

# **Assessment Report**

*Graduate School  
Experimental Plant Sciences EPS*

**Peer Review 2009 – 2015**

**June 2015**

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## **Preface**

This report embodies the findings and recommendations of an international peer review of the national Graduate School Experimental Plant Sciences (EPS) undertaken from June 2 to June 5, 2015.

The review consisted of peer assessment of the progress and achievements of the School as a whole and of its constituent research groups. The assessments were based on self-evaluation reports provided by EPS and the research groups over the past six years. This review report is both prospective and retrospective and has relied on a qualitative and a quantitative analysis of the School and its research groups.

The review has resulted in a number of specific recommendations and some more general observations.

As chair I wish to thank my fellow evaluators for their expert and sincere contributions to the discussions and final findings. The work was not only intense but also socially agreeable and academically rewarding.

We thank all members of EPS, staff, PhD candidates, students, researchers and professors, for their open and constructive participation in the review process. We hope this report to be the beginning of another equally successful period of excellent research and PhD education in the EPS research school.

June, 2015

Prof. Peter H. van Tienderen  
Chairman, International Peer Review Committee EPS

# 1. Introduction

## 1.1 The evaluation

All publicly funded university research in the Netherlands is evaluated at regular intervals in compliance with the national standard evaluation protocol (SEP 2015-2021), as agreed by the Association of Universities in the Netherlands (VSNU), the Netherlands Organisation for Scientific Research (NWO) and the Netherlands Academy of Sciences (KNAW). The evaluation process, which is applied at the research unit level, consists of a systematic external peer review conducted every six years and a three-year interim review, based on an internal self-reflection, focused on what is achieved since the last external peer review.

The evaluation system aims to achieve three generic objectives:

- *improvement* in the quality of research through an assessment carried out according to international standards of quality and relevance;
- *improvement* in research management and leadership; and
- *accountability* to the higher management levels of the research organisations and to the funding agencies, government and society at large.

At Wageningen University (WU) these reviews include another objective. Since 2015 - the ECOS-KNAW that was responsible for accrediting the graduate schools in the Netherlands, has ceased to exist, WU requests a formal recognition of the activities of its graduate school. The SEP includes a terms of reference for reflection on the PhD programme of the graduate school. Wageningen University requests whether its graduate schools comply with the following conditions:

1. The research school provides a well-organized, coherent and productive research environment for the PhD programme.
2. The research school offers a sound and institutionalised programme in which students are trained to become independent researchers
3. The research school functions as an independent organisational unit with its own budgetary and managerial responsibility, with the university or universities involved providing a level of financing for a period of at least six years that can be described as sufficient in view of the research school's planned capacity

These conditions comply with the previous ECOS-criteria as well with the special conditions by Sodola, the Dutch network of accredited research schools in all fields of academic research.

Early 2015 the European University Association (EUA) was invited by Wageningen University to conduct an evaluation of the generic elements of its doctoral education, with the aim of determining whether:

1. The intended learning outcomes of the Wageningen PhD programme meet international standards.
2. The Wageningen PhD programme has the structure and processes in place for PhD candidates to attain these learning outcomes.

The results of the EUA review already contribute to this special request substantially. But in addition it is also important to assess the quality of the specific elements for this graduate school of the PhD training programme (appropriate research environment, the course programme, the day-to-day PhD supervision etc.).

The intention is that these responsibilities of EPS and its research groups are evaluated in this peer review, with the overall aim of achieving an accurate view of the performance of the graduate school and in particular the position of its research (chair) groups, within the (inter)national science and PhD education arena (retrospective) and to find ways for further improvement (prospective). Therefore the peer review takes into account not only the quality of the work conducted and the ways that the results are communicated, but also the graduate school's broader missions. This includes evaluation of the arrangements and programmes for PhD students, who conduct much of the scientific research, and of the relevance, quality and effectiveness of the work in terms of the institution's wider missions and public accountability.

## **1.2 The assessment procedure**

The evaluation procedures followed by the Review Committee were those set out in the NWO/VSNK/KNAW "Standard Evaluation Protocol 2015-2021 for public research organizations". This protocol entails two main characteristics:

- *Two levels of assessment*: The assessment takes place at two levels of the research organisation, i.e. the level of the graduate school and the level of chair groups;
- *Three main criteria*: The chair groups are assessed on the three assessment criteria, i.e. research quality, relevance to society, and viability.

The evaluation committee was requested to report its findings on the chair groups in line with the three main criteria. With respect to the evaluation of EPS the findings should be reported in qualitative terms with a focus on policy and management questions. For the assessment of the research (chair) groups, the verdict should be cast in both qualitative and quantitative terms. In the text, the most important considerations of the committee should be clarified, while the conclusion should be summarized in a single term according to a four point scale (annex 1). Checklists and excerpts of the standard evaluation protocol were provided as a tool for assisting in assessment. The four criteria should always be reviewed in relation to the group's mission, especially if this mission restricts the group to operate only for / in a national scientific community.

The assessment was based on and supported by three main components of evidence:

- Self-evaluation reports detailing the operation, management, research activities, and SWOT analysis of the graduate school, and all chair groups; these self-evaluation reports were written as prescribed in the national standard evaluation protocol;
- An overview of the output of each research/chair group to allow the Committee to examine the quality of the published work, and a bibliometric analysis to provide a quantitative assessment of its impact;

- Discussions with boards, researchers, PhD students and council, academic staff and research managers about the work programmes, the aims and the strategy for the future of the research (chair) groups.

The site visit was undertaken during the period 2 June - 5 June, 2015 and consisted of a number of components, which can be summarised as follows (annex 2):

- a plenary introduction to Wageningen University and the EPS graduate school by the Dean of Sciences and the director of EPS;
- sub-committee sessions with all individual chair groups (leaders and key staff);
- a meeting with the EPS PhD candidates and PhD council;
- a final plenary debriefing meeting with invited boards, directors and staff of institutes.

The Peer Review Committee comprised eight peer members and a secretary (annex 3). Despite a full programme (annex 2) and a tight schedule the Committee was able to complete all the interviews in a satisfactory way. Consequently the final report with the conclusions and recommendations was formulated according to the formats that were made at the disposal of the peer review committee. The draft report was presented to the director of EPS to redress any (factual) errors.

### **1.3 Results of the assessment**

This report summarises the findings, conclusions and recommendations of an international peer review of the EPS graduate school undertaken in June 2015. The peer review covered the period between 2009 and 2014. The written and oral information permitted a good understanding of the research school by the Committee. The assessment of EPS and its chair groups was subsequently based and weighed according to the rationale explained in annex 1. This means that the performance of the groups was benchmarked against the performances of other groups in the global arena of comparable disciplines. The conclusions, as given in chapter 3 and 4 of this report, follow the structure and the criteria which are formulated in the Terms of Reference, annex 1. Chapter 3 gives an impression of the performance of the research school EPS and Chapter 4 elaborates on the performances of its individual research (chair) groups.

### **1.2 Quality of the information**

The documentation for the committee consisted of:

- Self-assessment report by the graduate school with honest and comprehensive information on EPS (66 pages).
- Report with open and complete self-assessments of each of the 21 participating research groups (596 pages).
- An informative bibliometric analysis of the Graduate School Experimental Plant Sciences 2008-2013, performed by Wageningen University Library.
- Evaluation of the Wageningen University PhD Programme 2014-2015, carried out by EUA solutions.

During the site visit, the committee was provided with additional information and with the presentations by the EPS director and research group leaders.

The committee finds the information adequate and honest, but was dissatisfied that it was provided on such a short notice. The committee found that additional information on the top 1% papers would have been useful for assessing their value in the review process (these results could only be accessed from a Wageningen account, and only for the Wageningen groups).

## 2 Structure, organisation and mission of the research school

### 2.1 Introduction

The Graduate School Experimental Plant Sciences (EPS) was established in 1992 as an interuniversity graduate school in which currently chair groups of 7 universities and 2 institutes participate. EPS functions as a collaborative research and teaching institution between the participating universities and institutes: Wageningen University (WU), Radboud University Nijmegen (RUN), VU University Amsterdam (VU), University of Amsterdam (UvA), Leiden University (LU), Utrecht University (UU), Groningen University (RUG) and the institutes Plant Research International (PRI) and the Netherlands Institute of Ecology (NIOO). The Board of Wageningen University is formally responsible for EPS since Wageningen University is the lead organisation for EPS.

For the research groups of Wageningen University this peer review is obligatory and takes place by order of Wageningen University. The in EPS participating chair groups of Leiden University, Utrecht University, University of Amsterdam, VU University Amsterdam and Radboud University Nijmegen participate in this review, not obligated by their universities but to take the opportunity to be reviewed as the national graduate school which they are part of. This peer review will focus on the research quality of the individual groups and clusters participating in EPS but also on the training program that the graduate school provides.

Institutes participating in this peer review:

- Leiden University
  - Plant Sciences cluster (Molecular and Developmental Genetics, Plant Cell Physiology, Plant Ecology)
- Radboud University
  - Plant Sciences
- Utrecht University
  - Molecular Plant Physiology
  - Plant Ecophysiology
  - Plant-Microbe Interactions
- VU University
  - Genetics
- University of Amsterdam
  - Green Life Sciences cluster (Phytopathology, Plant Physiology, Plant Development and (Epi)Genetics/Nuclear Organisation Group)
- Wageningen University
  - Biochemistry
  - Bioinformatics
  - Biophysics
  - Biosystematics
  - Entomology
  - Genetics
  - Molecular Biology
  - Nematology

- Phytopathology
- Plant Breeding
- Cell Biology
- Plant Developmental Biology
- Plant Physiology
- Virology

A number of research groups did not participate in the EPS peer review as only one staff member of each research group is an EPS member:

- Radboud University Nijmegen
  - Experimental Plant Ecology
- VU University
  - Biophysics of Photosynthesis
  - Structural Biology
- University of Amsterdam
  - Institute for Biodiversity and Ecosystem Dynamics, Molecular & Chemical Ecology
- NIOO
  - Multitrophic Interactions

University of Groningen, Plant Physiology did not participate because the research group will change its focus.

## **2.2 Mission of the EPS Research School**

The EPS mission is to organise the training of PhD candidates to become self-reliant, societally skilled researchers in the field of basic and strategic research on healthy plants or plants affected by biotic or abiotic factors. To increase the employability of our PhD candidates the graduate school offers courses aimed at the development of personal skills. The understanding of the functioning of plants under controlled conditions or in their wild habitat offers new means for establishing sustainable agriculture and sustainable production of food, feed, and non-food, and is also essential for the management of renewable natural resources. The graduate school's aim is:

1. To create a national platform for academic experimental plant scientists for mutual consultation, collaboration and coordination in research, research policy, fund raising, societal discussions and representation at the national and international level, thereby contributing to solutions for societal problems.
2. To create an international network with graduate schools in neighbouring countries for joint PhD activities.

As a networking organisation the Graduate School EPS has the following responsibilities:

- To facilitate the training and education of PhD candidates by organising courses, workshops, symposia and seminars.

- To stimulate and coordinate fundamental and strategic plant research of the collaborating universities.
- To monitor and stimulate the quality of academic research.

## **2.2 Management and organization**

All chair groups of EPS are embedded in their local universities. Each of the universities involved in EPS has its own strategy. EPS creates a scientific environment for EPS groups by providing a course programme, an annual meeting, symposia, theme meetings and activities organised for and by PhD candidates.

### *Boards and committees*

The EPS organisation structure consists of:

*Scientific director and executive staff:* The director is responsible for all daily affairs concerning EPS, delegated to him by the EPS Board. He is responsible for carrying out tasks regarding the education programme and the research programme. Currently, the director is Prof. dr. Bisseling, chair group leader of Molecular Biology (WU). He is supported by an executive staff (2.3 fte).

*EPS Board:* The EPS Board is responsible for the functioning of the graduate school. The Board takes strategic decisions regarding admission of new groups and/or staff members. The Board receives advice from the Research Committee, the Education Committee, the PhD Council, the International Advisory Board and the EPS Industry Board. The board meets once a year.

*Research Committee:* The Research Committee advises the Board on decisions regarding issues related to the EPS research programme. The EPS director is chairman of the Research Committee. All universities are represented in this Committee. This committee meets 2 to 3 times a year.

*Education Committee:* The education committee is responsible for all matters related to the educational programme of the PhD candidates such as the structure of the TSP (individual Training and Supervision Plan), the PhD course programme and seminar series. The education committee consists of three PhD candidate members and one staff member of each participating university. Currently, Prof. Dicke (WU, Entomology) is chairman of the Education Committee. The Education Committee meets ca once per year.

*PhD Council:* The PhD council advises the EPS committees, scientific director and executive staff both upon their request and on its own initiative. The council aims to have representatives from all participating universities and institutes of EPS. The chairman of the council attends the meetings of the Board, the Research Committee and the Educational Committee.

*International Advisory Board:* The International Advisory Board (IAB) evaluates and gives advice to improve the quality of EPS activities, in particular the research programme and the educational programme in order to continue to be successful in the future.

The IAB visits EPS once every 1 1/2 years during which they meet with the PhD council, the EPS Board, research committee and with the chair of the education committee. To obtain a view of the quality of the research, the PhD candidates and the course programme, the IAB members interview PhD candidates in their third year during their visit.

*EPS Industry Board:* EPS and the plant breeding industry decided in 2011 to establish the Industry Board to be able to be prepared for the demands of the top sector programming by the Dutch government. The top sector Horticulture and Starting Materials involves for a large part the plant breeding industry and the Dutch plant science community. A very important result of the establishment of this board was their support for funding of the EPS graduate programme which aims to attract talented MSc students to the plant sciences for their future career. The support of the Industry Board, and Plantum, the umbrella organisation of plant breeding companies, resulted in a three year programme for which MSc students get a self-designed PhD proposal funded by the national research council (NWO). The EPS Industry Board was formed to exchange ideas and goals. In this way we obtain insight in the needs of the industry concerning their future workforce and important research themes. Through Plantum the industry is active in setting the research agenda of the Top Sector programme. The Board also provides an opportunity through its activities to inform students of how science is applied in industry.

## **3 Performance of the Research School EPS**

### **3.1 Research School Experimental Plant Sciences EPS**

Participating universities: Wageningen University, Leiden University, Radboud University, University of Amsterdam, VU University Amsterdam, University of Groningen, (Netherlands Institute of Ecology NIOO, Plant Research International PRI).

The Assessment Guidelines ask for a statement whether the graduate school meets the following conditions:

- 1. The graduate school provides a well-organized, coherent and productive research environment for the PhD programme.*
- 2. The graduate school offers a sound and institutionalised programme in which PhD candidates are trained to become independent researchers*
- 3. The graduate school functions as an independent organisational unit with its own budgetary and managerial responsibility, with the university or universities involved providing a level of financing for a period of at least six years that can be described as sufficient in view of the graduate school's planned capacity*

The committee fully agrees with the above statements, as will be justified below.

### **3.2 The research environment for the PhD programme**

The mission of EPS is first of all focussed on the training and education of PhD candidates in the 33 participating research groups to become independent and skilled researchers in experimental plant sciences. EPS aims to produce new generations of plant researchers, not only for academic careers, but with equal importance for expert public and private positions in society.

A second goal of EPS is to stimulate the field of experimental plant science in the Netherlands, by creating an active research community that promotes collaboration among researchers, with the aim to influence the research agenda in the Netherlands and to establish firm links between research and its applications.

Concerning the first goal the committee agrees that EPS succeeds extremely well in offering an excellent research and networking environment for its 300+ PhD candidates. The candidates are very enthusiastic about the role that EPS plays in their education. Many PhD candidates also play an active part in EPS, through the PhD council, and in the organisation of meetings such as the Get2Gether initiative. The success of the programme can be seen from the fact that the majority of alumni easily find their way to jobs, in academia or in the public or private sector, with the plant breeding industry absorbing a large fraction of the EPS PhDs. Faculty members share this enthusiasm, which is exemplified by their willingness to, for instance, organize national courses and other activities.

Concerning the second goal the committee concluded that EPS is a network that is truly unique to the world. In the last couple of years EPS has increased its visibility. An excellent result from this strategy is that there is external support for a valuable (albeit limited) program in which talented MSc students are assisted in writing their own research proposal and then compete for four PhD positions annually. Other examples include STW programmes that were funded and in which many EPS partners participate with industry, such as the programme Green Defence against Pests, coordinated by the UvA.

ESP is managed effectively by its scientific director, the EPS Board representing the 6 participating universities, assisted and advised by a Research and Educational Committee, a PhD Student Council, International Advisory Board and Industry Board. The EPS director is chairman of the Research Committee.

For financial and organisational resources, EPS depends on the participating institutions with Wageningen as the main contributor. EPS mentions a disadvantage in not being a legal entity. However, the committee does not consider this as a major issue given the Dutch university governance structure, in which the participating organisations have their own responsibility and autonomy. In fact, EPS clearly operates well in the present atmosphere of co-operation between independent groups that is based on shared goals and interests.

The EPS research programme is divided into four themes: (1) developmental biology of plants; (2) interactions of plants and biotic agents; (3) metabolism and adaptation; and (4) genome biology. Each theme has several subthemes. The four themes are interconnected by the cross themes of signal transduction, ecology, comparative biology and evolution, and physiology. The themes do not act as restrictive demarcations in the conduct of research or as strategic profiles for the partner institutions. Rather, their function is to present the work done at EPS and stimulate interactions and co-operation between researchers and PhD candidates. The research environment for the PhD programme is flourishing and is expected to continue. Wageningen University is the largest participant and contributor to EPS; its policy to organize PhD training and quality control in graduate schools ensures a firm basis for the continuation of EPS in the years to come.

*The committee concludes that EPS is a vibrant research school that is unique to the world.*

### **3.3 PhD training and education programme**

For the findings on the Wageningen general PhD programme the committee refers to the EUA Solutions report, January 2015.

The EPS training and education programme has a well-structured set of policies, in addition to mandatory and optional activities to assist the candidate in his/her research project and personal development. After an evaluation of the candidate project proposal, (s)he is introduced into the graduate school, followed by development of a personalized training and supervision plan, assignment of an external supervisor, and one or more (daily) supervisors and/or (co-)promoter(es). Progress is monitored by EPS, and the PhD candidate

receives an EPS certificate upon successful completion of the program. Thus, the courses, symposia and other activities organized by EPS in which the PhD candidate can participate are flexible and tailor-made to the interests and needs of individual PhD students. The total amount that has to be spent on training (courses, seminars, international conferences, networking) is considerable (a total of 30 ECTS or about half a year), but PhD students indicated that this is a very worthwhile investment. Thus, the committee concludes that the education programme is of high quality and efficiency. About 9% of the PhD candidates do not complete a PhD – while this number is not very high, further analyses would be useful to see what puts these candidates at risk.

EPS alumni prospects in the job market are very good. While the capacity to absorb students in academia is limited, many PhD students pursue a career in science (including abroad where 70% of the PhD students come from). EPS acknowledges the need for well-trained staff members in industry, especially the plant breeding industry. PhD graduates from EPS increasingly get jobs in private companies, research institutes and government positions. The committee strongly supports the EPS objective to enhance the co-operation and communication with industry in research, knowledge exchange and recruiting.

Attracting and selecting the PhD candidates are carried out by the research groups themselves and not a matter for EPS policy. The successful and interesting EPS graduate Programme, financed by NWO and industry, is an exception to that rule.

### **3.4 Integrity**

Implementation of the national and international integrity codes for research conduct takes place within the research groups and the local graduate schools. The latter have integrated sessions on scientific integrity in their courses. These are obligatory for (starting) PhD candidates. EPS has included the guidelines for proper research conduct in the mandatory course requirements for starting candidates.

### **3.5 Recommendations**

The first obvious recommendation for the groups and institutions is that EPS should be supported in the years to come, given its unique position as PhD programme, as a community and as a player in defining priorities for research in the field.

There are a number of points and suggestions the committee would like to make for the future:

1. 'High potentials' in the faculty of different groups should be used more effectively. For instance as a 'think-tank' for out-of-the-box ideas, new collaborations, and new combinations of expertise, for instance combining biology with biophysics, biochemistry and bioinformatics. The current themes and sub-themes are useful for presentation, but this is not necessarily a structure for new ideas to arise.

2. Many groups are led by strong leaders, and highly qualified other group members sometimes remain in the shadows (see the many individual grants). It is probably up to the local organisations to increase their visibility; thus attention to individual development could certainly strengthen EPS. The position and support of female researchers should be carefully considered.
3. Further invest in influencing the priorities in research, including the activities of the Dutch (Topsector) policies, such as Food and Horticulture. The committee noticed that many research groups have put emphasis on applied aspects in recent years, to stress their relevance and increase funding options. While understandable, it is notable that industry specifically asks for fundamental research, to provide a basis for future activities. The research school could play a role here by identifying the fundamental issues for the future and lobby for funding in these areas.
4. Create a higher presence in European policy making. With Food security being one of the grand challenges EPS, could be instrumental in identifying the major issues that can be implemented in policies and calls for the Horizon 2020 European Commission programme. The influence appears to be limited and uncoordinated at this stage.
5. Strengthen the link with industry. Important steps have already been made, but this could be further expanded. For instance, internships for PhD candidates on a regular basis — e.g. for 3 months — in industry may be considered. Also, specific EU programs are meant to stimulate this (for instance via 'industrial doctorates' in the Marie Curie ITN program). The Industry Board could be used more effectively for both providing ideas and lobbying.
6. The committee suggests to further optimize the supervisory structure of (co-)promotors, (daily) supervisors and the external supervisor and the frequent reporting. The external supervisor is not always recognized as useful - or active - by the PhD candidates. PhD students would like to get more feedback from EPS on the reports they submit.
7. The review of the graduate school has a dual character. The policies and achievements of the school were clearly outlined, which made it relatively easy to draw conclusions. The second part, the process of evaluation of the different groups could be improved on the following points:
  - a. Provide detailed responsibilities for committee members before they agree to participate;
  - b. Provide documents at least four (4) weeks before the review;
  - c. Make sure that evaluated groups are more or less of equal size, following the SEP;
  - d. The current procedure does not guarantee that the ratings of groups and different schools are fully comparable. A joint start of panels and a few chairperson meetings are needed.
  - e. Align the procedure in time with other peer reviews (such as biology) to prevent overlap and reduce the work for all people involved.
  - f. Provide information on the top 1% cited papers to check if they are original research or reviews, and if they are at the very core of the work at the group or stem from (sometimes a rather loose) collaboration.
  - g. The 1-4 scale is rather coarse and does not allow a good separation between world class and excellent.

- h. Provide an opportunity to meet with representatives of the Industry partners to hear from them directly.
8. Although detailed reports are given below in the reviews of the chair groups, it is also useful to give some recommendations to the different universities that participate in EPS.

Leiden University has gone through a difficult period in which the output was maintained at a very high level. It has developed a strong focus and is now healthy. With the possibility to fill in high level vacancies the plant cluster can further invest in a unique and coherent research program, which will allow them to further increase their international visibility

Radboud University Nijmegen has gone through changes in personnel, so new initiatives are needed, and the strategy to achieve this was clearly outlined. A new hire is crucial, and links with other groups in Nijmegen should probably be strengthened to consolidate their position.

Utrecht University has three excellent plant groups with a clear focus and ambition. The Future Food initiative is well-chosen, and 'high potentials' are present. Provided that a move to a new building will be accommodated by the university the future is bright.

Amsterdam University has many very good to excellent researchers with great potential and individual grants. However, they need to become more visible as a group and present themselves better internationally, for instance by a clear focus on biotic and abiotic stress. The Green Life Science initiative with partners and industry is very promising.

The VU University Amsterdam group is small and was relatively isolated at the VU. The group has recently moved to the UvA, so the focus should be in creating synergy given the new environment and right conditions, which appear to be in place.

Wageningen University is clearly very strong in plant research, and many excellent and world-leading 'powerhouses' participate in EPS. However, some smaller groups have difficulty to attain sufficient critical mass and focus, and some are also service-oriented. The enthusiastic leaders of these groups could potentially combine their strengths in one or more new, integrative initiatives, perhaps innovative research associated with the Synthetic Biology initiative, supported by the university.

## 4 Assessment of the research programmes

### 4.1 Leiden University, Plant Sciences

University	Leiden University
Research Group	Plant Sciences and Natural Products
Leader research group	Prof.dr. P. Klinkhamer
Research input tenured staff 2014	3.7 fte (10 pers.)

#### *Assessment:*

Research quality	2
Relevance to society	2
Viability	2

#### **Research quality**

The Cluster has a very strong research program focused on three main directions: gene technology, developmental biology, and plant secondary metabolites and stress. The fundamental aspects of the research have immediate practical output and applications, showing a strong focus of the group on societal relevance. Despite major reorganizations in 2008 and 2011, the research quality and productivity of the group was not affected. The group is remarkably well funded with 83% of fte's being funded by research grants and industry.

While synergies obviously exist between teams, the Committee felt that the research topics within the Cluster are still distinct and diverse. The Committee appreciates though that the group recognizes this issue and plans to further strengthen the synergy between three research lines by hiring two new staff members at the tenure track/professor level, for which sufficient financial resources are available.

#### **Relevance to society**

The Cluster successfully combines basic and applied research. The outreach to the public is very good. The members of the groups are very proactive in disseminating obtained results through lectures to the general public. Several patents were filed on novel ideas for societal applications, which also led to creating a spin-off company. The infrastructure established by cluster members for genotyping, metabolic profiling and plant culture facilities are readily available and used by small start-up and breeding companies, and by societal groups. The cluster members participate in multiple committees, a summer school on Biochemistry and Molecular Cell Biology, and international metabolomics courses.

#### **Viability**

Overall, the viability is very good. It is a strong Cluster producing excellent science (both basic and applied). The research focus of the Cluster is in line with the objectives of the TOP Sector "Horticulture and Starting materials", as well as with the regional "Medical Delta" consortium. However, it is not completely clear to the Committee to what extent the general orientation of the Faculty of Sciences towards health will be a problem for this group in the long run. The Cluster is keenly aware of their age distribution, which leads to limited opportunities for personal grants at present. Thus, the future strategy is to

develop teams to apply for common grants, and to enhance opportunities for personal grants through new hires.

### **Recommendations**

Overall the Committee feels that the Cluster has a very good vision for future research, a realistic sense of applicability and strong potential.

The Committee believes that for the Cluster to become a world-leading group it will be required to find and invest in its own unique niche.

Considering age distribution within the Cluster, future success and integration of research teams will greatly rely on two new hires. New appointments should be considered with great care to strengthen the group's coherence and the international competitiveness of the research program.

The Committee recommends that every effort be made to identify missing links between research programs and required new expertise to truly develop integrative and innovative research.

## 4.2 Radboud University, Plant Sciences

University	Radboud University
Research Group	Plant Science, IWWR RU
Leader research group	Prof.dr. C. Mariani
Research input tenured staff 2014	1.4 fte (4 pers.)

### Assessment:

Research quality	3
Relevance to society	2
Viability	2

### Research quality

The group was established in 2013 by combining Molecular Plant Physiology and Ecogenomics groups with members of former Plant Genetics group. In the past few years the group has undergone significant changes including retirement of Prof. Gerats in 2013 and departure of Prof. van Dam in 2014, which led to a significant decrease in the group size and some effects on productivity. The group currently consists of two professors (Van Dam is still employed part-time) and two tenured staff members that are focused on plant-environmental interactions and plant stress responses and adaptation. The group has invested considerable time in developing molecular-genetic tools for and familiarity with a new model system, *Solanum dulcamara*, which provides great potential for future research on plant-environment interactions and as a source of new traits for industrial application, particularly in the area of plant-water stress relations. Despite the early stage of this work, limited numbers of scientific staff, heavy teaching load and development of a new model system, the group was able to sustain a good record of productivity and establish national and international collaborations. However, the Committee felt that the group heavily relies on direct funding (58% of total fte's are paid by the university) and external funding is needed to develop the group's research and its model system.

### Relevance to society

The societal relevance of the groups' research lies mainly on gaining knowledge on biotic and abiotic stresses in plants and dissemination of the findings to the scientific community and industrial partners. The group filed two patent applications and developed collaborations with seed companies. Research on heat stress and thermo-tolerance is very timely in the face of changing climate. The members of the group are very proactive in disseminating their findings through lectures and radio programs to the general public.

### Viability

Overall the Committee feels that the viability is very good and that some concerns are dealt with. The group has a vision for future research, a realistic sense of applicability and strong potential. The *S. dulcamara* model system represents a strong foundation for the future basic and applied research. External funding is needed to develop this further. The research focus of the group is in line with the objectives of the TOP Sector "Horticulture and Starting materials", which gives an extra opportunity to apply for external grants.

Departure of Prof. van Dam will impact the future research directions since the group has lost expertise in plant-insect interaction. However, there is a good chance that the quality and productivity of this group will improve over the next few years with the appointment of a new professor (the foreseen successor of Prof. Mariani) and the merger with the Experimental Plant Ecology group. Such a fusion, which is based on already established collaborations, will expand research from molecular genetics to physiology and ecology and increase scientific critical mass on ongoing projects.

### **Recommendations**

A substantial increase in external funding would have to lead to major improvements in the group's productivity, raise their international competitiveness and visibility.

Future success of the team will rely on a new appointment and on the merger with Experimental Plant Ecology group. Clearly, the new appointment should be considered with great care so as to establish both future leadership for the group and a high profile and unique research direction with international recognition.

Focus on a topic for which the groups wants to be known is needed here.

These changes should not imperil the just established *S. dulcamara* model system. Fruitful external collaborations with research groups would help to overcome critical mass limitations and would further strengthen the scientific output of the group. This could include liaisons with groups working on other (crop) Solanaceae in the Netherlands or abroad.

### 4.3 Utrecht University, Plant Ecophysiology

University	Utrecht University
Research Group	Plant Ecophysiology
Leader research group	Prof.dr. L.A.C.J. Voeselek
Research input tenured staff 2014	1.2 fte (3 pers.)

#### *Assessment:*

Research quality	1
Relevance to society	2
Viability	1

#### **Research quality**

The rationale for the research projects is to use field observations to generate the research questions. The objective is to understand complex interactions of plants with the environment. Two main research themes have been established: (1) How do plants cope with flooding as a complex stress? Flooding includes oxygen stress, CO<sub>2</sub> stress and light stress, and (2) How do plants cope with neighbour-induced shading? The research has been mostly developed using "non-model" plant species for which no transformation protocol is available and which makes a number of state-of the art approaches difficult. The research appears to be very well focused around the two research questions. The research quality is excellent and internationally world-leading which is reflected in the high standard of the publication output. The high quality is reflected in the recent personal grants of faculty members (Pierik and Sasidharan).

The group has acquired a unique scientific niche. Starting with complex observations the group has developed the tools to use transgenic plants to test the hypothesis which have been developed from the initial ecophysiological studies.

The group is relatively small, but due to very good leadership, strategic planning and external funding the group is well positioned for developing the research further. The appointment of Prof. Bailey-Serres as extraordinary professor is excellent and highly beneficial for the future research directions. Prof. Bailey-Serres is the world leading scientist in understanding flooding stress in rice from a molecular genetics point of view. She is interacting by advising the group in Utrecht and by hosting Utrecht research group members in her US laboratory. This is an important contribution to integrate complex molecular approaches into the research of the Utrecht group

An inspiring positive working atmosphere is present in the group. This very much supports scientific interactions and decision making processes.

#### **Relevance to society**

The group performs a number of out-reach activities which have been very well developed in recent years. However, the immediate application of their research and/or translation into products for research or industrial use are not yet very close. This is reflected in the relatively low number of fte's on externally funded contracts, and in the absence of patents. The Future Food initiative led by Prof. Voeselek could potentially be used to improve the relevance from very good to excellent.

## **Viability**

The group's core is rather small, but they have developed a strategy which will allow them to be productive and viable during the next years. Continuity will be granted by the foreseen appointment of Dr. Pierik as chair professor. In addition to this appointment a new tenure track position at the level of an assistant professor will become available. This structure together with available positions and the unique excellent research projects and hopefully a new university building will guarantee a viable research group with excellent perspectives.

## ***Recommendations***

It is recommended that the group stays focused in their research. It is important to include studies with mutants and/or transgenic approaches to verify the hypothesis deduced from their observations.

Eventually a systems biology approach should be considered. This requires thorough training in areas of bioinformatics which has to be implemented in the group, possibly through collaboration. The close link with Prof. Bailey-Serres should be maintained and appears very valuable.

The Future Food initiative should be used to intensify the link with industry, and increase contract funding.

#### 4.4 Utrecht University, Molecular Plant Physiology

University	Utrecht University
Research Group	Molecular Plant Physiology
Leader research group	Prof.dr. J.C.M. Smeeckens
Research input tenured staff 2014	1.5 fte (5 pers.)

##### Assessment:

Research quality	1
Relevance to society	1
Viability	2

#### Research quality

The main research line is regulation of development as affected by the sugar metabolism. Recently, exploitation of the aquatic fern *Azolla* as a source for protein supply has been added to the research portfolio.

The main question is thus to understand how sugar metabolism regulates development and growth processes and how the nutritional status of a plant is linked to growth. The basic molecular studies have been done in *A. thaliana*. A new PhD project (funded as EPS talent project) will attempt to transfer the knowledge to a vegetable crop with the objective to control bolting which is related to sucrose accumulation.

The project on protein producing *Azolla* is a new project which is carried out in an international collaboration with research groups in Germany and the US. This collaboration has managed to sequence the genome of *Azolla*. The group in Utrecht is establishing a transformation protocol for *Azolla* and is analysing the metabolites of *Azolla* in order to assess the potential as fodder.

The research work is very well-focused and the quality of the output is excellent. The group is one of the world leading groups trying to unravel sugar signalling in higher plants, and its research is internationally very well recognized and published in leading journals, and is highly cited.

The group has excellent collaborations and interacts with other research groups to use facilities or expertise when this is required for the progress of the project.

#### Relevance to society

The group's relevance to society is excellent, due to the mix of outreach activities, collaboration with companies and involvement in policy making. The research group has several links to agricultural industry, and has filed many patents that were subsequently transferred to companies.

The group leader Prof. Smeeckens has participated in many committees and strategic advisory groups.

The group is also active in conveying their results to the general public, using various media.

In particular the *Azolla* project has a strong link to societal needs as it is targeted towards protein production which can be used as food or fodder.

#### Viability

The group has a clear vision of future research plans and the future viability is very good. The group wants to follow a systems biology approach. For this strong

bioinformatics expertise is required. Already at present collaborations with bioinformaticians and modelling scientists are in place.

A limitation in the research area is the availability of permanent technical staff which is required for support work; this is a particular concern for the future. The university intends to employ technical staff on a project basis which could present a problem in continuity.

Although the group is relatively small, at present it is well set up, although it depends heavily on its inspirational leader, which could be a concern for the medium term future. We noted that two junior research leaders found a position elsewhere.

### **Other remarks**

The group is very pleased with and benefits a lot from the EPS school. It emphasises the training possibilities for the students and particularly the EPS talent student projects which were acquired.

### **Recommendations**

It is important to stay focused in the research projects, and the relationship between sugar metabolism and developmental processes.

It is too early to foresee how the *Azolla* project will develop, this requires close monitoring and it is important that it will not distract resources from the sugar signalling project.

Initiatives to improve the international profile of the faculty members (assistant professors) are recommended, aiming for high profile (and highly cited) publications or other means to advance their careers. For instance, establishing links or visits to international peer groups could help.

## 4.5 Utrecht University, Plant-Microbe Interactions

University	Utrecht University
Research Group	Plant-Microbe Interactions
Leader research group	Prof.dr.ir. C. Pieterse
Research input tenured staff 2014	1.4 (4 pers.)

### *Assessment:*

Research quality	1
Relevance to society	1
Viability	1

### **Research quality**

The group approaches plant-microbe interactions from a different and rather unique perspective: essentially they concentrate on fundamental aspects of the plant immune system as influenced by the root microbiome, pathogen infection and interaction with above ground herbivory. The relatively small group (4 tenured staff, 7 postdocs and ca 13 PhD candidates) have produced 105 papers over the assessment period.

Output is excellent and by publishing in high impact journals the group scores very well on the publications statistics. Its relative impact score (6.31) is the highest of all groups being assessed. This probably reflects the deliberate strategy of research targeting high impact journals.

The quality of the group has been recognised by Utrecht University. Prof. Pieterse, ERC Advanced laureate and member of the KNAW, was made a distinguished Professor and Dr. Van den Ackerveken will be the first Valorisation Professor in recognition of his outstanding work with industry. The awards attest that the quality and relevance of the work being undertaken is world-leading.

### **Relevance to society**

The fundamental work on plant immune responses has very high societal relevance as plant disease is perhaps one of the key threats to production given the decline in crop diversity. Soil fertility (plant root-microbe interactions) is also a key area. The group engaged in a large number of outreach activities for the general public, explaining the relevance of their work.

The group co-initiated the Future Food Utrecht initiative that raised the profile of plant sciences at UU. The group has an impressive portfolio of projects, filed several patents and very good and long lasting interactions with industry. The group has been very successful in attracting competitive funding in both the local Dutch funding schemes and EU: some 62% of fte's are funded by competitive research grants (including several personal grants, Veni Vidi Vici and ERC) and 31% from contract research.

The group has strong interactions with relevant groups within EPS (e.g. Entomology WUR) as well as relevant units internationally.

The success of their post-graduate research and education program is evidenced by the high uptake of graduates by the private sector in the Netherlands.

## **Viability**

The group has a clear strategy for development in the future and will make an appointment of a young tenure track staff member at the Assistant Professor level shortly. The group is well led and has a clear focus for its fundamental work which connects well with other groups in EPS. The group will continue to elucidate important aspects of plant-microbe interactions: defense hormone crosstalk, disease susceptibility, rhizobacteria-induced systemic resistance/defense priming, and root microbiomics.

The high proportion of the budget that supports staff (81%) and the bulk of the funding being “soft” money (competitive grants and contracts) means they may be vulnerable to future cuts in (national) budgets for research. Nevertheless, the high quality of the people and the work, plus initiatives such as Future Food led the committee to foresee an excellent future for the group.

A new building appears to have been ‘promised’ for some time but has yet to materialise – the university should therefore clarify its plans to make sure that research can be maintained at the highest level.

## **Recommendations**

The group is in an excellent position to further fundamental understanding of the plant immune system. Below-ground/above-ground interactions as a two way street as well as below-ground herbivory could be explored in the future.

The committee considers it important that the top scientists in the group continue to play an active role in setting the European research agenda – this could be developed further, as a service to science and society.

## 4.6 University of Amsterdam, Green Life Sciences

University	University of Amsterdam
Research Group	Green Life Sciences
Leader research group	Prof.dr. M.A. Haring
Research input tenured staff 2014	3.8 fte (11 pers.)

### *Assessment:*

Research quality	2
Relevance to society	2
Viability	2

### **Research quality**

UvA is part of the Amsterdam Science Park and recently moved into new buildings. The numbers of fte of the UvA cluster (Haring/Cornelissen/Stam-Fransz) has steadily increased since 2009, which reflects the increase in incoming funds (third-party funding). Overall, the quality of research and their publication record are very good. This is reflected by their invited lectures at international conferences (see Table 3.3, p. 114 in their report). A number of especially some younger PIs have an excellent international standing and reputation, as further evidenced by the high number of individual grants in the group. The different PIs and their groups are well connected.

The total number of publications (119) given the total fte is relatively low compared to other groups under evaluation. Moreover, there is heterogeneity between quality/productivity in terms of grants and publications in the – at this stage – three departments of UvA. Group leaders should be more visible internationally, e.g. as lead authors of key publications.

A concern/problem of UvA is the low number of M.Sc. students (as mentioned in the report), which according to the faculty members during the interview is due to the fact that among students Plant Sciences are not highly recognized yet at UvA. The PIs are taking active steps to change the situation, e.g. by designing a new curriculum for “Biochemistry/Molecular Life Sciences”, together with the PIs at the Chemistry department.

### **Relevance to society**

The UvA cluster has many connections to industry (seed companies), and has filed six patents. The impact is expected to grow thanks to the Green Life Sciences Hub initiative, by which initiatives are streamlined. UvA has made important and original contributions to society as evidenced by their report (p. 114-115), thus, the group’s relevance is considered to be very good already, and can increase further.

### **Viability**

Currently, the three departments of UvA (with total of 11 faculty members) cover very diverse topics. There are several world-leading PIs in UvA, who will certainly continue to do excellent research in the future.

The responsible group leader (Haring) appears to have established a very good position in the University with “Green Life Sciences” as a priority discipline, which

promises good support for the future. In addition, Haring obtained a large grant as coordinator of the STW Perspective Program "Green defence against pests" (2.2 m€). The viability is therefore very good.

The interview revealed the wish of UvA PIs to obtain a new technology platform performing protein-protein (or chemical)-interaction studies, but they do not have technicians to carry out such analyses.

## **Recommendations**

A concern for the committee was the lack of an apparent goal for the future. There is no clear strategy for how the work will be developed in the future – instead the PIs trust in getting good results which will be used to write future grant proposals. This lack of future directions is especially relevant in view of an upcoming retirement (Cornelissen) that will require better defined plans on the future and focus of the group's research. Also, the faculty members together (also the younger ones) need to think more about the future and how to develop a strong and focused profile.

## 4.7 VU University, Genetics

University	VU University Amsterdam
Research Group	Genetics
Leader research group	Prof.dr. R. Koes
Research input tenured staff 2014	1.8 fte (5 pers.)

### *Assessment:*

Research quality	2
Relevance to society	3
Viability	3

### **Research quality**

The group is one of the co-founders of an important platform for investigating flower morphology and colour determination in *Petunia*. The research was supported by a competitive TOP grant (2011). By all measures the group produces very good research: 52 peer-reviewed articles have been published over the last six years, mostly in the more specialized literature, but nevertheless in the top category of their field. Group members are regularly invited at conferences. Given the restructuring they went through towards a scientifically more stimulating environment, it is expected that the group's performance will increase in the coming years. Since the last evaluation substantial efforts have been made to integrate the research topics. Several topics have been terminated, others reoriented. As a result the department has set up a coherent and convincing research programme around flower development and colouring.

The group has a well-established research record on flower development. They have built up a strong international network of collaborators, both within the flower development field and the *Petunia* community.

During the on site visit, Prof. Koes explained the research avenues that will be pursued. He outlined the expected synergy between the two identified research lines within the group. However, how the expertise from the new university would be used in this research was not clear. It currently seemed to be based on "ad hoc" discoveries rather than on active fostering.

### **Relevance to society**

The group has good interactions with society at several levels. Information is given to the public (media exposure), there are existing interactions with plant breeders and companies and a patent was filed.

Surprisingly there is a lack in industrial (contract) income for the group. Given the interactions that the group has with industry, the committee recommend the group to actively foster and translate these currently rather informal contacts into collaborative projects with industry. Since the group wants to bridge the gap between basic science and application and given the fact that there are many interactions with industrial partners – there must be opportunities to translate this into important grants.

## **Viability**

The group has been subjected to many structural upheavals and thematic rearrangements. Important decisions have been made to focus onto two research themes. The group has moved to UvA given the isolation of the group at VU. They will join SILS merging with the group of Stam and Fransz. These changes should help them to further increase the scientific performance in the future.

However, it seems that the situation for the universities of Amsterdam are still not entirely stabilized. For this group, this means that two important aspects for their research are not assured: greenhouse capacity and cell biological tools, in particular laser scanning microscopy.

## **Recommendations:**

The recommendations that follow from the above mentioned topics are, in summary:

- The committee would recommend the group to take time to clearly draw the lines for possible collaborations with neighboring groups in order to enhance the quality and novelty of their own science.
- The committee recommends the group to better exploit the currently rather informal industrial contacts and seek funding for collaborative projects.
- The committee wants to strongly encourage the universities to make its own structures clear so that the group can forge ahead and focus again on science and teaching without being hindered by structural changes.

## 4.8 Wageningen University, Biochemistry

University	Wageningen University
Research Group	Biochemistry
Leader research group	Prof.dr. S.C. de Vries
Research input tenured staff 2014	2.5 fte (7 pers.)

### *Assessment:*

Research quality	1
Relevance to society	2
Viability	1

### **Research quality**

The group is doing excellent research as indicated by first class publications and recognized by multiple awards/prizes and invitations for plenary/keynote lectures at major conferences. The department is performing top-level basic research in biochemistry, with a clear opening to application. The focus on protein/DNA interactions is original within the EPS cluster and well positioned with exciting new findings. Following suggestions from the previous evaluation, the group nicely integrates structural protein work and plant cellular biochemistry. The group is in an optimal environment with outstanding technical facilities. The programme leaders are working on complementary topics providing an environment for synergy. All these internationally recognized activities are supported by a stable level of funding (although there are concerns for the future given changes in primary funding). The quality is exemplified by a recent VICI grant (Wijers), and several other personal grants in the review period.

### **Relevance to society**

Much of the ongoing work is primarily dedicated to basic research, and thus societal value is different from that of more applied groups. Nevertheless, the opening towards more applied aspects is clearly visible. Collaborations with the industry are mentioned, but the strategy to develop this further could be improved. Furthermore, how teaching in basic research is relevant for teaching in agronomy could be emphasized more.

### **Viability**

The overall viability is excellent, even so differences between the individual PIs are visible. The strategy to maintain the current lines of research seems logical. The group is very well connected to the leading groups in Europe. Attention is given to the situation that some members are close to retirement. The strategy for continuing excellent research by hiring new Group leaders sounds well planned. The policy to replace people step by step ensures that high quality new people can be hired.

### **Recommendations**

The group should hire new people step by step, as already planned, given the fact that some members are close to retirement.

In order to secure the financial situation for a group that runs expensive equipment, the focus on more applied "Top Sector" projects could be increased. Although still challenging the group should have an open eye for connections to computational opportunities in protein/DNA interactions (by collaboration with expert groups) to complement the experimental work.

## 4.9 Wageningen University, Bioinformatics

University	Wageningen University
Research Group	Bioinformatics
Leader research group	Prof.dr.ir. D. de Ridder
Research input tenured staff 2014	2.1 fte (4 pers.)

### *Assessment:*

Research quality	2
Relevance to society	2
Viability	3

The group of bioinformatics has gone through a major transition during the evaluation period and the new chair person has been hired only very recently. This makes it difficult to evaluate the current composition of the group. It is currently a small research group headed by Prof. de Ridder and composed of 5 members, representing approximately 2 fte's in total. Ongoing research is largely aimed at developing new analytical tools to integrate and understand large scale data sets at multiple levels (from molecules to phenotypes).

### **Research quality**

The chair group is performing very good basic research with openings towards applications and is well embedded within the local environment, with strong links to the Applied Bioinformatics group at PRI. The group has an extensive network of collaborators partly because much of the research is carried out with the groups producing the data. The group seems to be still struggling in finding the right balance between providing bioinformatics services to other groups and developing its own bioinformatics research aimed at the development of new tools for data analysis. Yet the best opportunity for the group may not reside in either of the above mentioned areas but rather in the development of its own biological research based on computational tools. There is clearly a need for increasing the number of publications but the overall quality of the research seems to be quite good, also in consideration of the fact that the group is still in a restarting phase and their scientific production is going through a temporary dip. The group has a reasonable level of funding, although support has been reduced significantly over the last 2 years. The areas outlined as central for the future activities of the group (genomes, transcript, protein, metabolism) do not seem to be as limited as stated in the self-evaluation and more focus may be needed to gain international relevance and visibility.

### **Relevance to society**

The relevance of bioinformatics to research, industry and education cannot be over stated, and the efforts performed by the group appear to be in the right direction to make their research of broad impact. The group is mainly producing enabling technology, which is, however, essential for more applied research. Tighter links with industry need to be established also to provide job opportunities for the graduates. Given the compelling need for more informatics education in biological curricula, the impact through education could potentially be very high.

## **Viability**

The chair group seems to have good opportunities in its future activities under the new guidance of prof. de Ridder. The group seems to have the right balance between scientists with a computer science and with a biological background. The presence of a number of young researchers in the staff is definitely a plus for the group but there is a need to clearly identify new and exciting areas of biological research where the use of the computational tools could allow the group to establish itself at the international level (e.g. synthetic biology could be made the main focus of the group if this area is a priority for the University). Overall the viability is difficult to assess. On the one hand there is definitely an increasing need for bioinformatics. On the other hand the group remains very small and as such will not be able to compete with top level groups in the international arena. It seems to function at the moment mainly as a service group and it is hard to envision how this could be otherwise if they do not succeed in creating focus and mass to set up their own research. There is therefore a vicious circle where they need extra support to improve performance and will have to perform better to obtain more funding.

## **Other remarks**

The group appear to be enthusiastic and well managed, with an open eye for the future and a great willingness to cooperate.

## **Recommendations**

The university has to make a commitment to make the group stronger through additional investments or it will have to change the embedding. This could be a merger with the Applied Bioinformatics group at PRI, or with a group that works experimentally on a research question that is excellently suited for a bioinformatics/computational approach; depending on the desired focus, either more on service and tools or on biological research.

## 4.10 Wageningen University, Biophysics

University	Wageningen University
Research Group	Biophysics
Leader research group	Prof.dr. H. van Amerongen
Research input tenured staff	1.3 fte (4 pers.)

### *Assessment:*

Research quality	2
Relevance to society	1
Viability	2

### **Research quality**

The goal of this group is to understand physical processes that underlie on one hand living systems and on the other hand food quality/technology. Research quality is excellent based on publications, project money and collaborations. The group is relatively small (currently 4 professors, a new assistant professor, Wientjes, will come in Sept. 2015) and pushes new technologies with a clear view on basic research and applications. The fact that the group is developing their own instrumentation for NMR and MRI analyses, especially *in vivo* imaging, is outstanding. Although the group works on different topics there is very good synergy and collaboration between the PIs. They have established an excellent network of local, national and international collaborations. The connection to industry is excellent. The department's combination of basic and applied science is also attractive for teaching. The oral presentation nicely demonstrated that modelling is an integrated part of their research. Six out of the 9 PhD students are part of EPS, which is highly appreciated by the PIs.

### **Relevance to society**

The relevance to society is very high since the group's research interest spans from basic research questions in plant biology and biochemistry to technology development in food science. There is extensive collaboration with the food and plant breeding industry. Several patents were filed. Collaboration is stimulated by the analytical and technical expertise (WISH) and also the endowed Unilever chair. Given all this, the number of fte's funded by contract research is limited (16%).

Outreach to the public is at an excellent level.

### **Viability**

Overall the viability appears very good: although there are career-stage-dependent differences between the PIs, the department is strong, producing excellent science, with increasing levels of funding. They also firmly occupy what looks like a very interesting niche. There is a clear, dynamic strategy to continue top-notch research or to stop projects when this seems appropriate. In addition, the group is engaged in excellent teaching, covering topics in niches not covered in this depth by others.

## **Recommendations**

For a technology-based group, with a strong focus on applied science, it may be difficult to publish more often in high-ranking journals. The group is very well balancing methodological developments, basic research and industry driven questions. Nevertheless, it could be helpful for an even better publication record if the group would define a small number of "focus projects" that could lead to such publications. Obviously, this should not hinder the group to carry on with their established activities. Also, the fte's in contract research could possibly be further increased by a focused approach with partners interested in long-term collaboration.

#### **4.11 Wageningen University, Biosystematics**

University	Wageningen University
Research Group	Biosystematics
Leader research group	Prof.dr. M.E. Schranz
Research input tenured staff	1.7 fte (4 pers.)

Assessment:	
Research quality	3
Relevance to society	2
Viability	3

##### **Research quality**

The chair group has experienced a number of changes since the last review and some of the hires are very recent, including that of the new chair person, Prof. Schranz. This means that the impact of these new appointments cannot be fully appreciated at this stage. There is a notable improvement in the performance of the group in terms of relative impact over the last 2-3 years of the evaluation period, indicating a positive trend (the increase in the same time of the papers without citations needs further analysis). There is a need for a more clear research focus in the group that right now still appears to be quite diversified, including different areas within the general umbrella of biosystematics. The diversification is also reflected in heterogeneity of research quality within the group. The appointment of Prof. Schranz as chair of the group has added the area of comparative genomics to those who were already present. The impact of the genomic approaches stewarded by Prof. Schranz is not yet fully visible in the other research areas of the group.

##### **Relevance to society**

The research areas addressed by the group are very relevant to society and have profound implications in both ecology as well as plant breeding. The group has made a commendable effort in order to focus on crops and crop related pests and to ensure a strong connection with industry. The group is also well connected with other groups within WU and EPS and has strong collaborative ties with the bioinformatics group in WU.

##### **Viability**

The group has clearly gained a strong competence in genomics through the appointment of Prof. Schranz and this represents an advantage for the future activities and research and students' recruitment. Attention should be given, however, to make the genomic analyses and tools relevant to the main goal of the group that is to address evolutionary processes at the above and below species level. The committee could not identify either from the self-assessment report or from the interview what the precise future research plans of the group are going to be. In consideration of the relatively small size of the group, there is clearly a need for a rethinking of the future research strategy with the goal of better positioning the group at the international level. While the proposed focus on the evolution of traits appears to be appropriate, there should also be a

choice of specific traits and specific groups of species in order to provide a clear biological focus to the group.

### **Recommendations**

In terms of research quality, aiming for higher quality papers and journals and some very high profile publications would be desirable to raise the international profile and visibility of the group. When it comes to future hires the most compelling need seems to be in the area of population biology and genetics to better address intraspecific evolutionary processes. Closer interactions with the bioinformatics group are to be encouraged given the complementary expertise present in the two groups, perhaps even up to the merging of the groups. It is not entirely clear why a competence in entomology and insect-plant interactions should be embedded within this group and not within the entomology group of WU, as it may lead to further diversification.

## 4.12 Wageningen University, Cell Biology

University	Wageningen University
Research Group	Cell Biology
Leader research group	Prof.dr.ir. M.E. Janson
Research input tenured staff	1.0 fte (4 pers.)

### Assessment:

Research quality	2
Relevance to society	2
Viability	3

### Research quality

The department is doing very good basic research on cell functions with a clear focus on cytoskeleton and cell wall biosynthesis. The quality is not yet world leading, even though some publications are outstanding (e.g. Nat. Cell Biol.), but the topic has great potential. Since the field of *in vivo* imaging is highly competitive the group has to find their niche in this field. Modelling and the new model system may help to do so.

The group has built a good network of collaborations, both national as international. High teaching load, offering a lot of microscopy service, and a relative small group size is a challenge for the group. Nevertheless, the group has a good productivity via collaborations. The inclusion of Mulder in the group as special chair is highly beneficial and is one of the best examples where these chairs results in an intense collaboration.

The novel focus of the group on *Physcomitrella patens* seems to be a good opportunity to become a leading group in one particular field. Again, the group appears to be well aware that it needs to focus.

The group has a stable, but increasable level of funding and the group members are regularly involved in the organization of international conferences.

### Relevance to society

Much of the ongoing work is fundamental science, but with clear openings towards application. Nevertheless, links with the industry seem to be largely indirect. The group has a good focus on education and provides a lot of service to other groups. Main relevance is through skilled students. Not clear from the report is whether this is state of the art. Incidental contribution to society, for instance through secondary school teachers, is recommendable, but it should be noted that the group is very small.

### Viability

Under current circumstances there are some concerns whether the group will be able to compete with world leading other groups in the field. While being focussed and led by an enthusiastic head of the department, Prof. Janson, the current group members have not succeeded in acquiring individual grants (with the VIDI of Vermeer, now mostly in Zürich, as exception), and given the competitiveness it is uncertain if this will be the case in the future.

The group is well connected within the EPS cluster as reflected by a good number of "shared" PhD students and the provision of microscopy services to the wider

community. As such, this provides a good prospect for the future, although the ambitions are higher than this.

## **Recommendations**

Getting one or two postdocs in the group could help to solve the dilemma between high teaching load and maximizing the output from basic research. The second recommendation is to continue and strengthen to the work on *Physcomitrella patens*.

Involvement in teacher training, education outreach is commendable, but in reality the group probably cannot afford spending much time on this, and should focus more on research.

The university has to consider to make the group much stronger or to change the embedding (e.g. decide on a cluster in System/Synthetic biology). The group should focus on acquiring a stronger position by teaming up with top groups within EPS or outside. Also, taking up a leading role in university priorities (e.g. Synthetic Biology) will help to establish a firm basis for the future.

Vacancy of PI position should be used to obtain a high potential person. It is an open question if the VIDI of Vermeer will lead to the development of a research group in the Netherlands (which is the main rationale for VIDI), given that the main appointment is in Zürich. It should be ensured that it is a functional link. The combination of cell biology and modelling is very promising and should be strengthened and continued.

#### 4.13 Wageningen University, Entomology

University	Wageningen University
Research Group	Entomology
Leader research group	Prof.dr. M. Dicke
Research input tenured staff 2014	2.4 fte (8 pers.)

*Assessment:*

Research quality	1
Relevance to society	1
Viability	1

The group is, without question, one of the most influential entomology research groups in the world, especially considering the relatively small size of the tenured research staff (8). Their research consists of a well-balanced combination of basic, curiosity-driven research side-by-side with the application of knowledge derived from these studies to solving problems in the real world. For example, their studies of insect-plant interactions provide information being used to structure improved and sustainable integrated pest management programs for controlling both crop pests and the mosquito vectors of human diseases such as malaria. The eight tenured research staff members carry out this important research together with non-tenured scientific staff, 13 postdoctoral fellows and 40 PhD students. During the period 2009 – 2014, 40 students received a PhD.

Evidence of the very high quality research carried out by this group is found in publications, which include more than four hundred papers over the current review period. Of these, over 120 are among the top 10% of widely cited papers in their field, and 18 of these are in the top 1%. Moreover, many of papers are published in excellent to highly prestigious journals such as Science, Nature Climate Change, Nature Chemical Biology and PLoS journals. Productivity per person in the group is also very high per full time equivalent staff. The quality and productivity of the group have been recognised at a national level with 3 staff being member of the KNAW and Prof. Dicke has been recognized with the Spinoza prize and the award of the NWO-KNAW Eureka prize for Science communication. Members of this group include three fellows of the Royal Academy of Sciences (KNAW). Owing to the high quality of their research, the Entomology group has been very successful in attracting competitive funding in both the local Dutch funding agencies (Veni Vidi Vici; NWO, KNAW) and the EU. Approximately 54% of funding comes from competitive research grants and 27% from contract research.

A novel aspect of this group's activities is the promotion of insects as highly nutritious supplements of animal feed and even as components of human diets. This research is done with an international focus and helps the FAO in their policy to improve protein supplement to feed and food. The leading position of the group in this area becomes visible, e.g. through a new scientific journal (<http://www.wageningenacademic.com/loi/jiff>).

#### **Relevance to society**

The group has an excellent record of undertaking research relevant to society both nationally and internationally. At the national level they have developed

effective integrated pest control programs for controlling insect pests with biological agents for both the glasshouse crop systems and field crops. They have several important international research programs and collaborations in, for example, Africa, South America, China, as well as in developed countries such as France, Italy, and the United States.

Their studies of insect-plant interactions provide information being used to structure improved and sustainable integrated pest management programs for controlling both crop pests and the mosquito vectors of human diseases such as malaria.

An important aspect of this group's activities is the high profile they have developed in the public through a variety of outreach programs. They have established a biannual lecture series entitled "Insects and Society," and routinely participate in radio and TV interviews on the biology of insects as well as their economic and medical importance. They also participate in collaborative research programs with other PE&RC groups such as Virology, Genetics, and Nematology.

### **Viability**

The group is well led and has a clear focus in fundamental work which connects well with other groups in EPS & PE&RC. The budget that supports staff (48%) means the group is not dependent on "soft" money (competitive grants and contracts) for support. The average age of key group members is 55, and the younger professionals are under 40. Thus, there is an important age gap that should be dealt with. The group has a strategy for attracting entry-level professors and will open a position for a young tenure track staff member at the assistant Professor level in the near future. A major concern is that the group still consists mostly of male members, thus major effort should be made to correct this gender imbalance.

### **Recommendations**

The committee has few recommendations given the quality present already:

- Make efforts to improve both knowledge and utilization of molecular biology techniques for the benefit of the staff, post-doctoral fellows, and PhD candidates through development of stronger collaborations and training of staff and PhD candidates in this area. Molecular biology is revolutionizing the field of entomology at the individual animal level as well as at the population level (i.e., ecology), and facilities and staff competencies in this area need to be developed.
- Develop a strategy to attain a better gender balance in Entomology.
- Continue the already quite successful efforts for increasing the quality of peer-refereed papers.

#### 4.14 Wageningen University, Genetics

University	Wageningen University
Research Group	Genetics
Leader research group	Prof.dr. B.J. Zwaan
Research input tenured staff	3.0 fte (9 pers.)

##### *Assessment:*

Research quality	1
Relevance to society	2
Viability	2

#### **Research quality**

For a group of moderate size, WUR Genetics is outstanding in its productivity and reputation. The group contains several excellent scientists with strong publication records in peer-reviewed journals. There have been several changes in the group since the last review, with a new Chair, and with the retirement of its most senior geneticist. The publication of research, and receipt of awards has been well maintained even as the group has shifted its focus to be based more on 'learning from evolution', and to consider more models in its studies of genetics. This allows the group to choose the 'right' model to address fundamental questions within three clear themes on (1) Organisation of heritable variation; (2) Genetics and levels of selection and (3) Genetics of adaptation. The group publishes at a high impact level and have received six personal (mostly young investigator) awards in the last 4 years, and recently a VICI grant (Aanen). As a consequence they can be regarded as world-leading in genetics research across a broader range of species than any other group in the world. With regard to plants, a successful program in generating useful populations and innovative phenotyping has led to multiple insights into complex traits and GxE interactions. This and another example in examining yeast adaptation to heavy metals, indicates how novel insights can be made from their structured research themes on model species, and that these can form the basis for application in commercial species.

#### **Relevance to society**

The group has identified their major societal stakeholders and is building relationships with them through teaching materials and work in ageing, for example, and through development of research linkages with companies working in genetics of fermented products and in plant breeding. These relationships are impressive, but will take more time to mature into strong societal impacts. The dynamic and diverse research environment is attracting large numbers of visiting scientists as well as new international collaborations. The expectation is that these relationships will lead to the group making an outstanding contribution to international and national society.

Students indicate that there are benefits to being part of a group that is in both plant-related graduate schools (PE&RC and EPS), partly because it exposes them to greater numbers of training ideas and opportunities. Industry is increasingly demanding graduates with high-quality training in quantitative skills, especially genetics, and students start to appreciate this early in their education from interactions with other EPS and PE&RC groups.

## **Viability**

The Genetics group is strong and dynamic with many new appointments, which distribute its capabilities and teaching responsibilities across a large number of people. The group indicated that potential dependence on (expensive) technologies can be a weakness in this field, but is addressing this through collaboration with other groups in WUR, e.g. to develop phenotyping platforms. The Genetics group has an ambitious future strategy to develop its themes, and this certainly will require the development of current and future staff. While the group is well equipped for these future roles, it will take time to improve its skills to fully exploit access to appropriate experimental facilities and new phenotyping methods. The group already shares many PhDs with other groups, and it needs to maintain these strong relationships.

Viability in the future, as with many programs at WU, will depend on increasing resources. In plant sciences this could be challenging as many other universities are active here, as well as several major corporations that invest heavily in revolutionizing crop traits based on fundamental advances in genetics. However, the fundamental approach to genetics and heredity provides a strong basis for increasing its viability in all fields of genetics from plants through to applications in environment and health.

The group has a bold vision, as explained by the group leader Prof. Zwaan, perhaps more so than any other group in this review. However, they are well on the way to delivering ambitious impacts into diverse economic fields (plant and animal breeding, biocontrol, industrial production, and human health).

## **Recommendations**

- The committee endorses the 'fundamentals' approach of the Genetics group, focussing on the communalities in the mechanisms of genetics and heredity, while it also recommends that it continues to look for innovations in diverse areas where genetics can impact on health, environment and food production.
- Regarding plant science, delivery of ideas into main-stream crop germplasm will be a major challenge. This will likely require extensive discussion and thinking about how to best facilitate collaboration, with Plant Breeding (the main 'outward-facing' group) and potentially other research groups within and outside WUR. For example, excellent research in CSL lines in Arabidopsis could be further confirmed in other plant models with groups who have CSL models (e.g. for rice CIRAD, France).
- Phenotyping and its role in breeding is an exciting area of research for Genetics, and in WUR is being developed by and together with the HPP group. Opportunities exist for further collaborations on novel traits and fields in other areas.
- Increasing the number of joint PhDs, could facilitate these synergistic collaborations. The group should look towards some of the well-established phenotyping groups in the European network for opportunities in these areas.

#### 4.15 Wageningen University, Molecular Biology

University	Wageningen University
Research Group	Molecular Biology
Leader research group	Prof.dr. T. Bisseling
Research input tenured staff	2.0 fte (6 pers.)

##### *Assessment:*

Research quality	1
Relevance to society	1
Viability	1

#### **Research quality**

The Molecular Biology group headed by Prof. Bisseling is currently composed of 31 members, representing about 18 fte's. The main objective of the group is to unravel molecular mechanisms that confer symbiotic properties to plant microbe interactions. For this purpose, different systems are used.

The group performs excellent science as evidenced by high impact publications in quality journals over the last 6 years and is world-leading in their research field. They have extensive expertise and developed new tools in rhizosphere interactions to tackle important scientific questions with a high value for technology transfer to green industry. They will continue to focus on the plant/bacteria interface at the symbiosome level and evolution of nodulation and nodule development. To get insights into nodule evolution and in order to transfer the process to non-legume crops, the group execute comparative genomics between the nodulating non-legume *Parasponia* and its non-nodulating relative *Trema* which should lead to insights into the functional requirements to enter in nitrogen fixing symbiosis. This knowledge will bring the community closer towards the capability to transfer nitrogen fixing symbiosis to non-legume crops. Additionally, several initiatives have been started to study the power of the microbiome to sustain growth in adverse conditions (links to desert plants) and to study the co-evolution of plant/rhizosphere microbiome in relation to soil properties. Within these topics, together with other expertise (groups Angenent, Scheres), they want to make a transcriptional network platform at the cellular level to study these in relation to different research questions.

#### **Relevance to society**

The committee assesses the quality, scale and relevance of contributions targeting specific economic, social or cultural target groups, of advisory reports for policy, of contributions to public debates as excellent. The group made several important investments into their links to the society. They invest in media communication, science for developing countries, and information towards the public and high school students.

The group has strong links with industry and important foundations. As a result, they currently hold several grants and funding seems to be assured for the coming years with upcoming grants. Apart from funding from industry the group also participates in projects funded by the Bill Gates foundation to sustain agriculture in Africa through nitrogen fixing bacteria.

## **Viability**

The group shows a sustained growth in PhD students and post-docs and with the indicated granted projects and upcoming grants, this is expected to continue. Many group members were able to acquire personal grants (Veni Vidi Vici, ERC), showing their potential. The integration of Angenent's group and foreseen fusion with Plant Developmental Biology (Scheres) was discussed during the session, as the committee had several questions about the rationale behind the integration. It was clear from the discussion that all PI's are very much in favour of these structural changes. During the session it has become clear what the added value is of the integration of Angenent's expertise and the transcriptional network platform as already mentioned above. Additionally, the fusion with the Plant Developmental group is not only beneficial for their common project (rhizosphere) but will also be extended to the other aspects of the symbiosis research such as nodule organogenesis and evolution. The committee was thus convinced by the synergism that these structural changes has created or will create.

## **Recommendations**

The group has taken several structural and thematic decisions which will keep them leading in their field. They will tackle scientific questions which are also relevant for the society and will help in the development of sustainable agricultural practices. The group should however stay focussed and pay attention not to tackle too many projects at the same time. This will be especially important once the fusion with Scheres group will take place.

#### **4.16 Wageningen University, Nematology**

University	Wageningen University
Research Group	Nematology
Leader research group	Prof.dr. J. Bakker
Research input tenured staff	2.5 fte (7 pers.)

##### *Assessment:*

Research quality	1
Relevance to society	1
Viability	1

#### **Research quality**

The Nematology (NEM) group is innovative, ambitious, clearly directed and performs exceptionally well. Worldwide it ranks among the top groups in the field of basic and applied nematology. The group aims at understanding and predicting (!) the functioning of roundworms in cultivated and natural systems and approaches this ambitious objective by addressing two major fields: (a) molecular events of plant host manipulation by parasitic nematodes, and (b) role of soil nematodes in multitrophic interactions. The laboratory of nematology thus is on a particularly successful way for merging the much too often disparate fields of phytopathology and biodiversity, molecular approaches and ecology as well as microbial ecology and soil biology. A particularly outstanding result of these transdisciplinary activities is the development of a method that allows for phylogenetic and community analyses of nematodes based on small subunit rDNA. Ground-breaking achievements at the level of the two individual research fields include research on secretory proteins to unravel plant-nematode interactions or the impact of plant sensitivity to pests and pathogens on the range expansion by invasive species. This prolific group continues to expand its international scientific reputation by approaching new research areas, adopting up-to-date techniques and proactively addressing future challenges (e.g., big data).

NEM continues to publish in much respected high-ranking journals with strong impact in a wide variety of disciplines. A clear strategy for streamlining publication efforts allowed for overcoming a problem detected by the previous assessment panel: the reduction of bibliometric indices by publishing in specialized journals. This strategy led to a remarkably high average RI of 3.32 and to a high share of publications in T10 and T1 journals (note though that not all were in the field of nematology). The group has excellent research links (in Europe and beyond) and received numerous highly competitive grants (e.g., ERC-advanced grant). The research agenda makes it possible to approach cutting-edge research questions and to address topics that are of enormous interest for stakeholders such as vegetable and tomato breeders or soil testing companies. The group holds several patents.

#### **Relevance to society**

All research fields addressed are of enormous societal relevance - from the local to the global scale. Outstanding topics range from DNA barcoding assays for identifying/quantifying nematode species that are used by private and

governmental labs to the breeding of nematode resistant cultivars and quantitative approaches to the impact that free-living nematodes have on soil health, ecosystem functioning and ecological services. The group very effectively outreaches to the society by excellently communicated focal areas to a broad range of groups. A very good example are the mobile DNA courses on marker-assisted breeding and GM crops, by which it has already reached more than 140,000 high school students. Where appropriate, the group provides training (e.g. workshops, e-Learning) to companies and policymakers. Moreover, NEM shows direct public engagement by displaying worm-pathogen interactions at the MicroZoo in Artis and by organizing science for children workshops.

## **Viability**

Though there are some concerns relating to the age structure of the group, NEM is very well equipped for the future by approaching vibrant scientific themes. The appointment of Prof. van der Putten as endowed professor (NIOO) significantly contributes to the sustainability of the group by broadening the field of research. The group has decisive leadership and firm plans for the future, with the two programme leaders having successfully managed to combine a strong guidance with the development of a very good and productive team spirit. We are confident that the scientific objectives will uphold their relevance and innovative strength for decades. The scientific visions for meeting future challenges are outstanding. Four new staff members who might become Assistant Professors together with two young Assistant Professors may act as catalysts for maintaining the long-term viability.

## **Recommendations**

Considering the high ranking of the group, it is difficult to make a recommendation other than trying to do everything for keeping Nematology at the level it currently is. With respect to the challenges provided by Global Change, however, investing even more efforts in merging the fields of phytopathology and ecology in the light of the "One Health"-concept definitely is an important advice. Moreover, public awareness of biodiversity and ecology should be elevated to the level phytopathology already has. And finally, the cooperation with other PE&RC/EPS groups should be further intensified.

#### **4.17 Wageningen University, Plant Breeding**

University	Wageningen University
Research Group	Plant Breeding
Leader research group	Prof.dr. R.G.F. Visser
Research input tenured staff	8.1 fte (21 pers.)

##### *Assessment:*

Research quality	2
Relevance to society	1
Viability	2

#### **Research quality**

Compared with other groups, the Plant Breeding group led by Prof. Visser is very large with approximately 200 people including 21 scientists, 50 PhD and 35 MSc students. The research in the group is organized around 5 themes and 10 mixed groups. It is one of the only two groups that integrated fully personnel from Wageningen University and from DLO-PRI. The group works on a wide range of species and uses multiple populations that they developed, with most being reused over time. It is the only plant breeding group in the Netherlands at the university level and as such it has a strategic role for the development of innovative methods for plant breeding in multiple species (especially polyploids), even more than for the development of breeding and pre-breeding material. The committee was impressed by the quality of the research as reflected by a large number of publications that have on average an impact that is well above the international mean. This performance has increased substantially since the 2009 review, and compared against some of the leading international groups in plant breeding the group appears to be at their level using quantitative measurements such as the number of publications and their number of citations. The funding in the group is dominated by contract research but the committee believes that the group would benefit from greater access to competitive grants such as the Veni Vidi Vici or the ERC granting schemes in order to support more researchers in developing original research in novel aspects of plant breeding. The committee feels quite strongly that there should be a greater effort in the group on frontier research in plant breeding especially in central themes such as elucidating the architecture of complex traits and GxE and developing novel approaches for the identification of genes underlying such traits, i.e. the group should take a leading role in developing novel types of populations (CSL, NAM, MAGIC, where relevant) to complement their largely 'QTL-based' breeding studies and solutions.

#### **Relevance to society**

The Plant Breeding group has a great societal impact that stems from multiple activities carried out such as the organization of courses for breeding companies and developing countries, the licensing of IPRs on pre-breeding materials, the strong partnerships with companies, the strong and dedicated effort in undergraduate and graduate education and the active involvement in the societal discussion on cis-genesis and new plant breeding methods and software. The group provides comprehensive training in different crops and topics which also accommodates specific needs of sandwich PhDs. New bi-lateral arrangements

(e.g. China, Korea, Chile, Ecuador), and new courses (summer schools and distance-learning modules) benefit early and mid-career breeders.

## **Viability**

The chair group is on a well-established and defined path that will ensure a bright future through the extension of currently carried out research activities and projects. The committee, however, has concerns on the ability of the group to move into new research areas partly as a consequence of the great success in the current activities. The advent of the genome editing technologies (e.g. the CRISPr/CAS technique) that could effectively replace current mutagenesis methods shifts focus to the identification of targets for editing, i.e. on the identification of genes and nucleotides that affect traits of agronomic relevance. This requires greater effort and collaboration in the development of novel methods, populations and phenotyping to accelerate trait dissection and gene identification. While the group expressed intent to develop high-throughput field phenotyping research, no evidence was given that this is yet happening, and the group has little active research around 'targeting' of breeding and exploitation of GxE as part of marker-based or genomic prediction based breeding.

The group listed as a threat that "more groups are shifting to crops and plant breeding research" and indicated concerns about sharing populations and data which could be used competitively against them. This is indicative of a need (perhaps mediated by the School) for improved mechanisms to strengthen links between Plant Breeding and the mathematical groups (Bioinformatics and Mathematics and Statistics) as well as with CSA for abiotic adaptation, and the Entomology, Nematology and Virology groups for biotic stresses. While Plant Breeding would often seem to be the obvious lead in such work, this will not always be the case. Some concerns do persist on the effective merging of the University and the DLO groups especially when it comes to the administrative aspects even though the efforts performed so far have been very successful in integrating the research efforts of the two groups.

## **Recommendations**

The recommendations that follow from the above mentioned topics are:

- Invest more into novel research areas and population development, especially through the active involvement, and possibly recruitment, of young scientists of the group into these activities in order to spread research expertise beyond the successful professor positions.
- Improve research collaborations by sharing data and germplasm to the benefit of WUR as a whole. Given its important role in industry, innovations in genetics, phenotyping and breeding in multiple crops depends on Plant Breeding being a leading but not dominating collaborator.

#### **4.18 Wageningen University, Plant Developmental Biology**

University	Wageningen University
Research Group	Plant Developmental Biology
Leader research group	Prof.dr.ir. B.J.G. Scheres
Research input tenured staff	1.6 fte (4 pers.)

*Assessment:*

Research quality	1
Relevance to society	1
Viability	1

#### **Research quality**

The Plant Developmental Biology group headed by Prof. Scheres is currently composed of 14 members, representing about 8 fte's. The group had focussed on identifying important ground breaking concepts in plant developmental biology, studying key processes in root, shoot and embryo development, and is continuing to do so while also building bridges towards application.

The research group performs cutting edge excellent fundamental research as can be seen from the continued publication of highly cited papers in high impact journals. The research group is internationally recognized and outreaches excellence in its field. For future projects, there is integration of innovative tools for imaging such as CMT and MRI to study root architecture and use of novel cell biological techniques and protein interactions techniques to get insights into fundamental aspects of plant development and its relation to the environment.

#### **Relevance to society**

The research group has invested much energy in linking with industry. This effort was fruitful and more than 1 M€ was collected. Likewise they bridge the gap from fundamental research towards application. By merging with the group of Molecular Biology (Bisseling) this will even be enforced. They further invest in collaborations with industry e.g. they will be part in a large collaborative project including academic and industrial partners.

The group participates in training programmes, and deliver PhDs that find their way to diverse functions in society

#### **Viability**

The group uses its advantage of being at Wageningen to connect the basic aspects of research to its application (e.g. root growth in natural environments) via collaboration with several other WUR groups. In that respect, the merging with the molecular biology department is the most pronounced one. This fusion is considered as synergistic, by the group leader as well as the staff. It is the explicit goal to bridge the gap between fundamental research and application and merging with the molecular biology group will greatly help to achieve this goal. Although the committee had some questions about this merging in terms of need, threat to the excellent fundamental science, group dynamics, during the session the group was able to convince the committee about future positive outcome of such fusion, as it will create synergistic actions and strengthen the

research. Reorganizational steps might result in some drawbacks, but the team is excellently positioned to carry the change.

The group indicated suboptimal age distribution of the staff. The committee agree with the team that fostering a young PI to be responsible for the new research directions (such as interaction with the rhizosphere, root growth in natural habitats) will be required to keep the group on forefront in their research area.

### **Other remarks**

The group experienced an integrity case with a former associated post-doc. The group has responded very well by adjusting internal policies, which could also help other groups to prevent such cases.

### **Recommendations**

The group should keep its focus on fundamental science using (wild) model systems and discovering basic concepts in plant science. There is some concern about the strong emphasis on crop plants and direct applications by funding agencies, as well as by the university through its budgeting system. On the other hand the EPS board noted that private companies emphasize the need for fundamental research in particular, and the group is well positioned to exploit such opportunities.

#### 4.19 Wageningen University, Phytopathology

University	Wageningen University
Research Group	Phytopathology
Leader research group	Prof.dr.ir. B.P.H.J. Thomma
Research input tenured staff	2.1 fte (7 pers)

##### *Assessment:*

Research quality	1
Relevance to society	1
Viability	2

#### **Research quality**

The U. Wageningen Dept. of Phytopathology has a long tradition and ranks among the best molecular phytopathology groups in the world. After Pierre de Wit left the chair position in 2013, Prof. Thomma took over as the new chair. He had been appointed as professor in the same dept. since 2006. The Dept. of Phytopathology is one of the largest departments the committee has interviewed, with currently 7 professors (incl. one endowed chair, Prof. Crous), a large number of postdocs (currently 18) and a total of currently 26 PhD students that are all in EPS. The research is focused on the interactions of model plants (*Arabidopsis*, tomato, potato) with mostly fungal/oomycete pathogens (*Verticillium*, *Cladosporium*, *Phytophthora*) and, as was presented in the talk, more recently, also the Gram-positive bacterium *Clavibacter*. The latter topic will be developed in the future by Dr. Nijland, a new assistant professor.

The research quality is excellent which is reflected by the number of publications in high-ranking journals. In addition, the department has succeeded to acquire important funds by private national and international companies and an impressive number of special grants: four VENI- (Van Esse, Smit, Bouwmeester, Van Damme), one VIDI- (Van den Burg, now in Amsterdam) and one VICI- (Thomma) grants, as well as the Wageningen University fund "Food-for-thought campaign" to dr. Govers.

When the committee had a closer look at the most cited publications from 2008-2013 it noticed that many were from Crous based on work largely performed at the Fungal Biodiversity Center at Utrecht (29 out of 62 of the top 1% publications).

#### **Relevance to society**

Working on plant pathogens and trying to understand the molecular mechanisms underlying pathogen virulence and plant resistance/defense automatically has a strong impact on society. The number of patents/patent applications, the links established with industry (seed companies) and outreach activities targeted at general and professional audiences are excellent. In addition, the 1.25 million EUR "Food-for-thought" award to Govers underlines the important contributions of her research to society.

#### **Viability**

As stated in the self-assessment the "research programme of the Chair group Phytopathology is perfectly viable". Although some research goals are straight-

forward, the future directions were too general in the opinion of the Committee. With respect to the recommendations given in the review report of 2009 to employ members with strong bioinformatics skills they now have 2 postdocs and 3 PhD students that perform the bioinformatics analyses of the chair. In addition, they collaborate with the WUR Dept. of Bioinformatics. It appears that the interaction with the Dept. of Bioinformatics is restricted to "using" them as a service based on specific needs for new tools that arise from time to time, rather than collaboration on fundamental research topics.

### **Recommendations**

The strategies how to achieve the future goals could be developed in more detail. The interaction with the Dept. of Bioinformatics could capitalize on their research skills in a more fundamental mode. This could be, for instance, through the use of novel computational approaches to better exploit the large data-sets that are generated by the Chair through, for instance, genome- and RNA-seq analyses or studying evolution of protein/DNA interactions.

## 4.20 Wageningen University, Plant Physiology

University	Wageningen University
Research Group	Plant Physiology
Leader research group	Prof.dr. H. Bouwmeester
Research input tenured staff	2.6 fte (8 pers.)

### *Assessment:*

Research quality	2
Relevance to society	1
Viability	1

### **Research quality**

The overarching question of the group is to answer the question: How do plants interact with the environment? The research is broken down into four main research themes, 1. Seed and bulb biology; 2. Plant resilience; 3. Plant metabolism; 4. Rhizosphere Physiology.

In general the group has a very high standard scientifically and publishes in high profile journals. The research areas 1 and 4 are very strong with excellent theme leaders and excellent research output in terms of grants and publications.

Research areas 2 and 3 are very good to excellent but some aspects could be improved in terms of research output. The ERC grant of Prof. Bouwmeester and the VIDI grant to dr. Bentsink reflect their outstanding qualifications and scientific expertise.

One problem which became apparent during the presentation was that the research topics are broadly spread out and could benefit from some efforts to focus the research to fewer topics in order to have the critical mass which is essential to be internationally highly competitive. The international excellence is seen in several research lines but not throughout.

The group has a good, sufficient infrastructure to conduct the research. It was also noted that the group benefits from the excellent scientific environment in Wageningen University. This is reflected in some collaborations such as in the entomological aspects of some research. There appear to be no common projects with the plant breeding research group.

The group benefits from the expertise of two endowed professorships which were appointed very recently, one is particularly involved in bulb physiology.

The main research focus is on *Arabidopsis*, but initiatives have started to translate the knowledge into crop plants mainly to tomato and to some extent also to rice and other crops. This is considered to be important for the viability in the future.

The group demonstrates a good balance between research and focused teaching, by which the group is able to recruit many talented students.

### **Relevance to society**

The research has an impact on seed / horticulture industry which is nationally and internationally important. It is also important for securing employment for students after they have obtained their PhD. The group is heavily involved in training students nationally and internationally, including students from less developed countries. The group has filed several patents.

## **Viability**

The group is partially in a transition phase with some members being close to retirement. This process will close some research projects. The members of the group are aware of the fact that efforts have to be made to strengthen the existing areas with new appointments. Strategic plans have already been prepared for this. The group is forward looking to ensure the viability. A strategic plan has been drawn-up to make this transition smooth and to further strengthen existing strong research areas. Young candidate scientists have already been identified for the vacancies.

## ***Other remarks***

The group points out that the EPS is very beneficial for the training of Ph.D. students and for communications among other national research groups. These communications may open up new avenues for scientific interactions.

## **Recommendations**

The group should reflect on focusing on the already very strong research areas in order to maintain the critical mass for future successful internationally competitive research. Some minor research lines should be closed. The teaching should be continued on the same high level.

#### **4.21 Wageningen University, Virology**

University	Wageningen University
Research Group	Virology
Leader research group	Prof.dr. M.M. van Oers
Research input tenured staff 2014	1.8 fte (6 pers.)

*Assessment:*

Research quality	2
Relevance to society	2
Viability	2

#### **Research quality**

This group has been under transformation with new appointments and the new leadership is fairly recent. The group has worked with establishing research directions and intends to concentrate efforts on 3 research lines, plant virology, invertebrate virology (primarily on viruses that kill insects or shrimp), and arbovirology (viruses transmitted by mosquitoes that cause disease in mammals). The primary focus is on using the basic knowledge of virus/host interactions with the aim being to prevent viral diseases. Other research deals with topics such as the use of baculovirus vectors for production of antigens used to generate vaccines for mammals, and understanding "virus mutualism" based on recent studies that show, for example, some plant viruses can be beneficial to plants by making them more tolerant to drought. Studies on the use of viruses to control lepidopteran pest populations, a major focus of this group in the past, is in decline, but still ongoing through collaborations with researchers in other countries, for example in Asia and Europe, where these viruses are still used in integrated pest control programs.

Overall, the publication record has been good, especially considering the relatively small size of the group. Over the period 2009 – 2014, 19% of the publications in their field were in the top 10% of publications cited, and 3% in the top 1%. There is a good trend toward publication of papers in higher-impact journals with a higher level of citations. Emeritus Professor Vlak adds to the group's international profile owing to his previous research on baculoviruses, and his ongoing collaborative work with researchers in other countries on viruses that attack shrimp in aquaculture, an important and growing food source in many countries.

One particular challenge is that this relatively small group works in three different major areas of virus research, so it could be argued that they have spread themselves too thin, albeit that the viruses have in common that they almost all replicate in insects. Also, although the number of PhD candidates is acceptable, the group would benefit from having more post-doctoral fellows to enhance their research profile and assist with the teaching.

#### **Relevance to society**

Viral diseases of plants and animals are a serious threat to future health and welfare of the world's food supply, as well as controlling mammalian diseases vectored by insects such as mosquitoes. Communication of the role of this group in this important area would be something to work on to raise the profile of the group (and possibly attract funding). Is there a communication strategy in place

for this group? Considering the importance of controlling viral diseases to plant and animal health, the efforts of this group are rather minimal with respect to raising their societal profile. More attention should be paid to communicating to the public the relevance of their research to societal needs. This could well benefit their funding.

### **Viability**

As noted above, this group currently has a low number of postdoctoral researchers, and in comparison to other groups, low international representation in the staff, as recognized in their SWOT analysis. The strategy for increasing the number of postdoctoral fellows and international representation is not clear. On the positive side, though a small group, it has one of the best records in gender balance among the groups under review, and the only group with a female research leader, while dr. Ros was awarded a VENI grant in 2011 and became assistant professorship in 2015. The new addition of Dr. Ros, who studies the manipulation of insect behavior by viruses adds strength to this program, as does the appointment of Dr. Van der Vlugt as a special professor focusing on plant/virus ecology. Given the relatively small size of this group, the number of international collaborations must be a drain on resources from the standpoint of administration. This could have a negative impact on this group if it continues in the future. Related to this, there is a clear need to better leverage their resources through, for example, extend the existing collaboration with the Entomology group or groups working in the field of plant protection. It should be kept in mind that the leadership of this group changed over the current review period, beginning with the tragic death of Prof. Goldbach in 2009. He was replaced with Prof. Vlak, as interim chair of virology, who realigned the research program and officially retired in 2012, but stayed in charge of the program until 2013. The appointment of Prof. Van Oers has added the necessary stability to this group, which should increase its future viability.

### **Recommendations**

- To increase the number of postdoctoral fellows in the near future through internal and extramural funding to strengthen the group's viability.
- To reduce the numerous international collaborations. It is recommended to strengthen and perhaps expand only those that result in truly productive relationships.
- To better leverage Virology's resources by establishing stronger and new relationships with other groups in EPS and PE&RC, especially those involved in crop pests, plant and animal vector control, and large scale data analysis.

## **Annex 1 Criteria and scores of national protocol SEP**

### *Criterion 1: Research quality*

The committee assesses the quality of the chair group's research and the contribution that research makes to the body of scientific knowledge. The committee also assesses the scale of the chair group's research results (scientific publications, instruments and infrastructure developed by the group, and other contributions to science). The following elements are to be considered in assessing this criterion:

- scientific quality
- productivity to the scientific community (in relation to the volume of the tenured scientific staff)
- the academic reputation of the group
- the strategy to provide the output at the highest relevant level possible

### *Criterion 2: Relevance to society*

The committee assesses the quality, scale and relevance of contributions targeting specific economic, social, or cultural target groups, of advisory reports for policy, of contributions to public debates, and so on. The point is to assess contributions in areas that the chair group has itself designated as target areas. The following elements are to be considered in assessing this criterion:

- a narrative in which the group demonstrates its relevance for society
- research products for societal target groups such as:
  - professional publications and outreach to the general public
  - other research output to society
- use of research products by societal groups such as
  - patents, licences, training courses
  - projects in cooperation with societal partners (European Union, Topsectoren, international funds)
  - contract research (including consultancies), also co-publications and use of facilities
  - present jobs of alumni
- demonstrable marks of recognition by societal groups such as demonstrated by
  - advisory reports for the government
  - media exposure as presentations on radio / TV, invited opinion articles etc.
  - membership societal advisory boards

### *Criterion 3: Viability*

The committee assesses the strategy that the chair group intends to pursue in the years ahead and the extent to which it is capable of meeting its targets in research and society during this period. It also considers the governance and leadership skills of the chair group's management. The following elements are to be considered in assessing this criterion:

- leadership of the chair
- (scientific) visibility and recognition
- research vision and strength of the research lines
- innovative strength
- strategic choices and decisions
- composition of the group (expertise, people)

- acquisition capacity

*The meaning of the scores for the three main assessment criteria:*

<b>Score</b>	<b>Meaning</b>	<b>Research quality</b>	<b>Relevance to society</b>	<b>Viability</b>
1	Excellent / world leading	One of the few most influential research groups in the world in its particular field	An outstanding contribution to society	Excellently equipped for the future
2	Very good	Very good, internationally recognized research	A very good contribution to society	Very well equipped for the future
3	Good	Good research	Makes a good contribution to society	Makes responsible strategic decisions and is therefore well equipped for the future
4	Unsatisfactory	Does not achieve satisfactory results in its field	Does not make a satisfactory contribution to society	Not adequately equipped for the future

## Annex 2 Programme Site visit EPS Peer Review

### Tuesday June 2

- 17:00 – 18:00 Welcome and introduction by Dean of Sciences Wageningen University  
Invited: Board members EPS, director EPS and office EPS  
(*meeting room Radix W.03*)
- 18:00 – 18:30 Introduction to programme and questions about the documentation
- 18:30 – 20:00 Preparatory meeting PRC: Discussion on pre-assessment and reviewing procedure (*meeting room Hotel de Wereld*)

### Wednesday June 3

- 8:45 - 9:30 Meeting with EPS research council & Educational Committee
- 9:30 - 9:50 Meeting with the PhD council
- 9:50 - 10:10 Bibliometric Analysis (Ellen Fest)
- 10:10 – 10:30 Meeting with candidates EPS graduate programme
- 10:30 – 11:00 Break
- 11:00 – 12:30 Meeting with chair groups

*Parallel session I*    **University of Amsterdam, Plant Sciences** (*meeting room Radix W.03*)  
Panel members: Ulla Bonas, Dorothea Bartels, Michele Morgante, Karsten Niehaus

*Parallel session II*    **Leiden University Plant Sciences** (*meeting room Radix W.02*)  
Panel members: Natalia Dudareva, Myron Zalucki, Peter van Tienderen

12:30 – 13:30 Lunch (*meeting room Radix W.03*)

13:30 – 14:30 Meeting with chair groups

*Parallel session I*    **Radboud University Plant Sciences** (*meeting room Radix W.03*)  
Panel members: Natalia Dudareva, Karsten Niehaus, Myron Zalucki

*Parallel session II*    **Utrecht University Molecular Plant Physiology** (*meeting room Radix W.02*)  
Panel members: Dorothea Bartels, Michele Morgante, Peter van Tienderen

*Parallel session III*    Writing session  
Ulla Bonas (*meeting room Radix W.05*)

14:30 – 14:45 Break

- 14:45 – 15:45 Meeting with chair groups
- Parallel session I* **Utrecht University Plant Microbe Interactions** (*meeting room Radix W.03*)  
Myron Zalucki, Ulla Bonas, Peter van Tienderen
- Parallel session II* **Wageningen University Biosystematics** (*meeting room Radix W.02*)  
Michele Morgante, Karsten Niehaus, Natalia Dudareva
- Parallel session III* Writing session (*meeting room Radix W.05*)  
Dorothea Bartels
- 15:45 – 16:00 Break
- 16:00 – 17:00 Meeting with chair groups
- Parallel session I* **Utrecht University Ecophysiology** (*meeting room Radix W.03*)  
Dorothea Bartels, Ulla Bonas, Myron Zalucki
- Parallel session II* **Wageningen University Biochemistry** (*meeting room Radix W.02*)  
Karsten Niehaus, Natalia Dudareva, Peter van Tienderen
- Parallel session III* Writing session (*meeting room Radix W.05*)  
Michele Morgante ,
- 17:00 – 17:30 Wrap up day 1
- 17:30 – 19:00 Poster session & drinks (*Radix Patio*)  
Invited: EPS staff members, postdocs and PhD candidates

Evaluation of groups: 10 minutes introduction, 40 minutes discussion, 10 minutes wrap up and change of committees. Groups are asked to be represented with 3-5 persons. For clustered research groups the times are adjusted proportionally.

#### **Thursday June 4**

- 8:30 – 9:30 Meeting with chair groups
- Parallel session I* **Wageningen University Plant Breeding<sup>1</sup>** (*meeting room Radix W.02*)  
EPS: Michele Morgante, Dorothea Bartels, Myron Zalucki;  
PE&RC: Scott Chapman
- Parallel session II* **Wageningen University Virology<sup>1</sup>** (*meeting room Radix M9*)  
EPS: Ulla Bonas, Natalia Dudareva; PE&RC: Brian Federici,  
Barbara Ekbom

<i>Parallel session III</i>	<b>Wageningen University Cell Biology</b> ( <i>meeting room Radix W.06</i> ) Karsten Niehaus, Peter van Tienderen, Sofie Goormachtig (tentative)
9:30 – 10:00	Break
10:00 – 11:00	Meeting with chair groups
<i>Parallel session I</i>	<b>Wageningen University Nematology</b> <sup>1</sup> ( <i>meeting room Radix W.02</i> ) EPS: Ulla Bonas, Dorothea Bartels; PE&RC: Volkmar Wolters, Scott Chapman
<i>Parallel session II</i>	<b>Wageningen University Entomology</b> <sup>1</sup> ( <i>meeting room Radix M9</i> ) EPS: Myron Zalucki, Natalia Dudareva; PE&RC: Brian Federici, Barbara Ekbom
<i>Parallel session III</i>	<b>Wageningen University Bioinformatics</b> ( <i>meeting room Radix W.06</i> ) Michele Morgante, Peter van Tienderen, Sofie Goormachtig (tentative)
11:00 – 11:15	Break
11:15 – 12:15	Meeting with chair groups
<i>Parallel session I</i>	<b>Wageningen University Genetics</b> <sup>1</sup> ( <i>meeting room Radix W.02</i> ) EPS: Michele Morgante, Dorothea Bartels; PE&RC: Scott Chapman, Brian Federici
<i>Parallel session II</i>	<b>Wageningen University Biophysics</b> ( <i>meeting room Radix M9</i> ) Karsten Niehaus, Ulla Bonas, Sofie Goormachtig
<i>Parallel session III</i>	Writing session ( <i>meeting room Radix W.06</i> ) Natalia Dudareva, Myron Zalucki, Peter van Tienderen
12:15 – 12:30	Break
12:30 – 13:00	Concluding session EPS and PE&RC committee members ( <i>meeting room Radix W.02</i> ): Scott Chapman, Brian Federici, Barbara Ekbom, Volkmar Wolters, Michele Morgante, Dorothea Bartels, Ulla Bonas, Natalia Dudareva, Myron Zalucki.
13:00 – 14:00	Lunch & excursion to greenhouse
14:00 – 15:00	Meeting with chair groups

*Parallel session I* **Wageningen University Plant Developmental Biology**  
(meeting room Radix W.02)  
Sofie Goormachtig, Karsten Niehaus, Natalia Dudareva

*Parallel session II* **Wageningen University Plant Physiology** (meeting room Radix M9)  
Dorothea Bartels, Michele Morgante, Myron Zalucki

*Parallel session III* Writing session (meeting room Radix W0.6)  
Ulla Bonas, Peter van Tienderen

15:00 – 15:30 Break

15:30 – 16:30 Meeting with chair groups

*Parallel session I* **Wageningen University Molecular Biology** (meeting room Radix W.02)  
Sofie Goormachtig, Dorothea Bartels, Myron Zalucki

*Parallel session II* **Wageningen University Phytopathology** (meeting room Radix M9)  
Ulla Bonas, Michele Morgante, Peter van Tienderen

*Parallel session III* Writing session (meeting room Radix W.06)  
Natalia Dudareva, Karsten Niehaus

16:30 – 17:00 Wrap up day 2 (meeting room W.02)

17:00 – 18:00 Writing session/Meeting with chair groups

*Parallel session I* **VU University Genetics** (meeting room Radix W0.6)  
Sofie Goormachtig, Karsten Niehaus, Myron Zalucki

*Parallel session II* Writing session (meeting room Radix W.02)  
Peter van Tienderen, Dorothea Bartels, Ulla Bonas, Karsten Niehaus, Michele Morgante

18:00 – 19:00 Wrap up day 2

<sup>1</sup> Combined meeting of graduate school EPS and graduate school PE&RC panel members involved in assessment of joint EPS/PE&RC groups. The panel composition reflects the participation in both schools: Genetics, Virology, Entomology and Nematology are assessed by a panel of 4 people: 2 from the EPS panel and 2 from the PE&RC panel. Plant Breeding is assessed by 3 members from the EPS panel and 1 from the PE&RC panel.

**Friday June 5**

- 8:30 – 9:00 Welcome day 4 with tea and coffee (*Meeting Room Radix W.03*)
- 9:00 – 9:30 Opportunity to ask questions to Board/Office EPS
- 9:30 – 12:00 Concluding & writing session
- 12:00 – 13:00 Lunch with EPS director and Board members
- 13:00 – 14:00 Presentation of preliminary findings by peer review panel (meeting room Radix W.01)

## **Annex 2 Curricula vitae of the Committee members**

### **Prof.dr. P.H. (Peter) van Tienderen (Chairman)**

Institute for Biodiversity and Ecosystem Dynamics (IBED)  
University of Amsterdam, Netherlands

Peter studied biology at the University of Utrecht with ecology & evolution and informatics as subject areas. He did his PhD work at the Netherlands Institute for Ecology and defended his thesis in 1989 at Utrecht University. He worked as postdoc at Duke University, before accepting a tenured position at the Agricultural University Wageningen, and later a dual research position at Wageningen/NIOO. In 2001 he became Professor of Experimental Systematics at the University of Amsterdam, and Director of the Institute for Biodiversity and Ecosystem Dynamics (IBED) from 2005-2014. He now is the vice-dean of the Faculty of Science.

He published over 60 papers in peer reviewed journals, recent work addressing the consequences of the introduction of genetically modified (GM) crops, and the origins of functional biodiversity. In 2010 he became the project leader for LifeWatch in the Netherlands, an ESFRI Roadmap initiative to establish a European research infrastructure for biodiversity and ecosystem research.

### **Prof.dr. D. (Dorothea) Bartels**

Institute of Molecular Physiology and Biotechnology of Plants,  
Rheinische Friedrich-Wilhelms-Universität Bonn, Germany

Dorothea is Professor in Molecular Physiology at the Institute of Molecular Physiology and Biotechnology of Plants, University of Bonn, Germany. She studied Biology and Chemistry at the University of Hannover, where she obtained her PhD in 1979. After having conducted research as a post and group leader, she became professor in botany at the University of Bonn in 1997 and afterwards in 2001 head of the department of Molecular Ecology and Plant Physiology at the VU Amsterdam. In the meantime she shortly served as vice rector of the University of Bonn, where she became deputy dean for research of the Faculty of Mathematics & Natural Sciences in 2005. From 2004 on to present she was editor in chief of the journal "Planta". She currently also holds a position as an editorial / advisory board member of several journals as The Plant Journal, Plant Cell & Environment and the Journal of Experimental Botany. She received several awards and honours.

Dorothea's research group is active in molecular physiology. The research group is concerned with the molecular basis of drought tolerance in higher plants, especially on the desiccation tolerant South African resurrection plant *Craterostigma plantagineum* that can adapt to extreme drought.

### **Prof.dr. J. (Jan) Traas**

Laboratoire de Reproduction et Développement Des Plantes,  
INRA, Lyon, France

Jan Traas is Professor of Plant Biology and Director of the Laboratory for Plant Reproduction and Development at the "Ecole Normale Supérieure" in Lyon.

He obtained his PhD in Plant Cell Biology at the University of Nijmegen. Since then, he has been working in the field of plant cell and developmental biology for over twenty-five years, addressing problems such as cell proliferation, cell signalling and meristem function. During his career he has worked successively in the Netherlands, the UK and France.

In 2005 he moved to Lyon (France), with the aim of starting an ambitious multidisciplinary research project on plant development. The campus in Lyon with departments for biology, computer science, physics and mathematics provided an ideal environment. He currently works on the role of the structural elements of plant cells (cell wall, cytoskeleton) in plant morphogenesis using multiple approaches including cell biology, genetics, biophysics and computational modelling.

Prof. Traas was not able to be present at the interviews; his place in the discussions with the research group leaders was taken over by Prof. Sofie Goormachtig.

### **Prof.dr. U. (Ulla) Bonas**

Institute for Biology, Department of Genetics,  
Martin Luther University Halle-Wittenberg, Halle, Germany

Ulla is Professor of Genetics at the Martin Luther University Halle-Wittenberg in Halle.

She studied Biological Sciences at the University of Cologne and obtained her PhD at the Max-Planck-Institut für Züchtungsforschung in Cologne in 1984, where she followed her career as a postdoc. Since then she has conducted research for a few years at the University of Berkeley, California, until she returned to Germany in 1988 to become head of an independent research group at the Institut für Genbiologische Forschung in Berlin. In 1993 she moved her group to the CNRS Institut des Sciences Végétales in Gif-sur-Yvette (France) for a period of 5 years. Since 1998 she is Full Professor of Genetics at the Martin Luther University Halle-Wittenberg. Her research focus is the genetic and molecular analyses of resistance and pathogenicity in the *Xanthomonas* / plant interaction. She received several awards and honours.

From 2005 - 2014 she was co-editor of the journal "The Plant Cell" and since 2013 she is member of the International Scientific Advisory Board of the SPS LabEx (France).

### **Prof.dr. N. (Natalia) Dudareva**

Department of Biochemistry  
Purdue University, USA

Natalia is a distinguished professor in the department of Biochemistry at Purdue University in West Lafayette, Indiana.

She studied Biology and Biochemistry at the Novosibirsk State University, Russia and obtained a Ph.D. in Biochemistry and Molecular Biology at the Institute of Biochemistry in Kiev, Ukraine (1982), as well as a Ph.D. in Plant Molecular Biology at the University of Louis Pasteur in Strasbourg, France (1995). Natalia conducted postdoctoral research at several research institutes/universities in Russia, France, Canada and USA. In 1997 she pursued her career starting as

assistant professor at the Purdue University. In 2005 she obtained a position as senior professor at this university and in 2010 as a distinguished professor. Her research focuses on the identification of biochemical and molecular mechanisms controlling the formation of an array of primary and secondary metabolites in plants, with emphasis on carbon flux distribution through two major metabolic networks (phenylpropanoid and terpenoid) using flowers as a model system. Natalia is elected fellow to the American Association for the Advancement of Science and has been acknowledged with a number of awards from Purdue University.

**Prof.dr. Sophie Goormachtig**

Department of Plant Biotechnology and Genetics  
Ghent University, Belgium

Sofie Goormachtig is associate professor at the Department of Plant Biotechnology and Genetics (Ghent University, Belgium) and principal investigator at the PSB department of VIB, Belgium. She is responsible for the education programs on Plant Biotechnology of the Faculty of Science at UGent. Her research interest focuses on rhizosphere interactions of plants. Emphasis has been lying on the symbiosis between legumes and rhizobia bacteria resulting in the formation of new root organs, the nodules in which the rhizobia reside and fix atmospheric nitrogen for the plant. During her PhD and early post-doc career, she was studying the interaction between the tropical legume *Sesbania rostrata* and the bacterium *Azorhizobium caulinodans* after which she switched to the model legume *Medicago truncatula* investigating nodule organogenesis, nodule senescence and autoregulation of nodulation. She currently investigates the signaling cascades caused by the rhizosphere signals, strigolactones.

**Prof.dr. M. (Michele) Morgante**

Genetics  
University of Udine, and Istituto di Genomica Applicata, Italy

Michele Morgante is currently the Scientific Director of Istituto di Genomica Applicata in Udine and is professor of Genetics at the University of Udine. His research group has been instrumental in establishing a number of genetic technology platforms that are now being widely deployed in plant genomic research. His research programme is currently focusing on genome analysis in plants, including genome sequencing and resequencing and genome evolution studies, sequence diversity analysis and epigenomics. He has contributed to the sequencing of the grapevine, peach and citrus genome and is currently sequencing the olive tree.

He is a member of Accademia Nazionale dei Lincei (National Academy of Sciences) and has received the 2005 Medal for Physical and Natural Sciences of the Accademia Nazionale delle Scienze detta dei XL. He is section editor of BMC Genetics and associate editor of BMC Plant Biology. In 2011 he has been awarded by the European Research Council an Advanced Grant for the analysis of plant pan genomes

**Prof.dr. K. (Karsten) Niehaus**

Proteome and Metabolome Research

Bielefeld University, Germany

Karsten is Professor for "Proteome and Metabolome Research" at the Bielefeld University.

He studied Biology at in Cologne and Bielefeld and obtained his PhD at the University of Cologne in 1991. After having conducted research as a post doc fellow for several years he defended successfully his habilitation thesis in Genetics and Cell Biology and became professor Professor at the Bielefeld University in 2005. In 2008 he also became CEO of the "Centre for Aesthetics" at this university and deputy spokesman of the Bielefeld CLIB Graduate Cluster "Industrial Biotechnology".

His field of research interests comprises a.o. proteomics, metabolomics, systemsbiology, cell culture techniques and molecular basics of microbe-host interactions.

### **Prof.dr. M.P. (Myron) Zalucki**

Entomology

University of Queensland, Australia

Myron is Professor of Entomology at the School of Biological Sciences at The University of Queensland.

He obtained his BSc (hon.) from the Australian National University in Canberra and a PhD from Griffith University in Brisbane in 1982. He was instrumental in setting up one of the first Cooperative Research Centers in Australia, the CRC for Tropical Pest Management, and is Australia's representative on the International Congress of Entomology Council. He has led large Australian Government funded projects on Diamondback moth, a key pest of horticulture, in China, North Korea and the South Pacific. With students and colleagues Myron has published over 300 referred papers and chapters in books and Proceedings and received several honours and awards.

He is an insect ecologist with a long history of working on both pure and applied issues. His basic work has been on the chemical ecology of oviposition and early instar foraging behaviour in various insect-plant systems, particularly monarch butterflies, and on the ecology and management of *Helicoverpa* spp., the major pest of field crops in Australia and elsewhere.

### **Dr. Frans van Steijn**

Secretary

Frans van Steijn (1949, Amsterdam) studied physics (BSc) at the Vrije Universiteit Amsterdam and philosophy (MA) at the University of Amsterdam. He received a PhD at the UvA on a thesis "The Universities in Society; a Study of part-time professors in the Netherlands"(1990).

Since 1996 Frans was senior advisor at Vereniging van Universiteiten (VSNU) the Association of Universities in the Netherlands. He was Secretary to the Board and secretary to the Rector's Conference. His expert fields are quality assurance, research policy and research integrity.

In September 2014 Frans van Steijn retired from VSNU and established an independent office for consultancy and project management, specialized in quality assurance in universities and research organisations.