the authors in large collaborations
Not applicable.	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
The report does not work out on this point. The importance of fundamental research for the society is beyond doubts. Each topic of the subgroups may have significance for understanding fundamental processes in plants such as regeneration, phytopathological processes and environmental acclimation.	
H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team's activity on proper practice in society in the area of social sciences and humanities
The group on plant pathology is active in deciphering mechanisms in plant-pathogen interactions which lead to patents.	
H2.3	Relation to practice
Combatting pathogens with novel strategies is a pressing issue in modern agriculture.	
H2.4	Participation in AV21 strategy
Not applicable	
H2.5	Cooperation with regions of the Czech Republic
The teams cooperate with six other teams of the IEB. The report also lists interactions with 10 institutes and universities, namely the University of Chemistry and Technology in	

Prague, Faculty of Science at Charles University, Czech University of Life Sciences in Prague, Mendel University in Brno, Tomáš Baťa University in Zlín, Institute of Oilseed Crops, OSEVA PRO, s.r.o. in Opava, Institute of Crop Production in Prague, Forestry and Game Management Research Institute in Strnady and Institute of Scientific Instruments AS CR in Brno. The precise interactions are not clear in each case. But the network of interactions indicates a high potential for collaborative research.

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the team with similar international and national institutes
The three subgroups follow specific research topics with highly limited resources. Given these restrictive conditions, the acquisition of grants of considerable amount compared to team size is appreciated. Nevertheless, the competitiveness may be limited.	
D1.2	Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation
The subgroups maintain cooperative projects with several reputed laboratories and host researchers from abroad. Thus the reputation is very good. The cooperation appears to occur at equal level.	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
The team members participate in the scientific community activities as editors and board members. However, this activity is minor.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
The three subgroups followed the previous plan of research. Understanding plant responses and tolerance to environmental stresses enables selection and breeding of adaptable genotypes. The subgroup plant pathology has filed patents for microbial substances increasing plant stress resistance or tolerance. A patent was filed in 2019 and two others were registered.	
D2.2	Assessment of the previous research objectives and their achievement
<p>The subgroups essentially reached the goals as described above. The progress concerned our understanding of phospholipid signaling in aluminium stress acclimation and the physiological, cellular and biochemical characterization of a particular phospholipase C, namely NPC1. Plants lacking NPC1 are impaired in thermotolerance. NPC2 overexpressors accumulate more reactive oxygen species upon elicitation. A new protein names flotillin was characterized for interacting partners and their role in membrane stabilization.</p> <p>The Brassica napus-Leptoshaeria maculans pathosystem was explored with respect to hormone homeostasis, particularly, salicylic acid, cytokinin, ethylene and auxin. The work also included approaches to understand the role of phospholipid signaling in the pathosystem. The use of compounds of microbial origin for increasing plant tolerance has led to patents.</p>	

<p>The nanotoxicological studies recently initiated in the team may receive some current momentum, but one wonders what the overarching hypotheses and expectations are.</p> <p>The Laboratory of Biologically Active Compounds followed three lines of research, namely understanding somatic embryogenesis in conifers, the role of polyamines, phenolics and phytohormones in stress acclimation and stress acclimation e.g. to increased UVB.</p> <p>The results were adequately published.</p>	
D2.3	Assessment of implementation of recommendations from past evaluation
<p>The subgroups included experimental directions as suggested in the last evaluation, e.g. on live imaging of signaling messengers in the cell or the comparison of somatic induction systems.</p>	
D2.4	Success in receiving grants
<p>The team received grants in the report period. Nevertheless, the research activity is restricted by financial limitations and affected by the successful acquisition of grants.</p>	
D2.5	Adequacy of instrumental equipment
<p>The team employs established and up-to-date methods. Microscopic and histochemical analysis of pathosystems and embryogenesis, tissue fractionation, enzymology and so on are examples of established methodology. The team makes use of the analytical platform of IEB.</p>	
D2.6	Effectiveness of management
<p>The cooperation between the three subgroups was strengthened. The team supports their members in attending meetings and performing research stays.</p>	
D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
<p>The age structure is balanced and the group attracted postdocs and PhD students from abroad (Ukraine, Croatia, Iran). The gender balance appears reasonable with a higher fraction of female scientists and co-workers.</p>	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
<p>The team has developed team building measures.</p>	
D2.9	Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.
<p>Not applicable</p>	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
<p>The team collaborates with the University of Chemistry and Technology (Prague) both on a particular interactor named flotillins with the phospholipase C and on the effect of nanoparticles made from noble metals like gold and palladium on the environment. Other interactions have been mentioned above. The team appears to be integrated in a functional network of interactions.</p> <p>There exist longlasting cooperations, e.g., with Paris (France) and Kiev (Ukraine) on phospholipid signaling, and with INRA (France) on somatic embryogenesis.</p>	
D3.2	Effectiveness of joint research centres
<p>The cooperative projects resulted in joint publications.</p>	
D3.3	Success rate in supervision of PhD students
<p>The team supervised 6 PhD students who graduated in the report period. Considering the composition of three subgroups, this number appears at the lower end and should be enhanced.</p>	
D3.4	Participation of PhD students in the outputs
<p>The students take author positions according to their input to the research outcome. It appears that there is not strict policy for first or shared author positions. One PhD student is explicitly mentioned who was first author on a particular output.</p>	
D3.5	Participation of the team in master or bachelor studies
<p>The team supervised or advised 8 BSc.- and 4 MSc.-students who graduated in the report period.</p>	
D3.6	Assessment of cooperation intensity with universities in the form of teaching
<p>The team members participate in teaching at five universities.</p>	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
<p>The team members participate in public outreach activities such as the „Week of Science and Technology“ of CAS, the Trade Fair of Science, the Museum Night and the Festival of Science, or in children’s hobby groups.</p>	
D4.2	Publishing activities and its quality
<p>The team members contributed popular articles to Czech popularization journals.</p>	
D4.3	Participation in professional organisations in the area of research and development
<p>Not apparent</p>	

Other comments of the commission: n/a

8. Laboratory of Virology

Strengths:

The team has a strong expertise in DNA cloning. They have invested considerable effort in assembling multiple DNA cassettes useful for transformation and protein expression. The team is interested in modern synthetic biology approaches and has competence in designing virus detection methods and introducing innovative novel technologies to this direction.

Weaknesses:

The team lacks a clear direction and biological focus. To attain grants the team became a technology provider of cloning.

Opportunities:

The suggested merge with the Institute of Crop Protection Virology laboratory could provide a better focus and utilisation of expertise in molecular techniques towards virology.

Threats:

The hunting for collaborations and projects where the team is technology provider has broadened the research focus far beyond the core remit and appears a risky strategy to sustain the team. The plantibody direction seems more of a distraction than focus for the future.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
<p>They selected 5 outputs for the 6 FTE, meaning less than 1 paper for each researcher over the 5-year period. The quality of the outputs is very low.</p> <p>One paper deals with LED lighting, another one and a review address epitope presentation and fourth describes potato virus M isolates. The outputs do not demonstrate that they have a strong biological focus.</p>	
H1.2	Contribution of workers on the outputs reached
<p>The team contribution to the outputs shows a good balance of collaboration.</p>	
H1.3	Quality of all outputs and results
<p>The team is largely methodologically driven, lacks biological focus, which is reflected by the quality of outputs.</p>	
H1.4	The most valuable discoveries and findings in the fields, their importance for the field
<p>A major discovery of broad significance is missing.</p>	
H1.5	Contribution of the participation of the authors in large collaborations
<p>They do not participate in large collaborative projects but have a number of bilateral collaborations.</p>	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
They have built a considerable expertise in vector construction that if connected with appropriate biological questions and research goals could be highly beneficial. The group could be seen as a synthetic biology lab for plant viruses.	
H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team's activity on proper practice in society in the area of social sciences and humanities
They have developed a LAMPS based virus detection method that can be useful in agronomy practice.	
H2.3	Relation to practice
More efforts should be made to connect the team's activity with practice. An institutionalised link with the Institute of Crop Protection should be highly beneficial.	
H2.4	Participation in AV21 strategy
Nothing noted	
H2.5	Cooperation with regions of the Czech Republic
The team collaborated with the Potato Research Institute in Havlickuv Brod in the past. It is not clear whether this collaboration is still ongoing.	

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the team with similar international and national institutes
In the current form, the laboratory is not internationally competitive. They need to gain a better research focus and capitalise better on their expertise in vector design and construction.	
D1.2	Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation
The research cooperation of the team focusses too much on technology rather than biological hypotheses and questions. They are providers of cloning technologies, but benefit relatively little from these cooperations in terms of building a coherent research program.	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
Helena Plchova acts as editor in chief for the home journal Biologia Plantarum where TM is an editor. Other activities are administrative.	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
<p>A full integration with ICP virology department is critical for the viability of the group. This should be mutually beneficial for developing innovative molecular viral testing methods, virus engineering and developing projects in virology that fully take advantage of the considerable synthetic biology expertise available in the team. The team should limit the participation in projects where the team is cloning technology provider without a connection to the mainstream virology research of the team.</p>	
D2.2	Assessment of the previous research objectives and their achievement
<p>The majority of resources were drained by the project towards antibody production in plants which led to little success. It might be time to call an end on this line and refocus on virology.</p>	
D2.3	Assessment of implementation of recommendations from past evaluation
<p>Unfortunately, the group has not progressed from the last evaluation. The limited resources are dispersed in many quite unconnected projects. A major rethinking of research direction is required.</p>	
D2.4	Success in receiving grants
<p>Some grants have been attained in collaboration with other groups. Unfortunately, thematically they are diverse and unconnected, which accentuated the lack of research focus for the whole group.</p>	
D2.5	Adequacy of instrumental equipment
<p>The instrumentation and institute infrastructure unlikely were factors causing the low productivity.</p>	
D2.6	Effectiveness of management
<p>The team is too small and drifting without strong direction. Integration with other virology groups could be very beneficial.</p>	
D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
<p>Unfortunately, the team got into a spiral of low productivity that presents a challenge for recruiting and retaining staff. A strong career development strategy for young scientists is unavailable.</p>	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
<p>No issues noted.</p>	
D2.9	Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.
<p>Nothing noted.</p>	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
Cooperation with Charles University addresses gene editing in tobacco BY2. It remained unclear how this fits to the remit of the team. Otherwise, the team provides cloning expertise.	
D3.2	Effectiveness of joint research centres
Nothing noted	
D3.3	Success rate in supervision of PhD students
One PhD student successfully defended his thesis and another one currently addresses a challenging but interesting project on TMV nanoparticles.	
D3.4	Participation of PhD students in the outputs
Jakub Dusek was the first author in a publication in Frontiers in Science.	
D3.5	Participation of the team in master or bachelor studies
Minimal teaching activity. Two team members gave 4x3 lectures for masters at Charles University	
D3.6	Assessment of cooperation intensity with universities in the form of teaching
The cooperation intensity is minimal.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
The team members have a good commitment towards popularisation of science and supporting high school teaching in forms of talks and open days.	
D4.2	Publishing activities and its quality
Nothing to note	
D4.3	Participation in professional organisations in the area of research and development
Editorship in the Biology Plantarum	

Other comments of the commission: n/a

9. Plant Reproduction Laboratory and Station of Apple Breeding for Disease Resistance

Strengths:

The team is an international leader in apple breeding with high total annual income from royalties (Station of Apple Breeding for Disease Resistance).

Weaknesses:

The team is composed of 2 different teams without connection. The Plant Reproduction Laboratory is vulnerable because of its size with low cooperation level with national universities.

Opportunities:

The establishment a of real connection between the two groups could open up an opportunity.

Threats:

The necessity to maintain a high success rate in obtaining grant support for the Plant Reproduction Laboratory.

Main criterion: 1. Quality of results (H1.1-H1.5)

H1.1	Quality of selected outputs of Phase I
<p><u>Concerning the Plant Reproduction Lab:</u> The average rating of the selected outputs of the Phase I is very low (i.e. 2.67) compared to the majority of the evaluated teams in the field. A low number of outputs has been selected for the Phase I evaluation. The quality of the distribution is also low since among the nine outputs evaluated, 0% were in the first decile (Q1*) and 11.1% in the first quartile (Q1* or Q1). Compared to the field, the production of the team is clearly below the range for the productivity of teams in excellent outputs (per FTE) rated as world-leading as well as world-leading + Internationally excellent. New recent publications with higher quality have been presented during the presentation.</p> <p><u>Concerning the Station Apple Breeding for Disease Resistance:</u> The main contributions are in the form of patents and the generation of new apple varieties.</p>	
H1.2	Contribution of workers on the outputs reached
<p><u>Concerning the Plant Reproduction Lab:</u> Most of the research studies were conceived, designed, conducted and/or finalized almost exclusively by members of the department or with their significant contribution.</p> <p><u>Concerning the Station Apple Breeding for Disease Resistance:</u> All the results are the contributions of the team members.</p>	
H1.3	Quality of all outputs and results
<p>The quality of all outputs and results is average with 0% in the first decile (Q1*), 11.1% in the first quartile (Q1* or Q1) and 44.4% in the second quartile. Therefore, 55.5% of all outputs are within the first/second quartiles.</p>	

H1.4	The most valuable discoveries and findings in the fields, their importance for the field
<p>The most valuable contributions of the Plant Reproduction Lab are in the field of flowering regulation using <i>Chenopodium</i> as model with major results on the influence of FTL genes on flowering, and mitochondrial genomes and cytoplasmic male sterility (CMS) using <i>Silene vulgaris</i> as main model with the most recent valuable finding on the roles of CMS genes and non-coding RNA in mitochondrial genome.</p> <p>The Station Apple Breeding for Disease Resistance established multiple resistance to scab and studied polygenic resistance. Many breeding certificates and patents both in Czech Republic and several foreign countries were obtained during the evaluated period.</p>	
H1.5	Contribution of the participation of the authors in large collaborations
<p>Some outputs of Plant Reproduction Lab were produced in both national and international collaborations with a decisive contribution of the members of the team, in particular the joint projects funded by the Czech Grant Agency P506/13/02290S and LTAUSA18.</p> <p>The Plant Reproduction Lab and the Station of Apple Breeding participate in the large project administrated by the Ministry of Education, Youth, and Sport, European Regional Development Fund-Project "Centre for Experimental Plant Biology" CZ.02.1.01/0.0/0.0/16_019/0000738.</p> <p>The Station of Apple Breeding also actively and intensively cooperates with several foreign research institutes and universities.</p>	

Main criterion: 2. Societal relevance (H2.1-H2.5)

H2.1	Societal relevance of outputs and results pursuant to CAS and institute mission
<p>The societal impact is high. The outputs have or will have social relevance in several ways, both directly and indirectly related to the CAS and Institute missions.</p>	
H2.2	System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team´s activity on proper practice in society in the area of social sciences and humanities
<p>Obvious is the impact for the Station of Apple Breeding with many certificates and patents both in Czech Republic and several foreign countries and an increase in total annual income from royalties during the evaluated period.</p>	
H2.3	Relation to practice
<p>Obvious for the Station of Apple Breeding through its main activities on apple breeding with an increase in total annual income from royalties.</p> <p>Possible for Plant Reproduction Lab through its activities on flowering regulation and cytoplasmic male sterility that could have many applications in plant breeding. But the transfer from the chosen model systems to horticulturally important plants essentially is unclear.</p>	
H2.4	Participation in AV21 strategy
<p>No information provided in the report on this aspect. However, the team activities are relevant to some of AV21's projects, such as Food for the Future.</p>	
H2.5	Cooperation with regions of the Czech Republic

Effective, in particular through the participation in the large project administrated by the Ministry of Education, Youth, and Sport, European Regional Development Fund-Project "Centre for Experimental Plant Biology" with other teams involved in this project from IEB Prague and Mendel University in Brno.

Further criterion: 1. Position in international and national context (D1.1-D1.3)

D1.1	Comparison of the team with similar international and national institutes
<p>The Station of Apple Breeding clearly emerges as an international player in the field of apple breeding.</p> <p>However, the impact activity of the Plant Reproduction Lab is only average as compared to similar international and national institutes.</p>	
D1.2	Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation
<p>The Station of Apple Breeding has a leader position both in Czech Republic and at international level with a great certificates and patents portfolio, and some varieties registered in more than 40 countries as well as through its active participation in the international expert group "Fachkommission Kernobst im Arbeitskreis Züchtung".</p> <p>The Plant Reproduction Lab has a strong collaboration with the Colorado State University in Fort Collins (USA) and the Czech University of Life Sciences (Prague) with join publications.</p>	
D1.3	Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)
<p>Active participation in the scientific community activities in different forms: Editorial board membership, conferences and workshop organization as well as invited lectures in national and international seminars and conferences.</p>	

Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

D2.1	Direction in line with the perspective of the planned research directions
<p>The team has continued to pursue experiments in its main research areas.</p> <p>The Station of Apple Breeding has evolved and introduced modern breeding methods in line with the perspective of the planned research axes.</p> <p>However, little evolution has been observed in the case of the Plant Reproduction Lab in particular concerning the size of the team and its capacity to obtain funds.</p>	
D2.2	Assessment of the previous research objectives and their achievement
<p>The Station of Apple Breeding has met all of the previously identified objectives and has obtained high-quality results.</p> <p>Almost all of the previously identified objectives of the Plant Reproduction Lab were achieved, and, considering the team size and available funds, produced good-quality results.</p>	
D2.3	Assessment of implementation of recommendations from past evaluation

<p>The Plant Reproduction Lab: the size of the team is still problematic and the team is therefore still considered as « vulnerable ».</p> <p>The Station of Apple Breeding has successfully considered and addressed all of the prior evaluation recommendations, in particular through the implemented modern breeding methods based on transcriptomics and genomics and its active participation in large international expert groups.</p>	
D2.4	Success in receiving grants
<p>The success in receiving grants was adequate for the Station of Apple Breeding. The Plant Reproduction Lab is still insufficiently successful in this activity to avoid a situation of vulnerability of the team</p>	
D2.5	Adequacy of instrumental equipment
<p>Instrumental equipment adequacy is fine for Station of Apple Breeding according to the provided information.</p> <p>Few information provided by the Plant Reproduction Lab, but seems to be correct.</p>	
D2.6	Effectiveness of management
<p>Correct according to the provided information.</p>	
D2.7	Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth
<p>The age structure of the team includes both experienced and early-stage researchers. Some team members will be close to retirement age within the next period.</p> <p>The suitable supplementation of 3 new team members under the age of 35 – two scientists and one graduated technician is noted for the Station of Apple Breeding.</p>	
D2.8	Creating work-life balance conditions, assessment of approach towards possible gender issues
<p>No information provided on these aspects, but no possible gender issues detected.</p>	
D2.9	Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.
<p>No information provided in the report nor in the presentation about the team implication in the National Programme of Sustainability II.</p>	

Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

D3.1	Scope of cooperation with universities on national and international level
<p>Cooperation mainly exists within the national area, namely cooperation with the Charles University in Prague, University of South Bohemia in České Budějovice and Mendel University in Brno. This activity comprises some lectures and supervisions of students.</p> <p>At international level, lectures at Texas A&M University (USA) are noted.</p>	
D3.2	Effectiveness of joint research centres

Participation in the large project administrated by the Ministry of Education, Youth, and Sport, European Regional Development Fund-Project "Centre for Experimental Plant Biology" with other teams involved in this project from IEB Prague and Mendel University in Brno.	
D3.3	Success rate in supervision of PhD students
Low. Only one PhD thesis defended during the 2015-2019 evaluated period.	
D3.4	Participation of PhD students in the outputs
Effective. The papers published by the Plant Reproduction Lab are frequently co-authored by PhD students.	
D3.5	Participation of the team in master or bachelor studies
Low. In the form of lectures only. No Master nor Bachelor students' supervision reported for the evaluated period.	
D3.6	Assessment of cooperation intensity with universities in the form of teaching
Have to be developed. The Plant Reproduction Lab is having difficulty recruiting students from Czech universities, but its cooperation intensity with universities needs to be increased to address this.	

Further criterion: 4. Outreach activities (D4.1-D4.3)

D4.1	Sufficiency of media strategy and activities in the area of research popularisation
The group has been actively involved in popularizing their research through radio broadcasts, television programs, public lectures and excursions.	
D4.2	Publishing activities and its quality
In addition, the team has been active in producing popularization papers and/or books.	
D4.3	Participation in professional organisations in the area of research and development
Excellent. The team, in particular the Station of Apple Breeding, has a major contribution in professional organisations in the area of research and development.	

Other comments of the commission: n/a

Final report was elaborated by:

Commission 6 - Biological sciences B

Evaluated teams No.: 1, 2, 3, 4, 5, 6, 7, 8, 9

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