

EVALUATION REPORT ON THE RESEARCH UNIT:

Biochemistry and Plant Molecular
Physiology (BPMP)

UNDER THE SUPERVISION OF THE FOLLOWING INSTITUTIONS AND RESEARCH BODIES:

Centre national de la recherche
scientifique – CNRS

Institut national de recherche pour
l'agriculture, l'alimentation et
l'environnement – INRAE

Université de Montpellier - Montpellier
SupAgro

EVALUATION CAMPAIGN 2019-2020
GROUP A



In the name of Hcéres¹:

Nelly Dupin, Acting
president

In the name of the experts committee²:

Christine Foyer, Chairwoman of the
committee

Under the decree No.2014-1365 dated 14 November 2014,

¹ The president of Hcéres "countersigns the evaluation reports set up by the experts committees and signed by their chairman." (Article 8, paragraph 5);

² The evaluation reports "are signed by the chairman of the experts committee". (Article 11, paragraph 2).

This report is the sole result of the unit's evaluation by the expert committee, the composition of which is specified below. The assessments contained herein are the expression of an independent and collegial reviewing by the committee.

Tables in this report were filled with data submitted by the supervising body on behalf the unit.

UNIT PRESENTATION

Unit name:	Biochemistry and Plant Molecular Physiology
Unit acronym:	BPMP
Current label and N°:	UMR 386 INRA, UMR 5004 CNRS
ID RNSR:	195817959H
Application type:	Renewal
Head of the unit (2019-2020):	Mr Alain Gojon
Project leader (2021-2025):	Mr Christophe Maurel
Number of teams and/or themes:	9

EXPERTS COMMITTEE MEMBERS

Chair:	Ms Christine Foyer, University of Birmingham, United Kingdom
Experts:	Ms Anna Amtmann, University of Glasgow, United Kingdom Mr Peter Doerner, University of Edinburgh, United Kingdom Ms Antonella Furini, University of Verona, Italy Ms Karine Gallardo-Guerrero, Inrae, Dijon Mr Michael Hodges, CNRS, Gif sur Yvette (representative of CoNRS) Mr Johann Joets, Inra, Gif-sur-Yvette (supporting personnel) Mr Enrico Martinoia, University Zurich, Switzerland Mr Benoît St-Pierre, Université François-Rabelais, Tours (representative of CNU) Mr Andreas Weber, Heinrich-Heine-Universität, Germany

HCÉRES REPRESENTATIVE

Mr Steven Ball

REPRESENTATIVES OF SUPERVISING BODIES

Mr François Pierrot, Université de Montpellier

Ms Catherine Rechenmann, CNRS

Mr Norbert Rolland, INRAE

Ms Marie Stéphanie Tixier, Montpellier SupAgro

INTRODUCTION

HISTORY AND GEOGRAPHICAL LOCATION OF THE UNIT

The UMR "Biochimie et Physiologie Moléculaire des Plantes" (BPMP) is located on the INRA/Montpellier SupAgro Campus ("La Gaillarde"). With almost 150 team members organised into 11 research teams, this is a large unit. Originating from the "Laboratoire de Biochimie et Physiologie Végétales" (BPV) BPMP is now associated with four institutions and directed by Dr. Alain Gojon.

BPMP has several technological platforms and common facilities that are located in a single building (the "Institut de Biologie Intégrative des Plantes"). BPMP also has another minor location in the Faculté des Sciences (Campus Triolet, University of Montpellier) for teaching activities. The BPMP has long standing collaborations with the UMR LEPSE ("Laboratoire d'Etude des Plantes sous Stress Environnementaux").

BPMP is associated to the LabEx AGRO which in Montpellier drives research on mostly tropical crops from genes to the field.

The focus of the unit is water and mineral nutrition, and the responses of plants to abiotic stresses.

Management team

BPMP is managed by a direction team. Alain Gojon was the former Director, Christophe Maurel, the former Deputy-Director is now the proposed new head.

HCÉRES NOMENCLATURE

SVE1, SVE2

THEMATICS

The general theme of the unit focuses on plant water and mineral nutrition, as well as responses to environmental abiotic stress factors. The activities of the unit focus on basic research in these areas, but with a significant emphasis on higher education. All the research teams study aspects of the functional and/or developmental processes determining plant water and mineral status, particularly membrane transport processes required for the acquisition of water and minerals roots. The second main scientific theme of BPMP research concerns the stress perception and signaling mechanisms that allow adaptive responses. This topic encompasses genome-wide transcription reprogramming and large-scale proteome modifications associated with changes in growth and development. In addition, the LabEx AGRO has undertaken research related to the agricultural development in Southern countries, as well as other international activities.

UNIT WORKFORCE

Biochemistry and Plant Molecular Physiology (BPMP)		
Active staff	Number 06/30/2019	Number 01/01/2021
Full professors and similar positions	3	3
Assistant professors and similar positions	4	4
Full time research directors (Directeurs de recherche) and similar positions	10	11
Full time research associates (Chargés de recherche) and similar positions	27	26

Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.")	0	0
High school teachers	0	0
Supporting personnel (ITAs, BIATSSs and others, notably of EPICs)	37	36
Permanent staff	81	80
Non-permanent professors and associate professors, including emeritus		
Non-permanent full time scientists, including emeritus, post-docs (except PhD students)	5	
PhD Students	19	
Non-permanent supporting personnel	7	
Non-permanent staff	31	
Total	112	80

GLOBAL ASSESSMENT OF THE UNIT

This excellent unit undertakes fundamental research into plant nutrition and responses to environmental stresses. It has achieved commendable success in terms of the quality of publications published in well-respected international journals, the organisation of conferences and the level of funding achieved, particularly in terms of European grants. While the unit does not have a large number of interactions with industry, there have been a good number of activities that allow dissemination of important findings and other information to the general public and society at large. The Unit is composed of a vibrant interactive community of researchers, with outstanding leadership and excellent management and communication throughout the different levels of the organisation. The researchers are highly supportive of the Unit as a whole and its activities, and there is a good sense of wellbeing and pride in joint research endeavour throughout. There is a good number of PhD students, most of whom archive first author publications during or soon after the completion of their studies. The 5-year plan was built through consultation and input from the researchers, and hence has a firm foundation of engagement from all the staff. The research plan is generally, novel, timely and innovative and well placed at the cutting edge of scientific endeavour in this field globally.

DETAILED ASSESSEMENT OF THE UNIT

UNIT'S RESPONSE TO PREVIOUS RECOMMENDATIONS

The unit's response to previous recommendations was poorly explained.

CRITERION 1: QUALITY OF SCIENTIFIC OUTPUTS AND ACTIVITIES

A – Scientific outputs and activities, academic collaborations, reputation and appeal

From 01/01/2014 to 06/30/2019	BPMP
Articles	
Scientific articles (total number)	162
Scientific articles with first and/or last authorship	87
Review articles (total number)	64
Other articles (professional journals, etc.) (total number)	18
Commentaries on judgements	0
Clinical articles	0
Books	
Monographs, critical editions, translations (total number)	2
Management and coordination of scientific books / Scientific book edition	2
Management and coordination of scientific books / Scientific book edition in English or another foreign language	2
Book chapters (total number)	16
Book chapters in English or another foreign language	16
Edited theses	0
Production in conferences / congresses and research seminars	
Meeting abstracts	0
Articles published in conference proceedings / congress	1
Other products presented in symposia / congress and research seminars	339
Electronic tools and products	
Softwares	6
Databases	
Tools for decision making	
Cohorts	

Instruments and methodology	
Prototypes	5
Platforms and observatories	3
Other products	
Theorised artistic creations, staging, movies	1
Editorial activities	
Participation in editorial committees (books, collections, etc.)	
Collection and series management	0
Reviewing activities	
Reviewing of articles	
Grant evaluation (public or charities)	
Reviewing of research institutes	11
Participation in institutional committees and juries (CNRS, Inserm, etc.)	
Academic research grants	
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants coordination	9
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – partnership	2
Other European grants - coordination	7
Other European grants - partnership	0
National public grants (ANR, PHRC, FUI, INCA, etc.) - coordination	35
National public grants (ANR, PHRC, FUI, INCA, etc.) - partnership	8
Local grants (collectivités territoriales) - coordination	2
Local grants (collectivités territoriales) - partnership	0
PIA (labex, equipex etc.) grants - coordination	17
PIA (labex, equipex etc.) grants - partnership	6
Grants from foundations and charities (ARC, FMR, FRM, etc.) - coordination	0
Grants from foundations and charities (ARC, FMR, FRM, etc.) - partnership	0
Visiting senior scientists and post-docs	
Post-docs (total number)	37
Foreign post-docs	21
Visiting scientists (total number)	67
Foreign visiting scientists	62
Scientific recognition	
Prizes and/or distinctions	3
IUF members	0

Chair of learned and scientific societies	0
Organisations of meetings and symposia (out of France)	1
Invitations to meetings and symposia (out of France)	44
Members' long-term visits abroad	1

Strengths

The unit has a high number of researchers who are recognised internationally for their work and the advances they have made in plant science. They are in a number of cases recognised as world-leading. The researchers have always published as corresponding authors in some of the best international journals in the field including top journals such as *Cell*, *Plant Cell*, *PNAS* or *top Nature Journals (Nature communications and Nature Plants)*. They undertake fundamental research that spans from molecular biochemistry to cell functions and beyond to whole organ and plant biology. The reputation and standing of the unit is globally excellent and this enables excellent international collaborations and a large number of visiting workers. The researchers have been very successful in gaining national and international grants particularly from the European union including the ERC. They have also been very active as participants in the foundation and participation of the AGRO LabEx, an important local initiative funding research on crops that also include the basic science aspects developed by BPMP. The unit has expanded the number of teams to incorporate some excellent young researchers who have expanded the portfolio of interdisciplinary research. There has been a continuous effort to organize in Montpellier prestigious international conferences in their field of research.

Weaknesses

The field is very competitive and the search for sufficient funding will continue to be challenging. The researchers have access to high level research platforms but the field is moving rapidly and there is a need for a centralisation of data storage and mechanisms for data access both internally and externally. Movement into an increasingly digital age where the use of artificial intelligence and similar technologies will increase exponentially. The unit has to be poised to embrace these new technologies. Nevertheless, the unit must also be careful not to dilute the focus of its research.

Assessment of scientific outputs, reputation and appeal of the unit

The unit has an excellent record of scientific publications in a range of international journals. The reputation of the unit is excellent. It has organised several international conferences and has a strong network of international collaborations. The funding record is excellent with some outstanding aspects such as several ERC grants.

B – Interactions with the non-academic world, impacts on economy, society, culture or health

From 01/01/2014 to 06/30/2019	BPMP
Socio-economic interactions / patents	
Invention disclosures	0
Filed patents	2
Accepted patents	0
Licensed patents	0

Socio-economic interactions	
Industrial and R&D contracts	8
Cifre fellowships	0
Creation of labs with private-public partnerships	0
Networks and mixed units	0
Start-up	0
Clinical trials	0
Expertise	
Consulting	
Participation in expert committees (ANSES etc.)	4
Legal expertise	0
Expert and standardization reports	0
Public outreach	
Radio broadcasts, TV shows, magazines and newspapers	9
Journal articles, interviews, book edition, videos, other popularization outputs, debates on science and society, etc.	

Strengths

The unit has continued to engage with the socio-economic environment, with 2 patents filed and 8 industrial contracts awarded, which resulted in almost 3-fold increased funding from these sources. Some efforts were made to engage with the public (>9 items of engagement such as articles in popular science journals or direct engagement with the public).

Weaknesses

Overall, the engagement with the socio-economic environment is weak, considering both the size of the unit and the significance of the key focus areas of the research. Engagement with industry resulting in funded work, has been restricted to three teams out of 9, and overall the foundations (e.g., not a single invention disclosure!) must be strengthened for successful industry engagement. There are huge opportunities here, due to the core subject matter of the unit.

Communication of the excellence of the science achievements to the non-academic world is crucial to the wider perception of the success of the unit. To ignore this key aspect is a weakness that should be rapidly remedied.

Assessment of the interactions of the unit with the non-academic world

This unit undertakes excellent basic research but it has relatively few interactions with the non-academic world. The interactions of the unit with society are good but with the following comments. There is little evidence of engagement with industry and too few opportunities to interact with the public and society are realised.

C – Involvement in training through research

From 01/01/2014 to 06/30/2019	BPMP
Educational outputs	
Books	0
E-learning, MOOCs, multimedia courses, etc.	1
Scientific productions (articles, books, etc.) from theses	
Scientific productions (articles, books, etc.) from theses	92
Mean number of publications per student	2,08
Training	
Habilitated (HDR) scientists	31
HDR obtained during the period	11
PhD students (total number)	46
PhD students benefiting from a specific doctoral contract	46
Defended PhDs	25
Mean PhD duration	37,5
Internships (M1, M2)	96
People in charge for a mention or a master's degree course (total number)	10
People in charge for a mention or a master's degree course with international certification (Erasmus mundus)	0

Strengths

The BPMB unit provides an excellent environment for training through research. Considering the number of research programs and technical platform in the teams and the span of experimental approaches covered, young scientists have access to a large panel of research training opportunities.

BPMP staff scientists (around 44 permanent staff scientist, including 31 scientists habilitated for research training) were strongly involved in supervising PhD thesis and internships for students at Master level (96) as well as undergraduate (>150). 25 PhD students have defended their thesis between 2014 and 2019, and 19 students are currently preparing their PhDs. The duration of the PhDs (mean duration 37,5 months) is in agreement with the French doctoral school standard (36 months). 70% of PhD students have at least one original publication as a first author. The mean number of publications per PhD students (1,8) is satisfactory and the quality of the journals is high (*Nat. Plant*, *PNAS*, *Mol. Plant*, *Plant Cell*, *eLIFE*, *New Phytol*, *Sci. Signal*, *Plant Biotechnol J.*, *Plant Physiol*, *Plant J.*, *Plos Genet*, *Plant Cell Environ*, *Mol Cell Proteomics*, *Sci Rep*, *Plant Cell Physiol*, *J. Biol. Chem.*, *Front Plant Sci*). Only one third of PhD students were recruited from local Master programs showing attractiveness of BPMP toward foreign students (50%). Many PhD students had or have opportunities to gain teaching experience, for instance through doctoral contract with teaching duty (16), which should be profitable in their future carrier. The ratio of researcher and professors (and associate professors) habilitated to supervise PhD students is very high (70%). Several new researcher/associate professor (11) have been habilitated during the term showing a strong commitment to support HDR access.

The unit is strongly involved in the diffusion of knowledge to students. Nine professors/associate professors and researchers are in charge for a master's degree course and one professor in charge of a mention of a master.

A noticeable involvement in high-level technical training is provided through the MISTRAL international summer school (Montpellier international school of ion and water transport in plants) which is fully supported by BPMP. A total of 43 attendees (68% from abroad), including PhD students, post-docs and senior researchers, have been

trained during the evaluation period both at the theoretical level and practical aspects of ion and water transports in plants during a full two weeks training.

Weaknesses

The ratio of PhDs defended per habilitated scientist is not very high, less than one per 5-year period. 8 PhD students did not publish an original scientific publication as a first author, although most of them coauthored a publication and have obtained post-doc and non-tenure teaching position.

Assessment of the involvement in training through research

The involvement of the unit in training through research is very good with excellent aspects.

CRITERION 2: UNIT ORGANISATION AND LIFE

From 01/01/2014 to 06/30/2019	
Management, activity and organisation in the unit	
Is there a policy validated by one or more tutelage?	Yes
Number of meetings of the council overseeing the unit's function? (from 01/01/2014 to 06/30/2019)	23
Number of internal seminars to the unit and team? (from 01/01/2014 to 06/30/2019)	
Number of specific meetings between the research staff and the Board (unit and team)? (from 01/01/2014 to 06/30/2019)	21
Is there a convivial place where the unit and each team can get together?	Yes
Is there a job description for each staff member (technicians, engineers, admins.) in the unit?	Yes
Is there a support plan for the unit's call for projects?	No
Are there other means of communication (newsletters, etc.)?	Yes
Does the unit grant money for publications?	No
Does the unit grant money for international publications? (translation, copy-editing, etc.)	No
Is there an incentive policy "Open Sciences" type? (HAL)	Yes
Parity	
Number of women in the unit	39
Number of men in the unit	41
Number of women among university lecturer-researchers and research workers in the unit	18
Number of men among university lecturer-researchers and research workers in the unit	26
Number of women within the Board (steering-committee, subdirector in the unit, team manager, etc.)	6
Number of men within the Board (steering-committee, subdirector in the unit, team manager, etc.)	8
Scientific integrity	

Does the unit offer lab-notebooks for the staff?	Yes
Does the unit have a policy regarding scientific integrity?	Yes
Health and safety	
Does the unit have a training policy regarding health and safety?	Yes
Does the unit have an awareness policy regarding psycho-social factors?	No
Is there a health and safety record?	Yes
Is there a record updated each year?	Yes
Number of safety assistants?	5
Sustainable development and environmental impacts	
Is there a chart regarding sustainable development or a section dedicated to its stacks in the internal rules?	No
Intellectual property and business intelligence	
Is the unit ranked ZRR? (area of restrictive regime)	No
Does the unit have a policy regarding data protection?	Yes
Is there an internal or external point of contact in charge of information-system safety?	Yes
Is there an SSL policy? (Information system safety)	Yes

Strengths

The unit has a very good organisation with a strong management, supported by appropriate administration. The unit is composed of nine research teams. The unit is well organised, with a joint vision for the future and has a strong interactive life with excellent management and engagement at all levels. Very good succession planning is in place to ensure that there is promotion of younger researchers into more responsible roles and that there will be no breaks in unit organisation. There is excellent communication from more senior to junior staff. Regular networking meetings of the teams and the unit as a whole are held to ensure that research strategy is discussed and agreed by the team of scientists. The unit has a good social life, with a range of social activities that act as good team-building events. All staff recognise the value of their science and are fully engaged in supporting the activities of the unit. The technical staff is very positive about its role in the unit and fully support its participation in the technology platforms.

Weaknesses

The technical staff has a low morale in terms of their prospects for promotion. The non-permanent staff has less engagement with unit organisation than the permanent staff. While the more junior teams are fully supported, they are financially more vulnerable than the better established teams. The permanent staff is the visible face of unit activities to the outside world. They have little appreciation of their vital role in promoting the unit as a whole, particularly through interactions with the non-academic world. The different organisations that support the researchers in the unit appear to have little discussion together to agree common goals and give consolidated advice to the unit. The teams and administration are highly professional in their conduct but personal issues may occasionally disrupt the smooth flow of unit organisation. The teams could pay more attention to completing all the required paperwork accurately for reviews such as the present one.

Assessment of the unit's life and organisation

The unit has excellent management with outstanding leadership. The unit has a vibrant and interactive community life with excellent interactions at all levels. The unit has a convivial climate and has a dynamic future with the promotion of novel ideas and younger scientists.

CRITERION 3: FIVE-YEAR PROJECT AND STRATEGY

	Objectives	Expected results (figures when possible)
Criterion 1: RESEARCH PRODUCTS AND ACTIVITIES		
Scientific outputs and activities, academic reputation and appeal		
Articles Books Production in conferences / congresses and research seminars Electronic tools and products Instruments and methodology Other products Editorial activities Reviewing activities Academic research grants Visiting senior scientists and post-docs Scientific recognition	1) To strengthen the exploratory potential of BPMP in fundamental plant biology 2) To articulate research work on model and cultivated plant species 3) To promote interdisciplinary research and method developments 4) To consolidate BPMP platforms and enhance their visibility	1) Publish >200 articles with mean impact factor >6.0 2) Supervision by BPMP scientists of 2-3 flagship or transversal programmes 3) Participation in interdisciplinary programs at regional, national and international levels 4) Upgraded root phenotyping platform
Interactions with the non-academic world, impacts on economy, society, culture or health		
Socio-economic interactions / patents Socio-economic interactions Expertise Public outreach	1) Improve partnership with private companies 2) Explain proposed solutions to climate change	1) LabCom joint project in operation 2a) Annual participation in the science festival 2b) Participation of PhD students to three minute thesis contest
Involvement in training through research		
Educational outputs Scientific productions (articles, books, etc.) from theses Training	1) Provide training in plant water and mineral nutrition at national and international levels	1a) Training of >30 post-docs, >40 graduate students and >90 Master students 1b) All graduate students are first author of a peer-reviewed article 1c) Sessions of MISTRAL Summer School in 2022 and 2024
Criterion 2: ORGANISATION AND LIFE OF THE UNIT		
Management, activity and organisation in the unit Parity Scientific integrity Health and safety Sustainable development and environmental impacts Intellectual property and business intelligence	1) Secure human resources on scientific platforms and small sized teams 2) Improve traceability of genetic resources 3) Reduce energy consumption	1) Recruited personels on PHIV and Stable isotope platforms 2) Interoperatable databases for molecular and genetic resources 3) Full implementation of energy saving plan

Strengths

The unit is built on a strong science foundation to continue to focus on its core area of expertise, the mineral and water nutrition of plants under abiotic constraints. A very focused and well-thought out approach was taken to re-organise the unit and to prepare for the change in overall leadership as well as the emergence of new or regenerated teams. The 5 year strategy is well formulated. Now is a time of great opportunities and change in plant biology, with all crops coming in reach of becoming the 'models'; the major impediment remains the

efficiency/effort in transformation. Extraordinary opportunities are arising as well for the unit with its subject focus to address the vital issue of food security in times of rapid climate change. The unit has laid some groundwork to seize the opportunities in these areas. The future research directions build on existing areas of expertise and knowledge, and do not go beyond those. Specifically by focusing on the excellent main scientific objectives identified (Root functions, Environmental stress signalling, Genome expression reprogramming, and Integrated responses of plants to complex environmental stresses) the unit has found integrative themes to project its strengths. Planned studies will incorporate a wider range of plant species as well as Arabidopsis. This should open new routes to translational biology.

Weaknesses

There are a number of weaknesses inherent to the present plan that will prevent the maximum potential scientific advances and benefits to the tax-paying public. The research strategy lacks novelty and innovation. There is a limited exploration of new topics or disciplines. First, while the strategic plan acknowledges the potential of crops, no clear set of criteria are developed that will allow a rational progression from Arabidopsis to crops; the intention is there, but there is the danger in staying in the comfortable Arabidopsis system for too long. This would largely inhibit the development of much more extensive interactions with public bodies and commercial entities, which will be absolutely critical for BPMP to attract increased funding and immaterial support to keep its scientific standing.

Second, there are opportunities for closer interaction with other entities, both in the region (e.g., LGDP on high ambient temperatures, KaliPHruit, MeMo) or globally. Engagement with the socio-economic environment, if to be successful, should be increasingly seen as a global endeavour. There are many opportunities, at least for engagement with commercial entities, at this level, especially with BPMP's reputation.

Third, crops are grown as populations in soil. Relevant studies of their responses to single or multiple stresses should be designed to begin to gravitate towards these real conditions, and not restrict themselves to synthetic conditions. These considerations should be increasingly taken into account, otherwise there is the danger of losing relevance over the next 5-year period.

Assessment of the unit's scientific strategy and projects

The five-year project is excellent exploiting genetic variation and spanning scales from molecules and cellular processes to whole plants.

RECOMMENDATIONS TO THE UNIT

A – Recommendations on scientific production and activities (criterion 1)

The panel recognizes and endorses the importance of the fundamental nature of the research undertaken in the unit. We recognize the efforts of unit researchers to publish in the major international science journals in the field. The panel recommends that the unit continues to consolidate its research efforts by publications in international journals. The panel recommends that wherever possible (and this will be in virtually all cases), the release of new publications should be accompanied by a media statement, Youtube videos and social media releases such as Twitter news, etc.

The panel recognizes the efforts of unit researchers to organize international conferences and recommends that they take every opportunity to organize similar events in the future.

The panel encourages senior management to put forward researchers for the prestigious awards and prizes presented by International Societies and likewise, for important National Honors, Awards and Prizes presented by governmental and non-governmental organizations in recognition of service to science achievement.

The panel recognizes the efforts of researchers to present their work at international meetings and encourages further activities of this type as well as participation in networking events.

The Panel encourages researchers to apply for prestigious and influential positions in International Societies (president, treasurer, etc.) and Senior Editorships (Editor in Chief) of international journals to maintain and increase the international profile of the unit. The Panel encourages researchers to apply for positions on international panels such as EU and FWO to maintain and increase the international profile of the unit.

The panel recognizes the efforts of unit researchers to obtain national and international funding and recommends that this effort be intensified wherever possible. Crucially, the panel encourages unit researchers to organize and lead international proposals such as EU and COST wherever possible.

The panel encourages unit management to place greater emphasis on interactions with the non-academic world. This is essential to enhance the national and international reputation of the unit. Moreover, this will ensure that unit researchers are better prepared to address this issue in future evaluations.

The unit staff clearly recognized the wider implications of their fundamental research findings for society but the panel noted a reluctance to disseminate this information to the non-academic world. The panel therefore recommends that unit researchers are more intensively trained in presentation of basic research news to society. This would appear to be particularly important with regards to the local academic and non-academic communities, where researchers voiced concerns that their efforts were not fully appreciated. The panel considers that it is the responsibility of all researchers to promote the importance and implications of their efforts to the local academic and non-academic communities, as well as society at large.

The panel finds that the non-permanent staff is an underutilized resource for interactions with the non-academic world. The panel is impressed by the enthusiasm of the post-docs and PhD students for these activities. The panel therefore recommends that wherever possible, the release of new publications should be accompanied by media promotion activities by the non-permanent staff, who should along with the technical staff by encourage to produce short articles and videos on techniques etc., for dissemination to the wider public.

Some members of the unit staff have strong interactions with schools and local non-academic societies. Such activities could be encouraged. The panel suggests the unit institutes a number of small awards or prizes in recognition of success in such activities.

The panel recognizes that developing relationships with industry requires intensive efforts on both sides. Since innovation occurs at the interface between academia and industry, the panel stresses the importance of such interactions and recommends that the unit takes every opportunity to embrace networking with potential industrial partners, and seeks to develop a larger number of short and long term collaborations with local, national and international industries and related organizations. The Unit needs to be pro-active; private enterprises require as much 'enlightenment' by the unit as the general public, albeit at the different level.

With respect to training through research, one recommendation is to increase the number of PhD students, both from international and national origins. Considering the large number of Master internship, the unit has a strong potential to further attract PhD students. In addition, commitment to secure publication of PhD student as first author should be strengthened.

B – Recommendations on the unit's organisation and life (criterion 2)

The unit might profit from having the participation of at least one member of non-permanent staff in the discussions/meetings concerning unit organisation. This would aid communication flow to all levels of unit organisation. While the permanent staff is the visible face of unit activities to the outside world, the non-permanent staff are an underutilised resource with regard to such activities. They are very enthusiastic and could champion activities with the non-academic world. Paying more attention to the maintenance of the buildings would increase the morale of the teams. It appears that even some 'minor' steps would make a big difference. French language classes could be organised to aid the integration of new staff without French language skills.

C – Recommendations on scientific strategy and projects (criterion 3)

The proposed scientific strategy for the unit is inclusive and lays out ambitions and themes for all existing teams. The level of detail and ambition of objectives for the individual teams is disparate, and therefore the scale of ambition is varied. To remain or reach world class and leading levels of output it is recommended to identify several transversal themes and refine the individual teams' plans to orient themselves on these more ambitious objectives. These strategic objectives are suggested to delineate more than a number of desirable goals (e.g., interaction of roots with the soil microbiome, or the study of multiple cotemporaneous stressors) but also formulate a strategy *how* to achieve such objectives.

The unit recognizes the opportunities provided by the remarkable advances made in biology over the last decade, which now enable, in principle, us now to overcome the restrictive thinking of 'model' systems. The unit and the Panel recognizes that its resources provide limitations in this respect (e.g., physical infrastructure might not work for certain crops, or the expertise might be missing). The Panel advises for the Unit's leadership to develop, in consultation, an explicit strategy based on clearly spelled-out criteria when the transition from a 'model' (e.g., Arabidopsis) to a crop should be pursued. Due to the convenience of the Arabidopsis system, the optimal timepoint for such a transition could be missed, leading to a loss in relevance. Furthermore, such a strategy will be a helpful confidence-building tool in interactions with the private sector which demonstrates to potential or prospective commercial partners a genuine interest to contribute knowledge and benefit to society.

The Panel recognizes the integrative potential (for synergies between teams or with external players) of the four listed main scientific objectives. We recommend several measures to enhance the likelihood that these can be achieved. The Panel suggests that the leadership makes efforts to attract a team working on soils, the soil microbiome or closely-related themes. To paraphrase Theodosius Dobzhansky: no work with roots makes sense without soil. Incidentally, such a team would also provide a bridge to the local/regional agronomic sector, by providing opportunities for collaborations. The panel suggests to identify a sharper focus for the teams working on environmental stress signaling and integrate these more tightly with the work on GRN and epigenetic mechanisms. This work is likely to generate TBytes to PBytes of data; the risk of data loss is immense and would come at a huge cost to the public, if an explicit strategy for data maintenance, accessibility and sharing is not developed and rigorously implemented. The Panel agrees that Systems Biology has a great potential and is increasingly used, but we suggest that it would help all teams if the unit's leadership would more explicitly spell-out how systems biology can be harnessed as a tool for modelling and predictive biology, also across teams.

The Panel recognizes the value of the unit's aim to focus on integrated responses of plants to complex and multiple environmental stresses. This will also require, as recognized, pushing technical capabilities beyond current boundaries. Many such approaches will be costly, and the aim to develop a multitude of them in house is too ambitious, and financially unrealistic. We recommend the Unit's leadership to identify key technologies to have in house (the criterion should be whether the unit can establish and maintain a world-class capacity) and aim to collaborate with other units or sites in this. We recommend to avoid wanting to have everything in house, or even duplicate such efforts within individual teams. In all of these platform technologies we suggest to pay particular attention to the proximity of the experimental system with the natural environment (e.g., PhenoRoot, which is not based on soil).

The Panel is concerned that the unit is missing out on opportunities for relevance and funding by insufficient development of working relationships with the private sector, but it is encouraged by the beginnings of engagement with the public. The Panel recommends the unit's leadership to develop and implement a detailed strategy to overcome these weaknesses. The Panel recommends the unit to be more ambitious in these activities, recognizing that its socio-economic environment is the whole globe. We strongly recommend to also look beyond Frayssinet as potential partner.

RESPONSES TO SPECIFIC QUERIES OF SUPERVISING BODIES

The INSB of the CNRS asked the committee to evaluate the impact of the creation of new teams (whether by internal processes or by welcoming new scientists) on the structuration and organization of the unit including team management, creation/renewal policy and evaluation criteria/time frame. The organization of BPMP is made up of individual teams (mainly of significant size) that are allowed a strong scientific and financial autonomy. This is believed to favor international visibility and efficiency. Common themes and joint projects are encouraged but not mandatory since this could limit team freedom. During the last period, BPMP attracted two new teams and five new internal teams emerged. Due to the closure of 2 teams, BPMP will be made up of 9 teams at the beginning of the new period. The capacity of BPMP to attract high-level scientists and to create new teams to develop new aspects of the unit's major themes was seen as a positive indicator of the attractiveness of BPMP and of the excellent research carried out. The development of the Plasticity team over the last 4 years was seen to be a success. The internal reorganization of teams was aimed at strengthening scientific dynamics, to allow the development of research on crop plants, and to promote and renew team leaders. In some cases it helped to resolve personal relationship problems and the frustration of young scientists. This was mainly achieved by redeploying BPMP staff between teams but also by the arrival of new members via mobility and recruitment. Rules were collectively discussed and adopted and included an application procedure, discussion within the unit's committees and finally validated by a vote of the laboratory committee. In the future, it was recommended that the creation of new teams should have a clear scientific rationale with new teams having/developing a clear identity. This was found to have occurred between the Integration and HoNuDe teams since they have now developed scientific specificities and identities. Special attention should be paid during the next period to monitor the progress of these new, emerging BPMP teams with respect to defined criteria including their scientific output, their collaborations, and their ability to obtain funding and to recruit both permanent and non-permanent staff. The prioritized scientific objectives of BPMP reveal 4 major fields and many common methods that should stimulate collaborations between old and new teams both at the scientific and technical levels and this should be encouraged by the BPMP direction. It is also recommended to propose a welcome package as soon as a new team arrives at the BPMP to help in their installation and targeted recruitments to help develop and stabilize small teams, and when possible to give them priority in obtaining Master and PhD students.

TEAM-BY-TEAM ANALYSIS

TEAM 1

Development and Plasticity of the Root System (Plasticity)

TEAM 1 LEADER

Mr Benjamin Péret

TEAM 1 SCIENTIFIC DOMAIN

Team 1 focusses on root developmental responses in different environments, using two (model) systems: Arabidopsis and white lupin (*Lupinus albus*). The main aspect of post-embryonic root system development in these dicot species is the initiation, emergence and growth of lateral roots, which reflects the plant's resource acquisition strategy.

TEAM'S 1 RESPONSE TO PREVIOUS RECOMMENDATIONS

Not applicable: as this is a new team. This team has been active for 4 years within BPMP which justifies an in-depth analysis of its activity within the BPMP unit.

TEAM 1 WORKFORCE

T1 : Development and Plasticity of the Root System		
Active staff	Number 06/30/2019	Number 01/01/2021
Full professors and similar positions	1	
Assistant professors and similar positions		1
Full time research directors (Directeurs de recherche) and similar positions		
Full time research associates (Chargés de recherche) and similar positions	2	2
Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.")		
High school teachers		
Supporting personnel (ITAs, BIATSSs and others, notably of EPICs)	1	1
Permanent staff	4	4
Non-permanent professors and associate professors, including emeritus		
Non-permanent full time scientists, including emeritus, post-docs (except PhD students)	2	
PhD Students	2	
Non-permanent supporting personnel	2	

Non permanent staff	6	
Total	10	4

CRITERION 1: QUALITY OF SCIENTIFIC OUTPUTS AND ACTIVITIES OF TEAM 1

A - Scientific outputs and activities, academic collaborations, reputation and appeal

From 01/01/2014 to 06/30/2019	Team 1
Articles	
Scientific articles (total number)	3
Scientific articles with first and/or last authorship	2
Review articles (total number)	0
Other articles (professional journals, etc.) (total number)	0
Commentaries on judgements	0
Clinical articles	0
Books	
Monographs, critical editions, translations (total number)	0
Management and coordination of scientific books / Scientific book edition	0
Management and coordination of scientific books / Scientific book edition in English or another foreign language	0
Book chapters (total number)	0
Book chapters in English or another foreign language	0
Edited theses	0
Production in conferences / congresses and research seminars	
Meeting abstracts	0
Articles published in conference proceedings / congress	0
Other products presented in symposia / congress and research seminars	0
Electronic tools and products	
Softwares	
Databases	
Tools for decision making	
Cohorts	
Instruments and methodology	
Prototypes	

Platforms and observatories	
Other products	
Theorised artistic creations, staging, movies	
Editorial activities	
Participation in editorial committees (books, collections, etc.)	
Collection and series management	
Reviewing activities	
Reviewing of articles	5-10 per year
Grant evaluation (public or charities)	5-10 per year
Reviewing of research institutes	0
Participation in institutional committees and juries (CNRS, Inserm, etc.)	1
Academic research grants	
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – coordination	1
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – partnership	0
Other European grants - coordination	0
Other European grants - partnership	0
National public grants (ANR, PHRC, FUI, INCA, etc.) - coordination	1
National public grants (ANR, PHRC, FUI, INCA, etc.) - partnership	0
Local grants (collectivités territoriales) - coordination	0
Local grants (collectivités territoriales) - partnership	0
PIA (labex, equipex etc.) grants - coordination	3
PIA (labex, equipex etc.) grants - partnership	1
Grants from foundations and charities (ARC, FMR, FRM, etc.) - coordination	0
Grants from foundations and charities (ARC, FMR, FRM, etc.) - partnership	0
Visiting senior scientists and post-docs	
Post-docs (total number)	4
Foreign post-docs	3
Visiting scientists (total number)	0
Foreign visiting scientists	0
Scientific recognition	
Prizes and/or distinctions	
IUF members	
Chair of learned and scientific societies	
Organisations of meetings and symposia (out of France)	
Invitations to meetings and symposia (out of France)	5

Members' long-term visits abroad	
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Strengths

The Team's research question is of fundamental importance, but also a very important issue for sustainable agriculture and food security. Wisely, the team has decided to focus on the developmental regulators underpinning the plasticity of root system development. Particularly the long-term ambition of the team and its leader to ask whether there are profound differences in this process in different taxa, and how these might be exploited in a more sustainable agriculture, are important and merit investigation. The team leader, albeit still relatively junior, is a leader in this field, and is well-placed to head the team into the next quinquennial period. This is reflected in the excellent exposure of the team at national and international level (5 invited presentations at international level and 4 at the national level, and 10 and 1 posters, respectively, at international and national level; and 6 and 4 invited seminars, respectively, at international and national level).

During the assessment period, the team published 3 papers, two of which were with first or last authorship. Just recently, the team published their first high-profile paper in *Nature Communications*.

The team has been very successful in securing funding (1 ERC starting, 3 LabEx-financed grants as coordinator, one further as partner).

A fundamental strength is that the team is composed of young researchers, which are likely to work together for an extended time, which allows them to develop complementary strengths.

Weaknesses

Despite the nascent project around white lupin, the relatively low number of influential publications remains of concern. It is understandable that the team wanted to publish "stories" not just "facts" and due to the developing nature of the program, the "stories" weren't ready yet. This is also worrying, because several of the key contributors to the team have already left. However, this could have been partially compensated by more "outreach" type papers, that would have raised the profile of the team, particularly in the non-academic world.

The attraction of pursuing an area that the team leader is comfortable with (auxin) in the context of the *lasso* mutation is understandable, but the link to the environmental parameter (hyperosmotic stress) is not clear from the description. It is not apparent how this program is going to lead anywhere longer-term beyond the identification of the affected allele.

Assessment of scientific outputs, reputation and appeal

The scientific outputs, reputation and appeal of the team are considered to be excellent.

B – Interactions with the non-academic world, impacts on economy, society, culture or health

From 01/01/2014 to 06/30/2019	Team 1
Socio-economic interactions / patents	
Invention disclosures	
Filed patents	
Accepted patents	
Licensed patents	
Socio-economic interactions	

Industrial and R&D contracts	0
Cifre fellowships	0
Creation of labs with private-public partnerships	0
Networks and mixed units	0
Start-up	0
Clinical trials	0
Expertise	
Consulting	
Participation in expert committees (ANSES etc.)	
Legal expertise	
Expert and standardization reports	
Public outreach	
Radio broadcasts, TV shows, magazines and newspapers	
Journal articles, interviews, book edition, videos, other popularization outputs, debates on science and society, etc.	1

Strengths

Team 1 is a new and young team, which has focused on advancing their science. There have been no interactions with the private sector and no activities to engage with their socio-economic environment yet.

Weaknesses

This team has great opportunities to engage with the private sector and their socio-economic environment, because their main scientific focus has a major importance for the future of sustainable agriculture. See in that light, the team has not made sufficient effort to reach out and collaborate with the relevant interest groups (association of farmers, agrobusiness, industry, environmentalists), and the team is strongly encouraged to significantly enhance outreach activities. This will also lay the ground for new funding opportunities.

Assessment of the interactions with the non-academic world

The team's interaction with the private sector and their socio-economic environment has been fair. The team has great potential in this area and is encouraged to make activities in this area a part of their strategic plan for the new period.

C – Involvement in training through research

From 01/01/2014 to 06/30/2019	Team 1
Educational outputs	
Books	
E-learning, MOOCs, multimedia courses, etc.	
Scientific productions (articles, books, etc.) from theses	

Scientific productions (articles, books, etc.) from theses	1
Mean number of publications per student	1
Training	
Habilitated (HDR) scientists	3
HDR obtained during the period	2
PhD students (total number)	2
PhD students benefiting from a specific doctoral contract	2
Defended PhDs	0
Mean PhD duration	0
Internships (M1, M2)	7
People in charge for a mention or a master's degree course (total number)	
People in charge for a mention or a master's degree course with international certification (Erasmus mundus)	

Strengths

Considering the start of the team in July 2015, PLASTICITY team is very well engaged in supervising PhD and Master level students. Plasticity team member's have already initiated the training of two PhD students in 2016 and 2018, and 7 Master students, which is a very good start.

The research supervision capacity of the team involves 3 HDR (2 CR1, 1 MCF) and is suitable for the size of the team. In addition, PLASTICITY training capacity included 1 CR1 and four post-docs (4.5 man-year). One PhD student has published a paper as a first author and a second one is going to be published now.

Weaknesses

One of the HDR will be leaving during the next contract (retirement) reducing the supervision potential.

Assessment of the involvement in training through research

Plasticity has a very good involvement in training through research considering the recent creation of the team.

CRITERION 2: TEAM 1 ORGANISATION AND LIFE

This criterion is assessed at the unit level.

CRITERION 3: FIVE-YEAR PROJECT AND STRATEGY FOR TEAM 1

Strengths

The main strength of the team is the assembled talent and the exciting developing project centered around the white lupin system with a focus on cluster root development. This system and the knowledge derived from the study of cluster roots has much potential to make a significant contribution to sustainable food security. It is suggested that the key questions to focus on would be the molecular-genetic control of cluster root development and the regulation of cluster root determinacy and its apparent co-regulation with physiological functions.

Weaknesses

Looking forward beyond 2020, when the ERC program grant will finish and no major (program) grant has been secured (yet); work in the team will be (human and material) resource-limited, not ideas-limited. Therefore, careful consideration of priorities will be required. Continued work in Arabidopsis will yield 1-2 papers, but the strategic impact and importance for the team is not apparent, and might better be rapidly and productively be wound up. In contrast, for work on white lupin, the team can capitalize on track-record **and** novelty, and therefore, a stronger focus on this system is suggested. A further narrowing of focus is recommended for work on white lupin (can be modified/expanded if significant funds become available).

The team leader will need wisdom to manage the transition from a team of 10 to a team of 6, and management decisions/scientific focus should be very carefully considered.

Much of the functional work in white lupin critically depends on the successful development of an efficient transformation system which has only recently been achieved. Alternatives exist but their suitability depends on whether understanding cluster root formation **or** understanding lateral root formation (including cluster roots) in white lupin is the primary objective of this program. For the former, recapitulation using the candidates identified in the forward genetic screen in a tractable system will deliver the answers, for the latter, a transformation system is essential. The team should not be so strongly dependent on the successful development of a transformation system.

Although the following is also an endeavour at the whole unit level, the Plasticity Team would benefit from the development of a strategy on how to engage with the private sector and the socio-economic environment. This can focus on communicating the importance of fundamental research in this area for sustainable agriculture.

Assessment of the scientific strategy and projects

The overall strategy of the Plasticity Team is excellent.

RECOMMENDATIONS TO THE TEAM 1

A – Recommendations on scientific production and activities for the team 1 (criterion 1)

The team has got off to an excellent start with a good balance of training by research and exciting research activities. With all this potential, the team should now sharpen its focus on the white lupin system. This will strongly help with funding and international competitiveness. It is also suggested to collaborate more widely, if it helps accelerate publication of work, which must be a priority for the team.

B – Recommendations on the team's 1 organisation and life (criterion 2)

Not assessed.

C – Recommendations on scientific strategy and projects for the team 1 (criterion 3)

It is strongly recommended to re-consider priorities and focus in light of the small number of team members and the uncertain funding situation. The team is encouraged to consider sharpening their focus onto the white lupin system further, and modify this flexibly according the success with funding. Considerations that reduce the dependency on a successful development of a transformation system are important and seizing the opportunities of heterologous systems.

TEAM 2

Hormones, Nutrients & Development (HoNuDe)

TEAM 2 LEADER

Mr Benoît Lacombe

TEAM 2 SCIENTIFIC DOMAIN

The team is dedicated to the study of molecular mechanisms governing nitrogen transport and sensing, and the interaction between nitrogen, phosphorus and hormone signaling pathways using Arabidopsis and Durum wheat.

TEAM'S 2 RESPONSE TO PREVIOUS RECOMMENDATIONS

The HoNuDe team resulted from a restructuring initiative. At the previous evaluation, several members of the HoNuDe team carried out their research activities in the team "Intégration des fonctions nutritives dans la plante entière" (organization chart 2014). Regarding the recommendation made to the previous team of not investigating too many candidate gene approaches to avoid a dispersion, the candidate genes studied in the HoNuDe team appear well chosen based on their potential roles in the different research aspects investigated and led to articles published in high-ranking journals.

TEAM 2 WORKFORCE

T2: Hormones, Nutrients and Development		
Active staff	Number 06/30/2019	Number 01/01/2021
Full professors and similar positions	1	
Assistant professors and similar positions		1
Full time research directors (Directeurs de recherche) and similar positions	1	2
Full time research associates (Chargés de recherche) and similar positions	3	2
Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.")		
High school teachers		
Supporting personnel (ITAs, BIATSSs and others, notably of EPICs)	3	3
Permanent staff	8	8
Non-permanent professors and associate professors, including emeritus		
Non-permanent full time scientists, including emeritus, post-docs (except PhD students)	1	
PhD Students		
Non-permanent supporting personnel		
Non permanent staff	1	

Total	9	8
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CRITERION 1: QUALITY OF SCIENTIFIC OUTPUTS AND ACTIVITIES OF TEAM 2

A - Scientific outputs and activities, academic collaborations, reputation and appeal

From 01/01/2014 to 06/30/2019	Team 2
Articles	
Scientific articles (total number)	20
Scientific articles with first and/or last authorship	see annex 4
Review articles (total number)	see annex 4
Other articles (professional journals, etc.) (total number)	
Commentaries on judgements	0
Clinical articles	0
Books	
Monographs, critical editions, translations (total number)	see annex 4
Management and coordination of scientific books / Scientific book edition	
Management and coordination of scientific books / Scientific book edition in English or another foreign language	
Book chapters (total number)	
Book chapters in English or another foreign language	
Edited theses	
Production in conferences / congresses and research seminars	
Meeting abstracts	
Articles published in conference proceedings / congress	
Other products presented in symposia / congress and research seminars	
Electronic tools and products	
Softwares	see annex 4
Databases	
Tools for decision making	
Cohorts	
Instruments and methodology	
Prototypes	
Platforms and observatories	
Other products	

Theorised artistic creations, staging, movies	
Editorial activities	
Participation in editorial committees (books, collections, etc.)	see annex 4
Collection and series management	
Reviewing activities	
Reviewing of articles	see annex 4
Grant evaluation (public or charities)	see annex 4
Reviewing of research institutes	see annex 4
Participation in institutional committees and juries (CNRS, Inserm, etc.)	see annex 4
Academic research grants	
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – coordination	2
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – partnership	1
Other European grants - coordination	1
Other European grants - partnership	0
National public grants (ANR, PHRC, FUI, INCA, etc.) - coordination	8
National public grants (ANR, PHRC, FUI, INCA, etc.) - partnership	1
Local grants (collectivités territoriales) - coordination	1
Local grants (collectivités territoriales) - partnership	0
PIA (labex, equipex etc.) grants - coordination	3
PIA (labex, equipex etc.) grants - partnership	1
Grants from foundations and charities (ARC, FMR, FRM, etc.) - coordination	0
Grants from foundations and charities (ARC, FMR, FRM, etc.) - partnership	0
Visiting senior scientists and post-docs	
Post-docs (total number)	9
Foreign post-docs	3
Visiting scientists (total number)	7
Foreign visiting scientists	6
Scientific recognition	
Prizes and/or distinctions	
IUF members	
Chair of learned and scientific societies	
Organisations of meetings and symposia (out of France)	
Invitations to meetings and symposia (out of France)	see annex 4
Members' long-term visits abroad	see annex 4

Strengths

The HoNuDe team made significant achievements over the period that mirrors its strong international reputation in nitrogen transport and sensing. The team has published 19 scientific articles in high-ranking journals (e.g., *Nature Commun.*, *Plant Physiol*, *Plant Cell*), including 14 as leaders, and 21 review articles (e.g., *Curr Opin Plant Biol*, *Nature Plants*, *Trends Plant Sci*, *J Exp Bot*). These scientific outputs provided significant knowledge of components that regulate nitrate transport, sensing and signaling, and of how nitrogen signal influences the phosphorus starvation response in *Arabidopsis*. The team has also been involved in developing softwares, such as *Arabidopsis GeneCloud* enabling to visualise semantic terms overrepresented in a gene list, or *TransDetect* that predict potential regulators from transcriptomics data. Overall, these data and tools form an original and outstanding basis for further work.

Members of the HoNuDe team were actively engaged in reviewing manuscripts (about 20 each year) and grant applications (about 10 each year), and contributed to editorial activities as associate or guest editors, or as faculty member (F1000). The team organized the 12th Congress of the International Plant Molecular Biology and the 1st International Plant Systems Biology meeting, and has been invited to 5 additional International meeting out of France. Collaborations with national and international researchers are evidenced in the scientific outputs and through their participation in national and international public grants. The team has been successful in raising public funds, with 2 European/International grants and 8 national grants, including 3 ANR-projects, obtained as coordinator over the period.

These activities attest to the success of the team in providing fundamental knowledge and in developing networks to carry on their research and to remain highly competitive in the field of nitrogen nutrition.

Weaknesses

The number of communications or posters presented in symposia or congresses is modest (13 products in total) considering the number of scientists, PhD students (4 theses defended over the period) and CDD/post-docs (3 over the period). The list of communications reflects a low participation of PhD students to congresses or workshops.

Assessment of scientific outputs, reputation and appeal

The scientific outputs have been considered as excellent to outstanding for some of their research. The reputation and appeal of the team is excellent, and the ability to access grants is very good.

B – Interactions with the non-academic world, impacts on economy, society, culture or health

From 01/01/2014 to 06/30/2019	Team 2
Socio-economic interactions / patents	
Invention disclosures	0
Filed patents	0
Accepted patents	0
Licensed patents	0
Socio-economic interactions	
Industrial and R&D contracts	0
Cifre fellowships	0
Creation of labs with private-public partnerships	0

Networks and mixed units	0
Start-up	0
Clinical trials	0
Expertise	
Consulting	see annex 4
Participation in expert committees (ANSES etc.)	
Legal expertise	
Expert and standardization reports	
Public outreach	
Radio broadcasts, TV shows, magazines and newspapers	
Journal articles, interviews, book edition, videos, other popularization outputs, debates on science and society, etc.	

Strengths

The HoNuDe team has been involved in three press releases linked to convergent studies with the Integration team.

Weaknesses

Although some fundamental aspects investigated by the team may have an impact at the applied level to improve the efficiency of nitrogen utilization, there was no link established with private companies to use the knowledge for crop improvement.

Assessment of the interactions with the non-academic world

The assessment is considered to be good with the following comments: good outreach activities but no interaction with private partners.

C – Involvement in training through research

From 01/01/2014 to 06/30/2019	Team 2
Educational outputs	
Books	
E-learning, MOOCs, multimedia courses, etc.	
Scientific productions (articles, books, etc.) from theses	
Scientific productions (articles, books, etc.) from theses	
Mean number of publications per student	
Training	

Habilitated (HDR) scientists	3
HDR obtained during the period	2
PhD students (total number)	4
PhD students benefiting from a specific doctoral contract	4
Defended PhDs	4
Mean PhD duration	35
Internships (M1, M2)	13
People in charge for a mention or a master's degree course (total number)	
People in charge for a mention or a master's degree course with international certification (Erasmus mundus)	

Strengths

HoNuDe members are well involved in supervising PhD and Master level students. Four students have defended their PhDs within the expected duration (mean 37.5 months). Three of the PhD students have published an original article as first author during their thesis. 13 students at Master level had been supervised. One assistant professor is in charged for two master's degree course.

Weaknesses

Currently the team has no PhD students. One PhD student has not published an original article in a peer-reviewed journal as a first author although his work was published (bioRxiv). However, a review article as a first author was published in a high IF journal and the student has now secured a post-doc in an international lab.

Assessment of the involvement in training through research

The team has conducted a very good training through research activity especially regarding the number of possible supervisors. The teaching activity is an asset for the attractiveness of the team.

CRITERION 2: TEAM 2 ORGANISATION AND LIFE

This criterion is assessed at the unit level.

CRITERION 3: FIVE-YEAR PROJECT AND STRATEGY FOR TEAM 2

Strengths

Part of the 5-year scientific project of the HoNuDe team is a continuation of previous work on nitrogen nutrition aiming at deciphering the molecular mechanisms underlying nitrate-phosphate interaction and long-distance nitrogen signaling in Arabidopsis. In view of the significant findings that came up during the previous period, this is a good choice and the team will undoubtedly continue to produce excellent fundamental knowledge using Arabidopsis. The team will also develop new and original themes of research using Arabidopsis and a crop (Durum wheat). In Arabidopsis, a focus will be made on: (1) transport systems enabling foliar-applied nitrogen absorption and translocation, and (2) nitrate-potassium interplay and its relationship with ABA signaling. In Durum wheat, the work will consist in deciphering the molecular pathways leading to an overaccumulation of phosphorus under zinc deficiency with the aim of improving phosphorus use efficiency in this crop. To carry on this ambitious research program, the team will use a combination of approaches, either targeted on specific molecular processes or without any a priori knowledge of the processes involved (GWAS, transcriptomics). In parallel, a system biology approach will be used to yield predictive tools that can generate reliable gene

regulatory network predictions, with a particular focus on transcription factor-target relationships. The complementary expertise of the scientists in the team will contribute to the feasibility and success of the project.

Weaknesses

The realization of the overall research program will depend on the financial resources that will be obtained in the coming period. It was sometimes difficult to apprehend the possible synergies between the diverse research topics that will be investigated, although all dealing with nutrient signaling, transport and interactions.

Assessment of the scientific strategy and projects

The future research strategy build on previous highly successful work by the team has been assessed as being very good, with excellent research aspects combining targeted molecular studies with systems biology approaches.

RECOMMENDATIONS TO THE TEAM 2

A – Recommendations on scientific production and activities for the team 2 (criterion 1)

The team has been very successful during the last 5 years in providing fundamental knowledge of nitrogen sensing and transport in Arabidopsis, and their PhD students have successfully published papers as first authors. The team is encouraged to continue its excellent fundamental research that has contributed to its reputation in the nitrogen nutrition field. It should maintain its attractiveness in terms of international and national collaborations and the hosting of students and post-docs.

B – Recommendations on the team's 2 organisation and life (criterion 2)

Not assessed.

C – Recommendations on scientific strategy and projects for the team 2 (criterion 3)

The five-year plan is ambitious. It covers a wide range of aspects dealing with nutrient signaling and interactions. This is an original and strong project whose overall realization will strongly depend on the acquisition of funding to secure all aspects.

The team organisation is such that each scientist has its own research topic, each topic dealing with nutrient transport, signaling and/or nutrient interactions. This enables each scientist to publish papers in leader position and to supervise PhD students on different aspects, thus not putting them in competition within the team. The team uses multi-disciplinary and highly innovative approaches (targeted, GWAS, omics, systems biology, modeling...). Regarding modeling, we encourage the team to consider it at the single cell level. We also encourage the team to maintain high the synergy between the diverse talents to share their multi-disciplinary expertise. This will help the team to keep an integrative and cohesive research environment, attractive for hosting students or post-docs.

The research of the team about phosphate homeostasis in Durum wheat is of particular interest and should be pursued. In this regard, it would be interesting to consider using Arabidopsis to answer some specific questions raised using the crop. We encourage the team to continue its excellent fundamental research with Arabidopsis that is well suited for mechanistic molecular studies on nutrient signaling, transport and interactions, and to establish collaborations with other groups or companies working on crops for translational research on this topic. This will greatly help the team to keep its leading position in this very competitive area of research.

TEAM 3

Integration of Nutrient Signaling Pathways (Integration)

TEAM 3 LEADER

Mr Alain Gojon

TEAM 3 SCIENTIFIC DOMAIN

Nitrogen is the major nutrient taken up by roots and after hydrogen, carbon and oxygen the fourth most abundant element found in living cells. The major form of nitrogen taken up by plant roots is nitrate. The work of this team is devoted to elucidate the mechanism of nitrate uptake and the regulation of nitrate uptake and allocation. Due to the fact that nitrate uptake is closely linked to carbohydrate metabolism this aspect plays also an important role in the research of this team.

TEAM'S 3 RESPONSE TO PREVIOUS RECOMMENDATIONS

The team has been newly formed in 2015 and emerged from the team "Integration of nutritive functions".

TEAM 3 WORKFORCE

T3: Integration of Nutrient Signaling Pathways		
Active staff	Number 06/30/2019	Number 01/01/2021
Full professors and similar positions	1	
Assistant professors and similar positions		1
Full time research directors (Directeurs de recherche) and similar positions	1	1
Full time research associates (Chargés de recherche) and similar positions	2	2
Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.")		
High school teachers		
Supporting personnel (ITAs, BIATSSs and others, notably of EPICs)	3	2
Permanent staff	7	6
Non-permanent professors and associate professors, including emeritus		
Non-permanent full time scientists, including emeritus, post-docs (except PhD students)		
PhD Students	3	
Non-permanent supporting personnel	1	
Non permanent staff	4	

Total	11	6
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CRITERION 1: QUALITY OF SCIENTIFIC OUTPUTS AND ACTIVITIES OF TEAM 3

A - Scientific outputs and activities, academic collaborations, reputation and appeal

From 01/01/2014 to 06/30/2019	Team 3
Articles	
Scientific articles (total number)	15
Scientific articles with first and/or last authorship	5
Review articles (total number)	9
Other articles (professional journals, etc.) (total number)	3
Commentaries on judgements	0
Clinical articles	0
Books	
Monographs, critical editions, translations (total number)	0
Management and coordination of scientific books / Scientific book edition	0
Management and coordination of scientific books / Scientific book edition in English or another foreign language	0
Book chapters (total number)	2
Book chapters in English or another foreign language	2
Edited theses	0
Production in conferences / congresses and research seminars	
Meeting abstracts	0
Articles published in conference proceedings / congress	0
Other products presented in symposia / congress and research seminars	28
Electronic tools and products	
Softwares	0
Databases	0
Tools for decision making	0
Cohorts	0
Instruments and methodology	
Prototypes	0
Platforms and observatories	0
Other products	
Theorised artistic creations, staging, movies	0

Editorial activities	
Participation in editorial committees (books, collections, etc.)	2
Collection and series management	0
Reviewing activities	
Reviewing of articles	5-10/year
Grant evaluation (public or charities)	4
Reviewing of research institutes	4
Participation in institutional committees and juries (CNRS, Inserm, etc.)	3
Academic research grants	
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – coordination	1
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – partnership	0
Other European grants - coordination	0
Other European grants - partnership	0
National public grants (ANR, PHRC, FUI, INCA, etc.) - coordination	4
National public grants (ANR, PHRC, FUI, INCA, etc.) - partnership	1
Local grants (collectivités territoriales) - coordination	0
Local grants (collectivités territoriales) - partnership	0
PIA (labex, equipex etc.) grants - coordination	4
PIA (labex, equipex etc.) grants - partnership	1
Grants from foundations and charities (ARC, FMR, FRM, etc.) - coordination	0
Grants from foundations and charities (ARC, FMR, FRM, etc.) - partnership	0
Visiting senior scientists and post-docs	
Post-docs (total number)	1
Foreign post-docs	0
Visiting scientists (total number)	2
Foreign visiting scientists	2
Scientific recognition	
Prizes and/or distinctions	0
IUF members	0
Chair of learned and scientific societies	0
Organisations of meetings and symposia (out of France)	1
Invitations to meetings and symposia (out of France)	6
Members' long-term visits abroad	0

Strengths

The team published 15 scientific papers and 9 reviews. Collaborators of the team acted as first/last authors for five scientific papers. This number may appear rather small. However, it should be taken into account that the original team has been divided into two groups and that several of the scientific publications are collaborative work with the former group members, which act as first/last authors for several additional publications. Among the scientific publications there are several highlights, such as the *Nature Plant* article published in 2015 (73 citations) and the PCE (*Plant Cell and Environment*) paper (58 citations) that attracted the interest of the community and had a broad impact. Working in such a competitive field requires to have an in-depth knowledge of the scientific questions and to find novel, creative solutions. This team did it very well. Apparently, the team is very well connected with the other groups in Montpellier as well as in France and at the international level. These collaborations demonstrate that the team is a reliable partner and that its work is very well recognized by other laboratories. The large number of presentations at international as well as national conferences and meetings by many members of the team demonstrates its scientific visibility and recognition. The recognition is highlighted by the fact that the team leader was invited at five international conferences, among them the very prestigious Intl. Plant Molecular Biology Congress in Brasil, 2015, The International conference on root development and nutrient/water absorption in Hangzhou, China and International symposium on plant responses to abiotic stresses and environmental signals in Beijing, China. Another group member was invited at the EMBO conference in integrative Biology hold in Santiago de Chile in 2019.

The team also did a very good job in attracting grants, a prerequisite for a successful continuation of the work. In 2014 the team obtained two national public grants (an ANR and an ACSE) and were a partner in a five year ANR PCR grant. Since 2015 the team obtained three grants as coordinator: an ANR grant (2013-2020), a BAP-INRA grant (2017-2018) and an iSITE grant (2019-2022).

The preliminary results described for the different projects are very promising (see also 5 year program)

Weaknesses

The team is doing very well. Nevertheless, it should try to have a higher proportion of publications with their own members as first and/or last authors, but as mentioned above this will be automatically be realized at least partially since in the future the topics will no more overlap with the members of the former team.

Assessment of scientific outputs, reputation and appeal

The team has had a very good output with several excellent publications. It has an excellent funding record. The international reputation is excellent with a large number of invitations to present the work at international conferences.

B – Interactions with the non-academic world, impacts on economy, society, culture or health

From 01/01/2014 to 06/30/2019	Team 3
Socio-economic interactions / patents	
Invention disclosures	
Filed patents	
Accepted patents	
Licensed patents	
Socio-economic interactions	
Industrial and R&D contracts	0
Cifre fellowships	0

Creation of labs with private-public partnerships	0
Networks and mixed units	0
Start-up	0
Clinical trials	0
Expertise	
Consulting	0
Participation in expert committees (ANSES etc.)	0
Legal expertise	0
Expert and standardization reports	0
Public outreach	
Radio broadcasts, TV shows, magazines and newspapers	0
Journal articles, interviews, book edition, videos, other popularization outputs, debates on science and society, etc.	2

Strengths

The team leader had an interview with the important national newspaper Le Monde.

Weaknesses

In this topic some progress could be done. Nowadays the issue of nitrogen fertilization is a problem, since it contributes also to global warming. Hence information of the public about these issues and what could be done is very important. The Panel can imagine some public talks, discussions with farmers and articles in the scientific pages of newspapers

Assessment of the interactions with the non-academic world

There is little evidence for the interaction with industry. The Panel judged this contribution as fair. There was some evidence of public outreach activity and hence it is ranked very good.

C – Involvement in training through research

From 01/01/2014 to 06/30/2019	Team 3
Educational outputs	
Books	0
E-learning, MOOCs, multimedia courses, etc.	1
Scientific productions (articles, books, etc.) from theses	
Scientific productions (articles, books, etc.) from theses	7
Mean number of publications per student	3

Training	
Habilitated (HDR) scientists	3
HDR obtained during the period	2
PhD students (total number)	4
PhD students benefiting from a specific doctoral contract	4
Defended PhDs	1
Mean PhD duration	38
Internships (M1, M2)	11
People in charge for a mention or a master's degree course (total number)	3
People in charge for a mention or a master's degree course with international certification (Erasmus mundus)	0

Strengths

The research supervision capacity of the team involves 3 HDR (1 DR, 2 CR), including two HDR defended during the contract, showing a good progress. In addition, Integration training capacity include one permanent scientist (MCF) and had included two post-docs (4.6 man-year).

Integration team members are well engaged in supervising PhD and Master level students. One student has defended his PhD within the regular duration (36 months) and has published two scientific articles as a first author in peer-reviewed journal. Three students are currently ongoing PhD thesis since 2017 and are already co-authors of scientific articles. 11 students at Master level had been supervised.

One associate professor teaches at Montpellier University and is in charge of a course in M1 and M2 levels of the Master Plant Functional Biology. Other members of the team contribute to the teaching in the same Master.

Weaknesses

Some of the team staff members may pass the HDR diploma to allow the team to cope with the expected decrease in its PhD supervising capacity following retirements of one HDR at last in 2023.

Assessment of the involvement in training through research

The training through research was found excellent.

CRITERION 2: TEAM 3 ORGANISATION AND LIFE

This criterion is assessed at the unit level.

CRITERION 3: FIVE-YEAR PROJECT AND STRATEGY FOR TEAM 3

Strengths

The structure of the team is well established and hence there is a high probability that it will be successful also in the future. The scientific part covers several main and eminent aspects on the regulation of nitrate uptake:

Nitrate sensing and signaling: from chromatin to protein. In this subproject the regulation of nitrate uptake will be studied including the development of root architecture, which depends on the availability and uptake of nitrate. The team has a long-lasting experience with nitrate and nitrogen metabolism in plants and produced many tools

to analyze these questions at several levels such as transport and regulation, including transcription factors. The project submitted is very interesting, since it will shed light on different aspects of nitrate uptake, including the regulation of the very important nitrate transporter NRT2.1 and epigenetic regulation. As stated at the beginning, nitrate nutrition is a central point in plant metabolism and plants need sufficient nitrogen to produce a high biomass. However, nitrate in the soil can have many drawbacks, such as water and air pollution and energy consumption, therefore optimizing nitrate uptake is a must if we wish to reach the goal of a healthy agriculture and ensuring that enough food is produced to feed the world population in the future. The two projects are complementary and are designed on one side to understand better nitrate uptake and on the other should be the basis to create or select better crops.

Weaknesses

As mentioned above the replacement of the team leader will be planned well in advance. From the scientific part of view no major flaws were detected. However, due to the complexity of the questions and approaches there is some risk, that one or the other project will remain at a descriptive level.

Assessment of the scientific strategy and projects

The five-year plan is very good with some excellent elements. While several projects appear to be a continuation of current work, there are several new aspects such as the epigenetic work.

RECOMMENDATIONS TO THE TEAM 3

A – Recommendations on scientific production and activities for the team 3 (criterion 1)

As mentioned above: Try to have a higher proportion of publications with their own members as first and/or last authors. The committee encourages researchers of the team that meet the requirements to go for an HDR degree.

B – Recommendations on the team's 3 organisation and life (criterion 2)

The team leader's successor should get at least one year overlap to get trained with this duty. It must be somebody accepted by the team and with excellent communication skills. Try to figure out whether somebody would have a high probability to get an ERC grant (young investigator is easier) or to attract a young investigator that has a high probability to get such a grant.

C – Recommendations on scientific strategy and projects for the team 3 (criterion 3)

As already mentioned in the weakness section: Due to the complexity of the questions and approaches there is some risk, that one or the other project will remain at a descriptive level. We therefore urge that if the members of the team recognize such a risk, they should join forces and concentrate on less projects. As also mentioned above, the competition in this field is high and hence it is necessary to speed up and concentrate on certain aspects in order not to be scooped.

Young collaborators, should be more proactive and outgoing especially when faced with the retirement prospects of the very well recognized former team leader. Facing such changes and discussing about it should help his successor to enter in this new task. In this respect, it is certainly worth to try to get an ERC young investigator grant to consolidate a new leadership.

TEAM 4

Ion Flux Coordination and Signaling in Plant Cells (Influx)

TEAM 4 LEADER

Mr Alexis de Angeli

TEAM 4 SCIENTIFIC DOMAIN

The INFLUX team studies the regulation and coordination of ion fluxes across the plasma membrane of plant cells, with a specific focus on ion fluxes across the plasma membrane and tonoplast of guard cells. The medium-term goal of the team is to integrate data on biophysical properties of transport systems and *in vivo* data on ion fluxes obtained by genetically encoded sensors into comprehensive models of ion fluxes in plant cells.

TEAM'S 4 RESPONSE TO PREVIOUS RECOMMENDATIONS

The Influx team is a new BPMP team proposed for the next evaluation period and that was created a year ago. Following general recommendations by the CNRS (INSB), no detailed analysis of its past activities will thus appear for this reporting period within the context of the BPMP review. However, the perspectives of this new team within BPMP are analyzed in detail below.

TEAM 4 WORKFORCE

T4: Ion Flux Coordination and Signaling in Plant Cells		
Active staff	Number 06/30/2019	Number 01/01/2021
Full professors and similar positions		
Assistant professors and similar positions		
Full time research directors (Directeurs de recherche) and similar positions		
Full time research associates (Chargés de recherche) and similar positions	1	1
Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.")		
High school teachers		
Supporting personnel (ITAs, BIATSSs and others, notably of EPICs)		
Permanent staff	1	1
Non-permanent professors and associate professors, including emeritus		
Non-permanent full time scientists, including emeritus, post-docs (except PhD students)		
PhD Students		
Non-permanent supporting personnel		
Non permanent staff	0	

Total	1	1
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CRITERION 3: FIVE-YEAR PROJECT AND STRATEGY FOR TEAM 4

Strengths

The five-year strategy of the team builds on a recently funded, highly competitive national young investigator (ATIP) project and a strong previous track record in the biophysics of ion transporters in plants, in particular chloride and nitrate channels, for example the recent work published in *Mol Plant* (2016) on blockage of anion channels by ATP. Also the earlier work on the role of ALMT4 in ion movement across the guard cell tonoplast (published in 2017 in *Plant Cell*) provides a strong foundation for the planned project. The project provides a clear 5-year vision, moving from the biophysical characterization of individual ion channels towards an integrative analysis of ion fluxes across the plasma and tonoplast membranes, with the longer-term vision of developing mechanistic models of ion fluxes in plant cells.

Weaknesses

At current, the team is under-critical with respect to staff and funding. Research on ion channels and the modelling of ion fluxes in guard cells is highly competitive at the international level. The same holds for the development and use of genetically-encoded sensors, which are targeted by several international high-profile groups. It is not yet entirely clear how the team will position itself in this highly competitive environment.

Assessment of the scientific strategy and projects

The team has developed an excellent five-year vision for taking research on ion homeostasis in plant cells to the next level by integrating ion fluxes across the plasma membrane and intracellular membranes and by moving towards *in vivo* biophysics through employing an advanced set of genetically encoded ion and pH sensors.

RECOMMENDATIONS TO THE TEAM 4

C – Recommendations on scientific strategy and projects for the team 4 (criterion 3)

It will be crucial for the teams long-term success to continue building a strong publication and funding record and to become internationally competitive through acquisition of a sufficient amount of extramural funding. Possible strategies could include increased collaborations with national and international teams. Making newly developed tools, such as novel genetically-encoded sensors, rapidly available to the broader community will increase visibility and demand for collaborations. At the current state, the team must further leverage the potential for synergies within the unit to compensate for small team size. The combination of experimental and modelling approaches (design-test-build cycle) holds substantial potential for increasing the speed of discovery and it might hence be sensible to try and increase capacity for modeling, either through collaborations or developing a new funding stream for this part of the team.

The team should devise its scientific strategy to avoid direct competition with established groups in the field of guard cell ion transport and to open new territory for future research. To this end it will be required to amalgamate the strong biophysics expertise with a more integrative biology approach, extending from the understanding of individual ion channels to a mechanistic and eventually predictive understanding of whole-cell, tissue, plant processes.

TEAM 5

Ion Transport and Adaptation to the Environment in Cereals (TICER)

TEAM 5 LEADER

Ms Anne-Aliénor Véry

TEAM 5 SCIENTIFIC DOMAIN

The TICER team has chosen to investigate the plant adaptation to abiotic stress, especially on the fate of salinity. In view of the actual global change this is an important question and integrates basic science as well as applied science. The team is focusing on only one main aspect, that of K⁺ nutrition and K⁺/Na⁺ homeostasis. To do this they propose to look at different aspects related to the K⁺/Na⁺ balance.

TEAM'S 5 RESPONSE TO PREVIOUS RECOMMENDATIONS

The team has been created after the last evaluation in 2015

TEAM 5 WORKFORCE

T5: Ion Transport and Adaptation to Environment in Cereals		
Active staff	Number 06/30/2019	Number 01/01/2021
Full professors and similar positions		1
Assistant professors and similar positions		
Full time research directors (Directeurs de recherche) and similar positions		1
Full time research associates (Chargés de recherche) and similar positions	4	4
Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.")		
High school teachers		
Supporting personnel (ITAs, BIATSSs and others, notably of EPICs)	1	2
Permanent staff	5	8
Non-permanent professors and associate professors, including emeritus		
Non-permanent full time scientists, including emeritus, post-docs (except PhD students)		
PhD Students	1	
Non-permanent supporting personnel		
Non permanent staff	1	
Total	6	8

CRITERION 1: QUALITY OF SCIENTIFIC OUTPUTS AND ACTIVITIES OF TEAM 5

A - Scientific outputs and activities, academic collaborations, reputation and appeal

From 01/01/2014 to 06/30/2019	Team 5
Articles	
Scientific articles (total number)	21
Scientific articles with first and/or last authorship	9
Review articles (total number)	5
Other articles (professional journals, etc.) (total number)	1
Commentaries on judgements	
Clinical articles	
Books	
Monographs, critical editions, translations (total number)	
Management and coordination of scientific books / Scientific book edition	
Management and coordination of scientific books / Scientific book edition in English or another foreign language	
Book chapters (total number)	3
Book chapters in English or another foreign language	3
Edited theses	
Production in conferences / congresses and research seminars	
Meeting abstracts	
Articles published in conference proceedings / congress	
Other products presented in symposia / congress and research seminars	see annex 4
Electronic tools and products	
Softwares	
Databases	
Tools for decision making	
Cohorts	
Instruments and methodology	
Prototypes	
Platforms and observatories	
Other products	
Theorised artistic creations, staging, movies	0
Editorial activities	
Participation in editorial committees (books, collections, etc.)	

Collection and series management	
Reviewing activities	
Reviewing of articles	5-10 per year
Grant evaluation (public or charities)	
Reviewing of research institutes	
Participation in institutional committees and juries (CNRS, Inserm, etc.)	see annex 4
Academic research grants	
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – coordination	0
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – partnership	0
Other European grants - coordination	4
Other European grants - partnership	0
National public grants (ANR, PHRC, FUI, INCA, etc.) - coordination	0
National public grants (ANR, PHRC, FUI, INCA, etc.) - partnership	0
Local grants (collectivités territoriales) - coordination	0
Local grants (collectivités territoriales) - partnership	0
PIA (labex, equipex etc.) grants - coordination	2
PIA (labex, equipex etc.) grants - partnership	1
Grants from foundations and charities (ARC, FMR, FRM, etc.) - coordination	0
Grants from foundations and charities (ARC, FMR, FRM, etc.) - partnership	0
Visiting senior scientists and post-docs	
Post-docs (total number)	2
Foreign post-docs	2
Visiting scientists (total number)	16
Foreign visiting scientists	16
Scientific recognition	
Prizes and/or distinctions	
IUF members	
Chair of learned and scientific societies	
Organisations of meetings and symposia (out of France)	
Invitations to meetings and symposia (out of France)	see annex 4
Members' long-term visits abroad	

Strengths

The team contributed to 21 original scientific papers and for 9 of them members of the team were either/and first or last authors. Furthermore, the team published 5 review articles (4 as first authors). The work where the team was the leading laboratory was published in good (e.g., *FEBS Letters*) or very good journals (e.g., *Plant Physiol.*, *Plant J.*). Several of these publications attracted the interest of scientists in the field, for instance the *Plant J.* paper has

been cited already 24 times and the review published in *J. Plant Physiol* in 2014 is a highly cited publication, despite the fact that this journal is a rather low-impact journal. The large number of papers where the team is a co-author demonstrates that the competences of this team is well-recognized at the national as well international level. A further indicator for the quality of the work of this team is that many abstracts have been chosen to be presented as oral presentations in international and national conferences and symposia. In line with this, members of the team have been regularly asked as reviewers by different scientific journals. The team has successfully attracted several grants to support their research. Since 2015 they attracted two international PHC grants, one for a collaboration with Vietnam, the other with the Magreb. Furthermore, they got two PIA grants as coordinators and are involved as partners in another. The large number of visiting scientists is a further indicator for the visibility of the work performed within this team. The preliminary results described for the different projects are very promising.

Weaknesses

This team has been established less than five years ago yet has been active for a full reporting period, therefore it is comprehensible that a minor proportion of publications have a member of this team as first or last author. It is assumed that several of the publications derive from the former joint team. Nevertheless, the team should try to publish more work where they are the leading house. The Panel is aware that it becomes more and more difficult to publish in very high impact journals, nevertheless, the goal should be to get in such journals (two to three times during a five-year period). This would allow to increase the international visibility and to be invited more often to present the work at international conferences. The scientific goals of the team are excellent, however enough funding is required to achieve these goals, therefore increasing the funding situation and possibly the manpower should be envisaged.

Assessment of scientific outputs, reputation and appeal

The output was assessed as very good output with several important papers. The funding is very good. The international reputation is good.

B – Interactions with the non-academic world, impacts on economy, society, culture or health

From 01/01/2014 to 06/30/2019	Team 5
Socio-economic interactions / patents	
Invention disclosures	
Filed patents	
Accepted patents	
Licensed patents	1
Socio-economic interactions	
Industrial and R&D contracts	0
Cifre fellowships	0
Creation of labs with private-public partnerships	0
Networks and mixed units	0
Start-up	0
Clinical trials	0
Expertise	

Consulting	
Participation in expert committees (ANSES etc.)	
Legal expertise	
Expert and standardization reports	
Public outreach	
Radio broadcasts, TV shows, magazines and newspapers	1
Journal articles, interviews, book edition, videos, other popularization outputs, debates on science and society, etc.	

Strengths

The team produced a broadcast within a TV show on rice along the Mekong to the red river.

Weaknesses

The subject on abiotic stress is very timely, the team could be more active in orienting the population about very important issues that touch also agronomy and our world nutrition. No patents or research contracts involving companies were mentioned.

Assessment of the interactions with the non-academic world

This activity was assessed as good with the following comments: there is no interaction with the industry while the outreach activities could further improve.

C – Involvement in training through research

From 01/01/2014 to 06/30/2019	Team 5
Educational outputs	
Books	
E-learning, MOOCs, multimedia courses, etc.	
Scientific productions (articles, books, etc.) from theses	
Scientific productions (articles, books, etc.) from theses	8
Mean number of publications per student	1.4
Training	
Habilitated (HDR) scientists	2
HDR obtained during the period	1
PhD students (total number)	6
PhD students benefiting from a specific doctoral contract	6
Defended PhDs	5

Mean PhD duration	36
Internships (M1, M2)	7
People in charge for a mention or a master's degree course (total number)	
People in charge for a mention or a master's degree course with international certification (Erasmus mundus)	

Strengths

The research supervision capacity of the team involved 2 HDR (2 CR) and has been reinforced by a new team member in 2019 (1 PR). In addition, TICER training capacity include two permanent scientist (2 CR) and had included two post-docs (2.5 man-year). TICER team members are actively involved in supervising PhD and Master level students. Five PhD students have defended their PhD with a mean duration (36 months) in compliance to French standards. One student has a currently ongoing PhD thesis that started in 2017. Four foreign PhD students were hosted for a few months. 7 students at Master level have been hosted for internship supervised by the team. One of the HDR was acknowledged during current contract.

Weaknesses

Publication as first author of a scientific article by PhD students is uneven. Only two of the 5 defended PhD led to a first author scientific article publication although some have second author articles. Accordingly, the mean number of publications per student (1.4) is low although the ranking of the journals are fairly high.

Assessment of the involvement in training through research

The training through research activity was good with the following comments: some PhD having defended still have no publication as primary author.

CRITERION 2: TEAM 5 ORGANISATION AND LIFE

This criterion is assessed at the unit level.

CRITERION 3: FIVE-YEAR PROJECT AND STRATEGY FOR TEAM 5

Strengths

The team has three independent projects all with the goal to understand better K⁺ nutrition and the K⁺/Na⁺ balance. In addition, there is a joint project with the ELSA team. Each sub-team is constituted by three to five collaborators, which allows that the different tasks of a project can be addressed efficiently. The fact that two team members are involved in two projects facilitates the information exchange within the whole team.

The goals for the next five years are:

- The plan for the five-year project involves two projects that deal with potassium nutrition, one with transpiration in two crop plants, rice and durum wheat and one on PGPR rhizobia on root hair development and plant nutrition. The structure-function analysis of HKT transporters is a highly interesting project and the preliminary work performed is excellent and it is therefore likely that this part of the five-year plan will be successful. In this case it can be predicted that this work can be published in a very high-impact journal. In former times mycorrhiza were thought to be only important for phosphate nutrition, nowadays we know that this is not the case and that mycorrhiza are important for the uptake of many nutrients and plant stress resistance. Therefore, the project where potassium nutrition through endomycorrhiza and the response of the plant to Na⁺ tolerance will be investigated is an important project. This is underlined by the fact that due to watering more and more soils get higher in sodium content, which can be toxic to plants. These results may not only help to understand better the relationship between plant, mycorrhiza, potassium and sodium but also to get hints under which conditions and in a near future with which mycorrhiza plants can be grown under stress conditions.

Drought is an environmental stress factor that will become more and more severe. Knowing markers and simple phenotypic characteristics to recognize drought stress will be helpful for an efficient watering regime. The analysis of leaf rolling at the phenotypic and molecular/physiological scale may not only provide results to understand better water stress in rice and durum wheat but have also an application in agriculture.

The team was implicated in developing high resolution imaging techniques to visualize root structures and root hairs in 2 to 3 week old cereals. They will take advantage of this progress to analyze the role of PGPR rhizobia on root hair development and plant nutrition. It is known that the microbiome plays an important role in plant nutrition and root development, but so far only few studies could address this question with such a resolution. Therefore, it is expected that this study will provide new data to interpret specific plant-microbia interaction.

Weaknesses

The projects are quite ambitious and hence there is a demand for high competence. The Panel fully trusts the group leaders, but it is important to recruit the best young scientists to successfully address the scientific questions. Furthermore, since this field is highly competitive it would be desirable that the team could recruit at least one, better two, post-docs. Special attention should thus be given to attract additional funding.

There is no dramatic weakness. Maybe one point is that there are very diverse aspects for a rather small team. As mentioned before the projects are ambitious and require enough woman/man power. Maybe for the second project (Stomatal movement and leaf rolling) there is the risk that they will stick at the descriptive aspects and thus not identify the real functions.

Assessment of the scientific strategy and projects

The five-year plan was assessed as very good. The very diverse projects need a strong financial basis.

RECOMMENDATIONS TO THE TEAM 5

A – Recommendations on scientific production and activities for the team 5 (criterion 1)

The team should find a good balance between supporting young scientists from other laboratories and not be disturbed in progressing in their work. In addition, commitment to secure publications of PhD students as first author should be strengthened.

B – Recommendations on the team's 5 organisation and life (criterion 2)

Not assessed.

C – Recommendations on scientific strategy and projects for the team 5 (criterion 3)

The team is well organized. Different subgroups are responsible for the different projects but there is also some overlap that facilitates communication

The team should be aware that the working load of the entire five-year plan is large. If the team cannot attract new scientists or if progress concerning one or two projects proves to be slow, it will be desirable to join forces and reduce the number of projects.

TEAM 6

KaliPHruit

TEAM 6 LEADER

Ms Isabelle Gaillard

TEAM 6 SCIENTIFIC DOMAIN

The team KaliPHruit conducts a combination of fundamental and translational research, aiming at a mechanistic understanding of the molecular basis of potassium ion accumulation in plant cells. Potassium ion transport and accumulation is essential for a multitude of processes in plant cells, including the building of turgor pressure that drives cell growth and as counter ion of inorganic and organic cations. The team attempts to dissect the complex network of multiple channels and transporters and to put them into a functional context. Knowledge generated through analyses in the genetically tractable model *Arabidopsis thaliana* informs translational research on the role of potassium fluxes and accumulation during grape berry development.

TEAM'S 6 RESPONSE TO PREVIOUS RECOMMENDATIONS

No specific text referring to previous recommendations was identified in the reviewing materials.

TEAM 6 WORKFORCE

T6: KaliPHruit		
Active staff	Number 06/30/2019	Number 01/01/2021
Full professors and similar positions		
Assistant professors and similar positions		
Full time research directors (Directeurs de recherche) and similar positions	2	2
Full time research associates (Chargés de recherche) and similar positions	1	1
Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.")		
High school teachers		
Supporting personnel (ITAs, BIATSSs and others, notably of EPICs)		
Permanent staff	3	3
Non-permanent professors and associate professors, including emeritus		
Non-permanent full time scientists, including emeritus, post-docs (except PhD students)		
PhD Students	2	
Non-permanent supporting personnel		
Non permanent staff	2	

Total	5	3
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CRITERION 1: QUALITY OF SCIENTIFIC OUTPUTS AND ACTIVITIES OF TEAM 6

A - Scientific outputs and activities, academic collaborations, reputation and appeal

From 01/01/2014 to 06/30/2019	Team 6
Articles	
Scientific articles (total number)	12
Scientific articles with first and/or last authorship	5
Review articles (total number)	4
Other articles (professional journals, etc.) (total number)	2
Commentaries on judgements	
Clinical articles	
Books	
Monographs, critical editions, translations (total number)	
Management and coordination of scientific books / Scientific book edition	
Management and coordination of scientific books / Scientific book edition in English or another foreign language	
Book chapters (total number)	
Book chapters in English or another foreign language	
Edited theses	
Production in conferences / congresses and research seminars	
Meeting abstracts	
Articles published in conference proceedings / congress	
Other products presented in symposia / congress and research seminars	13
Electronic tools and products	
Softwares	
Databases	
Tools for decision making	
Cohorts	
Instruments and methodology	
Prototypes	
Platforms and observatories	
Other products	
Theorised artistic creations, staging, movies	

Editorial activities	
Participation in editorial committees (books, collections, etc.)	1
Collection and series management	
Reviewing activities	
Reviewing of articles	6-8/year
Grant evaluation (public or charities)	2
Reviewing of research institutes	
Participation in institutional committees and juries (CNRS, Inserm, etc.)	4
Academic research grants	
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – coordination	0
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – partnership	0
Other European grants - coordination	0
Other European grants - partnership	0
National public grants (ANR, PHRC, FUI, INCA, etc.) - coordination	2
National public grants (ANR, PHRC, FUI, INCA, etc.) - partnership	0
Local grants (collectivités territoriales) - coordination	1
Local grants (collectivités territoriales) - partnership	0
PIA (labex, equipex etc.) grants - coordination	0
PIA (labex, equipex etc.) grants - partnership	2
Grants from foundations and charities (ARC, FMR, FRM, etc.) - coordination	0
Grants from foundations and charities (ARC, FMR, FRM, etc.) - partnership	0
Visiting senior scientists and post-docs	
Post-docs (total number)	1
Foreign post-docs	1
Visiting scientists (total number)	0
Foreign visiting scientists	0
Scientific recognition	
Prizes and/or distinctions	
IUF members	
Chair of learned and scientific societies	
Organisations of meetings and symposia (out of France)	
Invitations to meetings and symposia (out of France)	2
Members' long-term visits abroad	

Strengths

The team has long-standing, deep expertise in the biophysics and physiology of Shaker-type potassium channels. The team employs a clever combination of fundamental and translational research, taking advantage of the model system *Arabidopsis* and attempting to translate the gained knowledge to grape vine. As specific recent example is the establishment of a plasma-membrane tethered genetically-encoded pH-sensor in *Arabidopsis* roots, now followed by translation to grape berries, using a transient transformation system. The team publishes regularly in the best journals as corresponding authors, such as the recent work on the role of Shaker channels in grape berry potassium loading (*New Phytol*), and occasionally also in interdisciplinary journals, such as the work on the membrane-tethered genetically encoded pH sensor in *PNAS*. The team acquires extramural funding and is currently coordinating one ANR grant. The team is involved in a good number of collaborations at the local, national, and international levels. The team is able to attract a very good number of PhD students and members of the team are invited for presentations, mostly at the national level.

Weaknesses

Research on the perennial crop grape vine is relatively slow and genetic manipulation is non-trivial. Genetics is not straightforward, although the approach using mapping populations obtained by crosses of grape varieties might at least partially help with overcoming this concern. While this work is highly relevant and timely with respect to understanding the effects of climate change on grape berry physiology, the limited resources available to the team make it difficult to gain international competitiveness in translational research. While the quality of publications is very good, quantitatively the output of 12 publications given the size of the team is moderate. Further, the team runs the risk of losing impact by lack of coherence between sub-projects.

Assessment of scientific outputs, reputation and appeal

The team overall performs very good, with some excellent aspects, such as the work on development and application of a genetically encoded pH-sensor.

B – Interactions with the non-academic world, impacts on economy, society, culture or health

From 01/01/2014 to 06/30/2019	Team 6
Socio-economic interactions / patents	
Invention disclosures	0
Filed patents	2
Accepted patents	0
Licensed patents	0
Socio-economic interactions	
Industrial and R&D contracts	0
Cifre fellowships	0
Creation of labs with private-public partnerships	0
Networks and mixed units	0
Start-up	0
Clinical trials	0
Expertise	
Consulting	

Participation in expert committees (ANSES etc.)	
Legal expertise	
Expert and standardization reports	
Public outreach	
Radio broadcasts, TV shows, magazines and newspapers	
Journal articles, interviews, book edition, videos, other popularization outputs, debates on science and society, etc.	

Strengths

Research on grape berry metabolism and physiology in the context of climate change is certainly of general interest beyond the academic world.

Weaknesses

No interactions of the team with the non-academic world have been documented in the reviewing materials. This is difficult to understand since the research topics of the team should be of interest to economy and society.

Assessment of the interactions with the non-academic world

The achievements to date in this field was assessed as fair by the evaluation committee. No significant effort in this direction was recognizable.

C – Involvement in training through research

From 01/01/2014 to 06/30/2019	Team 6
Educational outputs	
Books	
E-learning, MOOCs, multimedia courses, etc.	
Scientific productions (articles, books, etc.) from theses	
Scientific productions (articles, books, etc.) from theses	3
Mean number of publications per student	2
Training	
Habilitated (HDR) scientists	3
HDR obtained during the period	0
PhD students (total number)	2
PhD students benefiting from a specific doctoral contract	2
Defended PhDs	0

Mean PhD duration	0
Internships (M1, M2)	6
People in charge for a mention or a master's degree course (total number)	
People in charge for a mention or a master's degree course with international certification (Erasmus mundus)	

Strengths

The research supervision capacity of the team involved 3 HDR (2 DR, 1 CR). In addition, KhaliPHruit training capacity included one post-doc (2 man-year).

The team currently hosts two PhD students. The ongoing PhDs have not published yet (as of June 2019) as first authors. Nevertheless one of the students has published two papers as co-author. This is only mildly surprising since the team was created in 2015. The team attracts frequently Master 1 and Master 2 students.

Weaknesses

Only one PhDs has been defended.

Assessment of the involvement in training through research

The team accomplished a very good activity in training through research, as far as can be assessed for this newly created team. Two students have started a PhD in the lab. In addition, the team is now very active at training master students and this will be an asset for future PhD student hiring.

CRITERION 2: TEAM 6 ORGANISATION AND LIFE

This criterion is assessed at the unit level.

CRITERION 3: FIVE-YEAR PROJECT AND STRATEGY FOR TEAM 6

Strengths

Overall, the team has identified a timely and ambitious research project that spans the scale from molecular mechanisms to translational aspects in grape berry fruits. The research program builds on the team's long-term expertise in ion channel biophysics and cell biology. The incorporation of genetically-encoded sensors into the research program is ambitious and, if successful, will take the team's research to a new level.

Weaknesses

Achieving scientific breakthroughs in the grape berry system will be challenging, given the team's limited resources in terms of staff and extramural funding. Further, the less-than-ideal toolbox for molecular research for this perennial crop may negatively impact the chances for success of the research plan. The coherence between the team's different research objectives is not particularly strong, which limits potential for synergistic activities between team members.

Assessment of the scientific strategy and projects

The team's scientific strategy and projects are very good.

RECOMMENDATIONS TO THE TEAM 6

A – Recommendations on scientific production and activities for the team 6 (criterion 1)

The team would benefit from integrating expertise on metabolism and computational modelling, either through additional collaborations or by recruiting based on additional extramural funding. Future progress will hinge on integration of biophysics and biochemistry of ion channels with a deeper understanding of their functions in a physiological and cellular context. Overall, the extramural funding of the team must increase, otherwise it will be difficult to continue research at an international competitive level.

B – Recommendations on the team's 6 organisation and life (criterion 2)

Not assessed.

C – Recommendations on scientific strategy and projects for the team 6 (criterion 3)

A better understanding of potassium homeostasis in grape berries will require a comprehensive modelling approach that integrates metabolism with ion, charge, and pH balancing between and within cells. Only with a solid modelling framework will it become possible to make meaningful predictions and span scales from genetics to physiology. The team may want to consider a streamlining of its research tracks to increase coherence and maximize synergies. While the ambitious and risk-taking approaches on grape berry are appreciated, the team should continue to take advantage of established plant model systems, such as Arabidopsis

TEAM 7

Metal Mobility (MeMo)

TEAM 7 LEADER

Ms Catherine Curie

TEAM 7 SCIENTIFIC DOMAIN

The team is focusing its work on the mechanisms responsible for Fe and Mn homeostasis. They investigate i) the process of Fe entry in the embryo during development ; ii) the characterization of a root low affinity Fe transporter and iii) the role of Fe ligands by identifying the role of phytate in Fe distribution and storage in seeds, as well as the role of nicotianamine in Fe mobility in the non-vascular plant *Physcomitrella patens*. Through a GWAS approach iv) the team is analysing Arabidopsis accessions to identify genetic determinants of the remobilization of Fe stores during germination. Furthermore, in 2015 v) the team started a research project with an industrial partner to investigate the impact of agropolymers on plant hydro-mineral nutrition.

TEAM'S 7 RESPONSE TO PREVIOUS RECOMMENDATIONS

In 2015 during the previous evaluation only one researcher of the team had the HDR and the committee encouraged the team to get at least one more HDR to increase the potential number of thesis supervision. This recommendation was met, one member of the team got the HDR in 2014. In addition, despite the excellent evaluation, taking in consideration the available working force the committee of experts suggested to pay attention to the number of research topics and find the good balance between the studies on Fe homeostasis and Mn homeostasis. However, the increase in staff achieved by the team gave it the opportunity to develop both research lines.

TEAM 7 WORKFORCE

T7: Metal Mobility (Iron Transport and Signaling)		
Active staff	Number 06/30/2019	Number 01/01/2021
Full professors and similar positions		
Assistant professors and similar positions		1
Full time research directors (Directeurs de recherche) and similar positions	2	2
Full time research associates (Chargés de recherche) and similar positions	3	3
Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.")		
High school teachers		
Supporting personnel (ITAs, BIATSSs and others, notably of EPICs)	3	3
Permanent staff	8	9
Non-permanent professors and associate professors, including emeritus		
Non-permanent full time scientists, including emeritus, post-docs (except PhD students)	1	

PhD Students	1	
Non-permanent supporting personnel	1	
Non permanent staff	3	
Total	11	9

CRITERION 1: QUALITY OF SCIENTIFIC OUTPUTS AND ACTIVITIES OF TEAM 7

A - Scientific outputs and activities, academic collaborations, reputation and appeal

From 01/01/2014 to 06/30/2019	Team 7
Articles	
Scientific articles (total number)	9
Scientific articles with first and/or last authorship	3
Review articles (total number)	2
Other articles (professional journals, etc.) (total number)	2
Commentaries on judgements	
Clinical articles	
Books	
Monographs, critical editions, translations (total number)	
Management and coordination of scientific books / Scientific book edition	
Management and coordination of scientific books / Scientific book edition in English or another foreign language	
Book chapters (total number)	
Book chapters in English or another foreign language	
Edited theses	
Production in conferences / congresses and research seminars	
Meeting abstracts	
Articles published in conference proceedings / congress	
Other products presented in symposia / congress and research seminars	43
Electronic tools and products	
Softwares	
Databases	
Tools for decision making	
Cohorts	
Instruments and methodology	

Prototypes	
Platforms and observatories	
Other products	
Theorised artistic creations, staging, movies	
Editorial activities	
Participation in editorial committees (books, collections, etc.)	1
Collection and series management	
Reviewing activities	
Reviewing of articles	12/year
Grant evaluation (public or charities)	3/year
Reviewing of research institutes	
Participation in institutional committees and juries (CNRS, Inserm, etc.)	2
Academic research grants	
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – coordination	0
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – partnership	0
Other European grants - coordination	0
Other European grants - partnership	0
National public grants (ANR, PHRC, FUI, INCA, etc.) - coordination	4
National public grants (ANR, PHRC, FUI, INCA, etc.) - partnership	1
Local grants (collectivités territoriales) - coordination	0
Local grants (collectivités territoriales) - partnership	0
PIA (labex, equipex etc.) grants - coordination	0
PIA (labex, equipex etc.) grants - partnership	1
Grants from foundations and charities (ARC, FMR, FRM, etc.) - coordination	0
Grants from foundations and charities (ARC, FMR, FRM, etc.) - partnership	0
Visiting senior scientists and post-docs	
Post-docs (total number)	4
Foreign post-docs	3
Visiting scientists (total number)	5
Foreign visiting scientists	4
Scientific recognition	
Prizes and/or distinctions	
IUF members	
Chair of learned and scientific societies	
Organisations of meetings and symposia (out of France)	

Invitations to meetings and symposia (out of France)	8
Members' long-term visits abroad	

Strengths

Team 7 is now composed of 5 researchers (3 CNRS and 2 INRA) and 1 assistant professor; plus 1 technician, 0.5 ETP University technician and 0.5 ETP engineer. As a result its strength is much more on the research side than on the training/teaching side. Of interest is that during this evaluation period 4 researchers have joined the team demonstrating the capacity of the team to attract scientists.

During the past 5 years team 7 published 9 excellent scientific articles (*i.e.* *Plant Cell*, *PNAS*, *New Phytologist*) with an average IF = 5.37. Three of them with corresponding author and last authorship (average IF = 5.45). The level of the journal in which they publish is overall high. The work output is thus scientifically very good with several excellent papers, and the team shows complementary expertise in Biochemistry, Molecular Genetics, Plant Physiology and Omics Sciences.

The strength of the team has also been demonstrated through invitation to prestigious international symposia such as "Iron Symposium on iron Nutrition and Interactions in Plants", and national symposia in addition to selected oral presentations and seminars in foreign institutions. Furthermore, the outstanding scientific skill is demonstrated by the capacity to attract researchers in the team and, grants (3 ANR with a member of the team as coordinator and 1 in partnership in addition to 2 PIA grants with member of the team as coordinators). The outstanding level of the team is also demonstrated by the presence of foreign post-docs and visiting scientists as well as through the establishment of collaborations with well-known research team around the world.

Weaknesses

Despite the excellent productivity and international recognition for the scientific output and the innovative work the main source of funding during the past 5 years was national. It is plausible that the recent arrival of new researchers and the presence of foreign post-docs and visiting scientists will help in reaching international funding. On the other hand, the team is solid and does not show real weakness.

Assessment of scientific outputs, reputation and appeal

The team has very good output with two excellent publications. The ability in attracting funding is also excellent. The participation to international congress/symposia is particularly excellent.

B – Interactions with the non-academic world, impacts on economy, society, culture or health

From 01/01/2014 to 06/30/2019	Team 7
Socio-economic interactions / patents	
Invention disclosures	
Filed patents	
Accepted patents	
Licensed patents	
Socio-economic interactions	
Industrial and R&D contracts	3
Cifre fellowships	0

Creation of labs with private-public partnerships	0
Networks and mixed units	0
Start-up	0
Clinical trials	0
Expertise	
Consulting	
Participation in expert committees (ANSES etc.)	
Legal expertise	
Expert and standardization reports	
Public outreach	
Radio broadcasts, TV shows, magazines and newspapers	
Journal articles, interviews, book edition, videos, other popularization outputs, debates on science and society, etc.	5/year

Strengths

The team managed to obtain 3 contracts with industrial partners. In addition, one member of the team has participated in the "Fête de la science", whereas others have been vigorously active on scientific popularization events (in colleges, primary school and other social event related to science).

Weaknesses

The unit has recently seen the arrival of 4 scientists. Therefore, they can devote now a little more time to improve their public outreach activities

Assessment of the interactions with the non-academic world

The team shows excellent interaction with the non-academic world. In particular excellence in translation research is indicated by the participation in a consortium with an industrial partner and by the presence of industrial funding. Furthermore, excellence is demonstrated by interactions with schools, colleges and in participation in social events to present and discuss scientific topics.

C – Involvement in training through research

From 01/01/2014 to 06/30/2019	Team 7
Educational outputs	
Books	
E-learning, MOOCs, multimedia courses, etc.	
Scientific productions (articles, books, etc.) from theses	
Scientific productions (articles, books, etc.) from theses	3

Mean number of publications per student	
Training	
Habilitated (HDR) scientists	2
HDR obtained during the period	1
PhD students (total number)	3
PhD students benefiting from a specific doctoral contract	3
Defended PhDs	1
Mean PhD duration	38
Internships (M1, M2)	5
People in charge for a mention or a master's degree course (total number)	
People in charge for a mention or a master's degree course with international certification (Erasmus mundus)	

Strengths

The number of scientists with an HDR has increased from 1 to 2 during the period. Two students are doing their thesis in the team.

Weaknesses

Only one PhD defended (2015) in the period (1 paper in revision).

No involvement in teaching reported.

Assessment of the involvement in training through research

Training through research is ranked good.

CRITERION 2: TEAM 7 ORGANISATION AND LIFE

This criterion is assessed at the unit level.

CRITERION 3: FIVE-YEAR PROJECT AND STRATEGY FOR TEAM 7

Strengths

The five-year project is very much in the continuation and development of the previous findings, and will benefit of the presence of additional scientists. The available grants and contracts with industrial partners will ensure the possibility to complete the research according to the five-year plan. The project is very ambitious and convincing. Strength of the team is the presence of scientists with complementary expertise essential to reach the goals. They will continue the investigation on low affinity Fe transport by using different genetic screens, and the study of Fe homeostasis in the seeds. Furthermore, part of the team will be particularly dedicated to investigate Fe speciation (using two model species: *Arabidopsis* and *Physcomitrella patens*). The team is well recognized in the iron community. The unit will proceed with the Mn homeostasis by investigating the translocation of Mn to seeds, with the goal of deciphering the Mn-dependent post-translational regulation of NRAMP1. Projects on climate change and impact on plant yield and nutrition -particularly on crops- is very relevant and up-to-day.

The new presence of scientists devoted to quantitative genetics and cell biology and ion imaging will surely greatly benefit the work of the team. Very positive are also the collaborations with biophysicians and analytical chemists to pursue the objectives.

Weaknesses

New scientists have joined the team during this evaluation time, this will help to develop the five-year project. The team is solid and it appears that they can efficiently work together. However, a weakness may be represented by a small number of PhD students in relation to the number of researchers. In addition, no specific attention has been paid by the team in their plan to maintain or increase their otherwise excellent level of social-economic interactions and public outreach.

Assessment of the scientific strategy and projects

The scientific strategy is very ambitious, Overall the team presented a very good plan with several excellent aspects.

RECOMMENDATIONS TO THE TEAM 7

A – Recommendations on scientific production and activities for the team 7 (criterion 1)

The scientific approaches were excellent and have led to interesting results. The diversity of objectives has nevertheless required specific competences. It can be beneficial to interact with other teams of BPMP. International funding (coordination of international conferences, networks etc.) may be improved.

Encouraging staff to get the HDR degree would help to maintain student supervision.

B – Recommendations on the team's 7 organisation and life (criterion 2)

N/A.

C – Recommendations on scientific strategy and projects for the team 7 (criterion 3)

The scientific strategy is close to excellent as it stands. More effort should be directed in order to reach international funding.

TEAM 8

Mineral Nutrition and Oxidative Stress (FeROS)

TEAM 8 LEADER

Mr Christian Dubos

TEAM 8 SCIENTIFIC DOMAIN

The FeROS team focuses on deciphering the molecular mechanisms that participate to the regulation and to the maintenance of Fe homeostasis.

TEAM'S 8 RESPONSE TO PREVIOUS RECOMMENDATIONS

The FeROS team implemented a number of actions in response to recommendations received after the previous visit. They have maintained a critical mass of researchers while increasing necessary skills. They have been successful in obtaining funding beyond the ANR at both local (Labex Agro & iSITE MUSE) and Institution (INRA BAP) levels. They have begun knowledge transfer to a species of agronomic interest by initiating studies with tomato where they benefit from connections with experts from INRA Avignon & INRA Bordeaux.

TEAM 8 WORKFORCE

T8: Mineral Nutrition and Oxydative Stress		
Active staff	Number 06/30/2019	Number 01/01/2021
Full professors and similar positions		1
Assistant professors and similar positions		
Full time research directors (Directeurs de recherche) and similar positions	1	1
Full time research associates (Chargés de recherche) and similar positions	3	4
Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.")		
High school teachers		
Supporting personnel (ITAs, BIATSSs and others, notably of EPICs)	2	3
Permanent staff	6	9
Non-permanent professors and associate professors, including emeritus		
Non-permanent full time scientists, including emeritus, post-docs (except PhD students)		
PhD Students	4	
Non-permanent supporting personnel		
Non permanent staff	4	

Total	10	9
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CRITERION 1: QUALITY OF SCIENTIFIC OUTPUTS AND ACTIVITIES OF TEAM 8

A - Scientific outputs and activities, academic collaborations, reputation and appeal

From 01/01/2014 to 06/30/2019	Team 8
Articles	
Scientific articles (total number)	10
Scientific articles with first and/or last authorship	5
Review articles (total number)	8
Other articles (professional journals, etc.) (total number)	3
Commentaries on judgements	0
Clinical articles	0
Books	
Monographs, critical editions, translations (total number)	0
Management and coordination of scientific books / Scientific book edition	1
Management and coordination of scientific books / Scientific book edition in English or another foreign language	0
Book chapters (total number)	3
Book chapters in English or another foreign language	3
Edited theses	0
Production in conferences / congresses and research seminars	
Meeting abstracts	0
Articles published in conference proceedings / congress	0
Other products presented in symposia / congress and research seminars	44
Electronic tools and products	
Softwares	0
Databases	0
Tools for decision making	0
Cohorts	0
Instruments and methodology	
Prototypes	0
Platforms and observatories	0
Other products	
Theorised artistic creations, staging, movies	0

Editorial activities	
Participation in editorial committees (books, collections, etc.)	0
Collection and series management	0
Reviewing activities	
Reviewing of articles	12-18/year
Grant evaluation (public or charities)	27
Reviewing of research institutes	0
Participation in institutional committees and juries (CNRS, Inserm, etc.)	9
Academic research grants	
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – coordination	1
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – partnership	0
Other European grants - coordination	0
Other European grants - partnership	0
National public grants (ANR, PHRC, FUI, INCA, etc.) - coordination	5
National public grants (ANR, PHRC, FUI, INCA, etc.) - partnership	2
Local grants (collectivités territoriales) - coordination	0
Local grants (collectivités territoriales) - partnership	0
PIA (labex, equipex etc.) grants - coordination	1
PIA (labex, equipex etc.) grants - partnership	1
Grants from foundations and charities (ARC, FMR, FRM, etc.) - coordination	0
Grants from foundations and charities (ARC, FMR, FRM, etc.) - partnership	0
Visiting senior scientists and post-docs	
Post-docs (total number)	2
Foreign post-docs	0
Visiting scientists (total number)	6
Foreign visiting scientists	3
Scientific recognition	
Prizes and/or distinctions	0
IUF members	0
Chair of learned and scientific societies	0
Organisations of meetings and symposia (out of France)	0
Invitations to meetings and symposia (out of France)	9
Members' long-term visits abroad	0

Strengths

While the FeROS team has undergone several personnel changes over the last 5 years (2 retirements, 5 arrivals with 2 having already left during the period) it has managed to make significant advances in each of their three major research topics that have been published in excellent plant journals including *Plant Cell*, *Molecular Plant*, *New Phytology*, *Plant Physiology* and *Journal of Experimental Biology*.. ILR3 has been shown to be a central regulator of Fe homeostasis and a new interactor IPI1 was discovered (recently accepted for publication in *Plant Cell*). PDR9 was identified as a coumarin transporter in roots and a tight connection was shown with the high affinity IRT1/FRO2 uptake machinery. The Fe-S carrier protein NUF2 was found to be required for normal root development and associated with the biosynthesis of branched-chain amino acids via a DHAD protein. All of the three axes involve collaborations (local, national & international) and funding mainly at local (LabEx Agro/iSITE MUSE) & national (BAP INRA/ANR/CARNOT PLANT2PRO) levels although FeROS has an ongoing International exchange contract (ECOS SUD-CONICYT) with H. Roschztardt (Chile) to study the transcriptional regulation of Fe homeostasis in seeds. Over the evaluation period, the FeROS team have welcomed 3 foreign visiting scientists from Chile and Taiwan. Members of FeROS have a high degree of complementarity in both skills & knowledge & a long standing expertise in plant Fe nutrition.

Weaknesses

Over the last 5-year period, the FeROS publication record has been rather low with only 10 research papers mentioned and only 50% of them associated with team member leadership (deduced from corresponding authorship/number & position in the author list). It appears that invitations to International meetings was quite low and mainly in small specialized symposia/workshops.

Assessment of scientific outputs, reputation and appeal

The FeROS team conducts very good research validated with some excellent original. The reputation and appeal of the team is good and their ability to obtain funding was seen to be very good.

B – Interactions with the non-academic world, impacts on economy, society, culture or health

From 01/01/2014 to 06/30/2019	Team 8
Socio-economic interactions / patents	
Invention disclosures	
Filed patents	
Accepted patents	
Licensed patents	
Socio-economic interactions	
Industrial and R&D contracts	0
Cifre fellowships	0
Creation of labs with private-public partnerships	0
Networks and mixed units	0
Start-up	0
Clinical trials	0
Expertise	

Consulting	0
Participation in expert committees (ANSES etc.)	0
Legal expertise	0
Expert and standardization reports	0
Public outreach	
Radio broadcasts, TV shows, magazines and newspapers	0
Journal articles, interviews, book edition, videos, other popularization outputs, debates on science and society, etc.	1

Strengths

Although rather limited, the FeROS team has produced a video associated with a review paper on Fe nutrition, biomass & plant quality that can be found on the TV channel of the University of Montpellier & Youtube. A former team member coedited a book about the agroecology before he retired. A FeROS team member is an expert for the HR excellence label since 2018.

Weaknesses

The FeROS team has no links/contracts with private partners although the development of a project with a private company in the framework of an ANR LabCom call in 2019 was briefly mentioned. Team members do not appear to be involved in many public outreach events.

Assessment of the interactions with the non-academic world

Interactions with the non-academic world were considered to be very good for public outreach and good for engagement with industrial partners.

C – Involvement in training through research

From 01/01/2014 to 06/30/2019	Team 8
Educational outputs	
Books	0
E-learning, MOOCs, multimedia courses, etc.	0
Scientific productions (articles, books, etc.) from theses	
Scientific productions (articles, books, etc.) from theses	8
Mean number of publications per student	3
Training	
Habilitated (HDR) scientists	4
HDR obtained during the period	2
PhD students (total number)	5

PhD students benefiting from a specific doctoral contract	5
Defended PhDs	1
Mean PhD duration	38
Internships (M1, M2)	7
People in charge for a mention or a master's degree course (total number)	0
People in charge for a mention or a master's degree course with international certification (Erasmus mundus)	0

Strengths

The research supervision capacity of the team involved 5 HDR (1 DREX, 1DR, 3 CR) but two (1 DREX, 1 CR) of them retired during the period. In addition, FeROS training capacity included 2 CR and one invited professor (1 man-year). One PhD student defended his thesis during the period after a normal 38 month thesis duration and published one first author and one co-author paper. The first authored publication was in *New Phytol* an excellent (top) journal in Plant Biology. However, a new dynamic was started in 2017 with the recruitment of 4 students.

Weaknesses

The number of defended PhDs during the last period is low.

No member of this team seems to be involved in teaching, either as a teacher or as a module manager.

Assessment of the involvement in training through research

The global past activity was good.

CRITERION 2: TEAM 8 ORGANISATION AND LIFE

This criterion is assessed at the unit level.

CRITERION 3: FIVE-YEAR PROJECT AND STRATEGY FOR TEAM 8

Strengths

The proposed scientific strategy is coherent with the existing research topics developed by the FeROS team and the proposed research is clear and justified. The topic dedicated to transcriptional regulation of Fe homeostasis aims to fully decipher the molecular mechanisms dependent on ILR3 activity on gene reprogramming in the context of Fe availability in both roots and leaves. This will include the development of investigating systemic signals dictating root responses to Fe. The same permanent staff will also continue to study the transport and storage of coumarins in the root by precisely depicting coumarin trafficking within root cells. The challenge in the topic dealing with Fe-S cluster biogenesis will be to characterize HCF101 that is essential for photosynthetic performance by identifying new HCF101 targets. A second task will be to better understand GRX-BolA function in Fe homeostasis. Finally, redox regulation of Fe-S assembly machineries in connection with environmental changes will be studied.

Weaknesses

A lack of finance may handicap the advancement of the proposed projects as most current grants end in 2020. Although mentioned in the research activities section, the effect of coumarins in shaping microbiome communities was not proposed as a future scientific orientation even though this was associated with potential grant applicants. Although a need to improve work on crop plants was mentioned in the FeROS SWOT analysis,

this was missing from the strategies described in the written report although briefly mentioned in the oral presentation.

Assessment of the scientific strategy and projects

The FeROS team proposes a good scientific strategy and project with some very good novel aspects such as the development of systemic signalling and the impact of climate change on Fe homeostasis.

RECOMMENDATIONS TO THE TEAM 8

A – Recommendations on scientific production and activities for the team 8 (criterion 1)

The FeROS team must try to improve its scientific productivity while maintaining its excellent quality and continue in their funding efforts with a critical choice of collaborators and the transfer of knowledge gained using Arabidopsis to crop plants. Attendance at International and National conferences/congresses could be improved so as to increase team visibility.

B – Recommendations on the team's 8 organisation and life (criterion 2)

Not assessed.

C – Recommendations on scientific strategy and projects for the team 8 (criterion 3)

Efforts should be continued to maintain/improve the team workforce by reducing departures and transient stays while trying to attract new arrivals including students and post-docs.

Established collaborations should be used to construct grant proposals to finance the proposed FeROS team research strategies. The transfer of FeROS knowledge to improve Fe homeostasis in crop plants should be strengthened.

TEAM 9

Water, signaling and hydraulic architecture (Aqua)

TEAM 9 LEADER

Mr Christophe Maurel

TEAM 9 SCIENTIFIC DOMAIN

The Aquaporin team studies the molecular processes that underpin water flow through the plant (hydraulics) and their regulation in response to environmental and developmental signals. Given that fresh water is a limited resource and that drought/flooding events are occurring with increasing frequency, this topic is of fundamental importance for humankind.

TEAM'S 9 RESPONSE TO PREVIOUS RECOMMENDATIONS

Not assessed.

TEAM 9 WORKFORCE

T9: Water, signaling and hydraulic architecture (Aquaporins)		
Active staff	Number 06/30/2019	Number 01/01/2021
Full professors and similar positions		
Assistant professors and similar positions		
Full time research directors (Directeurs de recherche) and similar positions	2	2
Full time research associates (Chargés de recherche) and similar positions	4	5
Other scientists ("Conservateurs, cadres scientifiques des EPIC, fondations, industries, etc.")		
High school teachers		
Supporting personnel (ITAs, BIATSSs and others, notably of EPICs)	2	2
Permanent staff	8	9
Non-permanent professors and associate professors, including emeritus		
Non-permanent full time scientists, including emeritus, post-docs (except PhD students)	1	
PhD Students	2	
Non-permanent supporting personnel	1	
Non permanent staff	4	
Total	12	9

CRITERION 1: QUALITY OF SCIENTIFIC OUTPUTS AND ACTIVITIES OF TEAM 9

A - Scientific outputs and activities, academic collaborations, reputation and appeal

From 01/01/2014 to 06/30/2019	Team 9
Articles	
Scientific articles (total number)	31
Scientific articles with first and/or last authorship	18
Review articles (total number)	5
Other articles (professional journals, etc.) (total number)	3
Commentaries on judgements	
Clinical articles	
Books	
Monographs, critical editions, translations (total number)	
Management and coordination of scientific books / Scientific book edition	
Management and coordination of scientific books / Scientific book edition in English or another foreign language	1
Book chapters (total number)	6
Book chapters in English or another foreign language	6
Edited theses	
Production in conferences / congresses and research seminars	
Meeting abstracts	
Articles published in conference proceedings / congress	1
Other products presented in symposia / congress and research seminars	84
Electronic tools and products	
Softwares	2
Databases	
Tools for decision making	
Cohorts	
Instruments and methodology	
Prototypes	
Platforms and observatories	2
Other products	
Theorised artistic creations, staging, movies	
Editorial activities	
Participation in editorial committees (books, collections, etc.)	1

Collection and series management	
Reviewing activities	
Reviewing of articles	25-30 /year
Grant evaluation (public or charities)	10-12 / year
Reviewing of research institutes	1
Participation in institutional committees and juries (CNRS, Inserm, etc.)	4
Academic research grants	
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – coordination	3
European (ERC, H2020, etc.) and international (NSF, JSPS, NIH, World Bank, FAO, etc.) grants – partnership	1
Other European grants - coordination	2
Other European grants - partnership	0
National public grants (ANR, PHRC, FUI, INCA, etc.) - coordination	4
National public grants (ANR, PHRC, FUI, INCA, etc.) - partnership	1
Local grants (collectivités territoriales) - coordination	0
Local grants (collectivités territoriales) - partnership	0
PIA (labex, equipex etc.) grants - coordination	2
PIA (labex, equipex etc.) grants - partnership	1
Grants from foundations and charities (ARC, FMR, FRM, etc.) - coordination	0
Grants from foundations and charities (ARC, FMR, FRM, etc.) - partnership	0
Visiting senior scientists and post-docs	
Post-docs (total number)	8
Foreign post-docs	6
Visiting scientists (total number)	6
Foreign visiting scientists	6
Scientific recognition	
Prizes and/or distinctions	2
IUF members	
Chair of learned and scientific societies	
Organisations of meetings and symposia (out of France)	
Invitations to meetings and symposia (out of France)	9
Members' long-term visits abroad	

Strengths

There is no doubt that this team produces excellent science as documented in a considerable number of high-quality papers published over the reporting period (31 of which 21 as main authors) in leading journals, both in general science (*Nat Commun*, *Cell*, *PNAS*, *Elife*) and in plant science (*Plant Cell*, *Plant Physiology and Plant, Cell & Environment*, etc.). The team is quite big but the publication/ staff ratio is still very good. The high scientific productivity is evidence of a considerable additional post-doctoral workforce supported by grants both from the French national funding agency (3 ANR grants) and from the EU (2 MCS fellowships, 1 ERA-CAP and 1 ERC). Clearly this team has established a fruitful circle of funds being translated into excellent science and vice versa. One of the post-docs working with the team leader was awarded a prestigious prize (Major Advances in Biology 2017) from the French Academy of Science following publication of their paper in *Cell* (IF 36.2) and another prize from the French Academy of Science was awarded to the team leader in 2018.

The team has also established a long-term collaboration with industry (Syngenta) and is actively involved in technology and software development related to automated phenotyping platforms and high-throughput molecular interaction studies. These capacity-building activities make a strong contribution to the Institute infrastructure.

The research is very well structured. Activities are summarized under two major themes each encompassing several projects; (1) Cell signaling and aquaporin regulation (Aquaporin interactome, Aquaporin phosphorylation, Cell biology of aquaporins and osmotic signaling, Aquaporins and stomatal functions, Aquaporins and plant reproduction) and (2) Tissue hydraulics (Stimulus-induced regulation of root hydraulics, Endodermal barriers, Quantitative genetics and root hydraulics, Modelling and MRI, Root development). This structure reflects both an intensification of the effort to understand the molecular characteristics of aquaporins and a broadening of this topic into the wider context of plant tissues, e.g., root architecture. It is encouraging that each of the projects had outputs and that many of them involve successful collaborations with other scientists within the Institute and in other research institutions in Montpellier, France and abroad (e.g., UK, Germany).

There is a large portfolio of national and international conference participation of junior researchers: members of the team were regularly been invited to speak at international conferences (e.g., ICAR, Carnegie workshop, ICPMB) and younger members have been given an opportunity to present posters and attend workshops.

Weaknesses

There are no obvious weaknesses; this is a very strong team. One could point out that some of the research is very specific and sometime lacks the bigger question, but the team leader is clearly in the process of broadening the topic and integrating the specific molecular research into a wider context of both plant and environment. One aspect currently missing is the interaction with other plants (e.g., at root level) which could be of interest for the future. The report mentions a lack of in-house technical support, which has to certain extent been remedied through external funding, but could still limit progress in the future.

Assessment of scientific outputs, reputation and appeal

The scientific outputs, reputation and appeal of this team are outstanding.

B – Interactions with the non-academic world, impacts on economy, society, culture or health

From 01/01/2014 to 06/30/2019	Team 9
Socio-economic interactions / patents	
Invention disclosures	
Filed patents	
Accepted patents	
Licensed patents	

Socio-economic interactions	
Industrial and R&D contracts	2
Cifre fellowships	0
Creation of labs with private-public partnerships	0
Networks and mixed units	0
Start-up	0
Clinical trials	0
Expertise	
Consulting	
Participation in expert committees (ANSES etc.)	3
Legal expertise	
Expert and standardization reports	
Public outreach	
Radio broadcasts, TV shows, magazines and newspapers	8
Journal articles, interviews, book edition, videos, other popularization outputs, debates on science and society, etc.	3

Strengths

The team has established a long-term collaboration with an industry (Syngenta), and there is prospect that this collaboration will continue. The team is actively involved in technology and software development related to automated phenotyping platforms and high-throughput molecular interaction studies. These activities have not resulted in commercial outputs or patents but they build capacity and know-how in an area that is of great importance for research that directly benefits agriculture and industry, hence their support.

The topics of water, drought, flooding etc. are of global importance and of great interest to the public. It is good to see that the team actively engages with the public. They contributed to a public open day (Fascination of Plants), a workshop for high school students ('Fête en Sciences') and a public debate ('Feeding 9 billions'). The Cell publication was followed by excellent engagement activities including several interviews for radio channels (French and Suisse) and newspaper articles (la France Agricole, L'Humanité Dimanche) on the topic of flooding.

Weaknesses

Given the importance of the topic for food security one would expect more interaction with the agricultural sector. It is good to see that this has been realized and that the ERC grant and the strategic plan now include work on crops (maize). This should provide opportunities for engagement with breeders and agrotech companies.

Assessment of the interactions with the non-academic world

Interactions with the non-academic world are very good with some excellent components.

C – Involvement in training through research

From 01/01/2014 to 06/30/2019	Team 9
Educational outputs	
Books	
E-learning, MOOCs, multimedia courses, etc.	
Scientific productions (articles, books, etc.) from theses	
Scientific productions (articles, books, etc.) from theses	14
Mean number of publications per student	2.9
Training	
Habilitated (HDR) scientists	4
HDR obtained during the period	1
PhD students (total number)	6
PhD students benefiting from a specific doctoral contract	6
Defended PhDs	3
Mean PhD duration	38
Internships (M1, M2)	18
People in charge for a mention or a master's degree course (total number)	1
People in charge for a mention or a master's degree course with international certification (Erasmus mundus)	

Strengths

The research supervision capacity of the team involved 4 HDR (2 DR, 2 CR). One HDR (CR) moved to another team during the period. In addition, Aqua training capacity included 3 CR and several post-docs (16.3 man-year). Three theses were defended during the period. Each student has published at least one article as the primary author (>2 on average) in very good level journals. The number of researchers with HDR (5) is increasing. In total, 6 PhD students contributed to the research with an average 2.9 papers per student, which is very high.

Weaknesses

The report mentions only a few teaching activities which were restricted to only a single team member.

Assessment of the involvement in training through research

The activity of the team in training through research is excellent with 3 PhD defended each with a very good track of publication.

CRITERION 2: TEAM 9 ORGANISATION AND LIFE

This criterion is assessed at the unit level.

CRITERION 3: FIVE-YEAR PROJECT AND STRATEGY FOR TEAM 9

Strengths

The overall scientific strategy and the plan for the next 5 years are both visionary and realistic. The plan manages to combine continuity with novelty and vision. The team will build on its excellent expertise in hydraulics, aquaporins and signaling to expand into new research areas. A new name of the team 'Aqua: Water, signaling and hydraulic architecture' reflects the broadening of the research beyond aquaporins. The individual projects are still organized in the two main themes (now 'Perception and molecular signaling' and 'Root hydraulic architecture'), but they expand existing lines of research into new areas, such as membrane microdomains and biotic stresses, as well as mathematical modeling of 'hydraulic root architecture. The team also included a new model (maize), on which specific lines of research will be carried out to gain impact on this crop. In addition to the detailed plans regarding scientific topics the report summarizes plans for progress in three areas: methodological development, collaborations and succession. The proposed measures are excellent and will contribute to the future success of this team and its environment.

The plan is ambitious but feasible given the expected level of funding and staffing. Two of the five planned project in the Signaling theme are already funded with applications being prepared for the others, the Hydraulic theme is already fully funded by the ERC grant (until 2023). The healthy financial situation is mirrored in personnel expansion with a new permanent researcher joining the team who already has an ANR grant with a post-doc (until 2022).

Weaknesses

The strategic plan had no obvious weaknesses.

Assessment of the scientific strategy and projects

The strategic plan is excellent with outstanding components.

RECOMMENDATIONS TO THE TEAM 9

A – Recommendations on scientific production and activities for the team 9 (criterion 1)

The team should consider to widen the accessibility of their publications : while publications from this team are clearly of excellent/outstanding scientific quality they do not always achieve high level of citations. This could be due to the topic being very specific, the results that are difficult to apprehend or the wider context not being made clear to a non-specialist readership.

In addition to focusing on top-quality fundamental science we recommend the team to identify a few 'big questions' in the context of climate change and global water scarcity, and discuss how their research can be pooled to address at least one of these big questions even without the prospect of immediate publications.

There could still be more engagement with the agri-food sector: given the importance of irrigation, drought and flooding for food production this team should have a much larger portfolio of collaborations with stakeholders.

B – Recommendations on the team's 9 organisation and life (criterion 2)

Not assessed.

C – Recommendations on scientific strategy and projects for the team 9 (criterion 3)

The SWOT analysis is an honest representation of some potential weaknesses (lack of specific know-how, lack of technical support) and threats (some lack of proactive leadership in sub-teams) that they have been identified and thus can be addressed. There may not be a need to be entirely self-sufficient for all expertises (e.g., mathematical modelling) or technologies – working collaborations can be very useful and inspiring.

The panel understands that maize will primarily be used as a model for fundamental research. However, at some stage one may want to see some of the research moving from the exploratory to a predictive and potentially applicable level. We would therefore recommend the team to have regular discussions (amongst themselves and with potential stakeholders) on how the discoveries made could be used to improve plant performance under drought and flooding in the field. They should seek to directly test some of these hypotheses (in maize or other crops). This could be done in collaboration with companies or breeders, and engagement with them should be sought early on.

CONDUCT OF THE VISIT

DATES

Start: January 23rd of 2020 at 8:30 am

End: January 24th of 2020 at 5 pm

VISIT SITE

Institution: UMR BPMP: Campus Montpellier SupAgro-INRA

Address: Bâtiment 7, 2 place Viala, 34060 Montpellier

CONDUCT OR PROGRAM OF THE VISIT

Thursday 23 January

Plenary Session (Amphitheatre 206 – cœur d'école SupAgro – Building 9)

08:30-08:45: **Introduction** by Steven Ball

08:45-09:45: **Results and project of the whole unit** by Alain Gojon and Christophe Maurel

Individual research team sessions (seminar room-BPMP)

10:00-10:40: **Aquaporins (Aqua)** team

10:40-11:10: Coffee break

11:10-11:40: **FeROS** team

11:40-12:15: **HoNuDe** team

12:15-13:00: Internal committee meeting

13:00-14:00: Lunch

14:00-14:20: **Influx** team

14:20-14:55: **Integration** team

14:55-15:20: **KaliPHruit** team

15:20-15:50: **TSF (MeMo)** team

15:50-16:20: Coffee break

16:20-17:20: Internal committee meeting

17:20-17:45: **Plasticity** team

17:45-18:20: **TICER** team

18:20-19:20: Internal committee meeting

Friday 24 January

Specific sessions (seminar room-BPMP)

08:30-08:50: Meeting with the scientists

08:50-09:10: Meeting with the engineers and technical and administrative assistants

09:10-09:30: Meeting with non-permanent staff and students

09:30-10:15: Meeting with the representatives of CNRS, INRAE, University of Montpellier and Montpellier SupAgro

10:15-10:30: Coffee break

10:30-11:15: Internal committee meeting

11:15-11:45: Meeting with the current and future management of BPMP

11:45-12:30: Lunch

12:30-16:00: Internal committee meeting

SPECIFIC POINTS

All experts were present on site with the exception of Anna Amtmann who was present during both days by visioconference.

SUPERVISING BODIES' GENERAL COMMENTS



HR EXCELLENCE IN RESEARCH

MONTPELLIER,
LE 28 FEVRIER 2020



Pierre GLAUDES
Directeur du Département
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OBJET : rapport d'évaluation - DER-PUR210019342 - BPMP - Biochimie et
physiologie moléculaire des plantes.

Monsieur le Directeur,

Je tiens à remercier le comité de visite HCERES pour la qualité de son
rapport d'évaluation concernant l'unité de recherche BPMP dirigée par Alain
GOJON et dont le projet pour le futur contrat sera porté par Christophe MAUREL.
Le directeur d'unité, le CNRS et moi-même avons pris connaissance des
recommandations formulées par le comité de visite.

Le directeur de l'unité, moi-même et le CNRS n'avons pas d'observations
de portée générale à formuler.

Nous vous prions d'agréer, Monsieur le Directeur, nos salutations
distinguées.

Le Vice-Président chargé de la recherche

Jacques MERCIER

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