B&PMP - Biochimie & physiologie moléculaire des plantes

Rapport Hcéres

agence d'évaluation de la recherche
et de l'enseignement supérieur

Section des Unités de recherche

AERES report on the research unit

Biochimie et Physiologie Moléculaire des Plantes (B&PMP)

From the

Montpellier 2 University

CNRS

INRA

SupAgro

Mai 2010

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Le Président
de l'AERES

Jean-François Dhainaut

Section des unités
de recherche

Le Directeur

Pierre Glorieux

Mai 2010

Research Unit

Name of the research unit : Biochimie & Physiologie Moléculaire des Pplantes (B&PMP)

Requested label : Joint Research Unit (UMR)

N° in the case of renewal : UMR N° 5004 (UM II/CNRS) – UMR N° 386 (INRA/SupAgro)

Name of the director : M. Jean-François BRIAT

Members of the review committee

Committee chairman

M. Alain PUPPO, University of Nice – Sophia Antipolis

Other committee members

M. Marc BOUTRY, University of Louvain, Belgium

M. Frans MAATHUIS, University of York, UK

Mrs Hélène BARBIER-BRYGOO, CNRS, Gif-sur-Yvette

Mr Alain VAVASSEUR, CEA, Cadarache

Committee members suggested by CNU, CoNRS, CSS INSERM, CSS INRA, INRIA, IRD

M. Dominique ROLIN, suggested by CNU 66

M. Philippe POTIN, suggested by CoNRS

M. Jean-Denis FAURE, suggested by CSS INRA

Observers

AERES scientific advisor

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M. Dominique EXPERT, Representative of INSB – CNRS

M. Loïc LEPINIEC, Head of INRA - BV Department

M. Armand BOYAT, Vice-President of the INRA Centre of Montpellier

M. Jacques MAILLET, Vice-Director of Supagro Montpellier

Mrs Ghislaine GIBELLO, Region Representative of CNRS

Report

1 • Introduction

- **Date and execution of the visit :**

The visit was spread over two days and half, on November 18-20. The committee members had received, six weeks ahead, a clear and well presented document including the detailed assessment of the 2005-2009 period and the research projects. The visit took place as planned: presentation of the committee and the evaluation procedure, global presentation of the unit by the director, presentation of each team and discussion, meeting with the parent organizations representatives and with the laboratory council, the administrative and technical staff, the PhD and post-doctoral students and the researchers and teachers-cum-researchers.

- **History and geographical localization of the research unit, and brief presentation of its field and scientific activities :**

The B&PMP unit is located on the SupAgro-La Gaillarde Campus and gathers around 100 people, among which 57 permanent staff (33 scientists, 9 engineers and 15 technicians and administrative staff) mainly from INRA (55 %) and CNRS (38 %). It has a long-lasting (twenty years) experience in studying, at the molecular level, the mechanisms which contribute to determine the hydro-mineral status of plants, submitted to various abiotic conditions. By integrating cellular, molecular, genetic, biochemical, biophysical and physiological approaches, it studies transport activities (transporters and channels) and some aspects of mineral nutrition. In the last four years, other topics have been developed also to define sensing, signalling and regulatory mechanisms and to study developmental processes of the root system and metabolic processes linked to mineral utilization, assimilation and toxicity. The aim of the unit is to perform studies from functional genomics to system biology. This has gone hand in hand with a diversification of plant models: while Arabidopsis remains the major model plant shared by the research groups of the unit, other biological models such as pea, Medicago and rice are now used.

The unit is a member of the Institute for Integrative Plant Biology (IBIP) with two other research units: the Ecophysiology of Plants under Environmental Stress Laboratory (LEPSE) headed by Thierry Simonneau and the Laboratory of Functional Proteomics (LPF) headed by Michel Rossignol. It is also, together with the two other IBIP laboratories and six other laboratories, part of the "Federative Institute of Research" (IFR) named "Daphne" (Development, diversity and adapatation of plants, phenotype, genes). This was the first mandate of the Director, Jean-François Briat, who took over from Claude Grignon as head of the unit. An organization in 9 teams is proposed for the forthcoming four years period.

- **Management team :**

The unit has a director and a deputy-director and the B&PMP reearch activities are supported by administrative and logistic services. The laboratory council, where the various personnel categories are represented, meets 4 times a year. It gives advices on all the aspects related to daily running of the laboratory, paying special attention to health and safety, budget, human ressources and management of laboratory common services. A general assembly of all the people working at B&PMP is held once a year. Upstream from this official council, three other laboratory committees prepare the issues to be discussed. The group leaders committee meets once a month and helps the management to make choices related to the scientific policy of the unit, including hiring new people and making investments for scientific equipments. The laboratory technical committee, which meets at least once every two months, is composed of one member of each research group and of the management. It is in charge of proposing solutions to solve technical problems and recommendations aiming at improving the B&PMP running on a day to day basis. The budget committee is composed of management, staff in charge of the laboratory financial management and one member per research group. It meets three times a year to ensure previously set budgets are adhered to and make recommendations to set future budgets. It must be underlined that the high quality of the management and the

progress made in terms of communication within the unit clearly appeared throughout the discussions the review committee had with the different personnel categories.

- **Staff members (on the basis of the application file submitted to the AERES) :**

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)	5	5
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	28	28
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	11	2
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	24 (= 22,7 ETP)	26 (= 24,7 ETP)
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	0	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	14	6
N7: Number of staff members with a HDR or a similar grade	16	17

2 • Overall appreciation on the research unit

- **Summary :**

This unit has performed pioneering work on various aspects of the hydro-mineral status of plants, which gives it a large international recognition. This can be assessed through (i) the very good overall publication record which includes 5 PNAS, 7 Plant Cell and 31 Plant J and Plant Physiol papers, (ii) the percentage (50 %) of publications in journals having an impact factor over 5, (iii) the important contribution of the unit to numerous reviews (9) in high impact factor journals (Annu Rev Cell Dev Biol, Annu Rev Plant Biol, Trends Plant Sci, Curr Opin Plant Biol) and (iv) the unit's ability to gain funding from the National Resarch Agency (20 contracts in the framework of the national programs and 3 international projects). The important number of PhD students (24, among who 8 foreigners from 3 different countries) and post-doctoral researchers (44, among whom 16 foreigners from 11 different countries), as well as the number of HDRs granted (6) in the 2005-2009 period, underline the unit's dynamism. The unit is also significantly involved in teaching, student training and the SIBAGHE doctoral school.

The unit has been reorganized according the previous 2005 evaluation, which led to new positions inside the unit for permanent people of the two research groups which no longer exist independly. Other voluntary changes occurred during the last four year period, which led to an appropriate unit restructuring. The overall unit functioning is good and the quality of the management is particularly worth mentioning. Special attention has been paid to the communication within the unit, via a web site including an intranet and the publication of an electronic letter. A very good atmosphere prevails in the unit in which everybody, from PhD students to researchers, is very satisfied with the working conditions.

- **Strengths and opportunities :**

The strengths of the unit may be summed up as follows:

- the quality of the publication record;

- the international reputation in the mineral nutrition including iron, water transport and abiotic stress fields. The unit gathers research groups that are world leaders on at least three topics;

- the large range of approaches used, ranging from molecular genetics and biochemistry to biophysics and cell biology, which really makes B&PMP a plant integrative biology research unit;

- the cohesion of the topics studied;

- the originality of the work leading to a functional analysis of membrane transport;

- the good quality of the management, the unit organization and communication together with the involvement of all personnel categories in the unit's activities and prospective reflection, which leads to a good general atmosphere;

- the existence of very nice facilities through the Gene to Integrated Phenotype platform (greenhouses, growth chambers, imaging, electrophysiology).

Based on its "multi-tutelages" status and its geographical situation, the unit has a good opportunity to maintain and further improve its research, training and teaching activities.

- **Weaknesses and threats :**

The unit international visibility and its ability to attract from abroad should be improved during the forthcoming four years period. In the same way, the number of international invited speakers is abnormally low. Special attention should be paid to the emergence of new projects leaded by young principal investigators.

- **Recommendations to the head of the research unit :**

It is recommended to the head of the unit to :

- reduce the compartmentalization existing between the teams;

- pay special attention to a better integration of the Intracellular Dynamics of Membrane Proteins group;

- assist the weaker teams in their effort to improve their scientific level;

- encourage some researchers to publish more and better;

- improve the international visibility.

- **Production results :**

(cf. http://www.aeres-evaluation.fr/IMG/pdf/Criteres_Identification_Ensgts-Chercheurs.pdf)

A1: Number of permanent researchers with or without teaching duties (recorded in N1 and N2) who are active in research	29
A2: Number of other researchers (recorded in N3, N4 and N5) who are active in research	12
A3: Ratio of members who are active in research among permanent researchers [(A1)/(N1 + N2)]	O,88
A4: Number of HDR granted during the past 4 years	6
A5: Number of PhD granted during the past 4 years	24

3 • Specific comments on the research unit

- **Appreciation on the results :**

  – Relevance and originality of the research, quality and impact of the results:

The unit has a long lasting experience in studying the molecular mechanisms of the water / mineral status of plants. Besides the main topics studied till 2005 (last unit assessment), i.e. ion and water transport and some aspects of mineral nutrition, new topics have been developed on (i) the regulatory mechanisms of terminal targets involved in the establishment of the plant water / mineral status, (ii) the determinants of root plasticity in response to abiotic constraints and (iii) the metabolic aspects linked to mineral utilisation by plants and the metabolic perturbations related to mineral excess or deficiency. This testifies to the relevance and originality of the research. The quality and impact of the results is highlighted by (i)) the important contribution of the unit to numerous reviews (9) in high impact factor journals (Annu Rev Cell Dev Biol, Annu Rev Plant Biol, Trends Plant Sci, Curr Opin Plant Biol), (ii) the organization of two international congresses and (iii) the ability to establish international collaborations (37, among which 15 were funded), leading to 25 joint publications.

  – Number and quality of the publications, scientific communications, thesis and other outputs:

The unit has a very good overall publication record: 113 publications (in the 2005-November 2009 period) which include 5 PNAS, 7 Plant Cell and 31 Plant J and Plant Physiol papers. The average impact factor is 6 and 50 % of the publications are in journals having an impact factor over 5. The average number of publications per permanent scientist is 4.09. The scientific production also includes 16 book chapters and 50 invitations to give presentations at conferences. 24 PhD theses have been defended.

  – Quality and stability of partnerships:

Not relevant.

- **Appreciation on the impact, the attractiveness of the research unit and of the quality of its links with international, national and local partners:**

  – Number and reputation of the awards obtained by staff members, including invitations to international conferences and symposia:

The situation in this framework appears to be heterogeneous between the different teams of the unit. Although scientists belonging to some of them were invited to a significant number of international conferences, the overall achievement in this respect needs improvement.

  – Ability to recruit high levels scientists, post-docs and students, and more particularly from abroad:

This aspect is good concerning the PhD students (8 foreigners from 3 different countries) and post-docs (16 foreigners from 11 different countries) but it should be largely improved concerning high level scientists.

– Ability to raise funds, to successfully apply for competitive funding, and to participate to scientific and industrial clusters:

Again, the situation appears to be mixed. The ability to successfully apply for competitive funding at the national level is very good: in 2009, the competitive grant funding is 2.4 fold that of the tutelage sustainable. In this framework, it must be taken into account that (i) the ratio was 1.3 in 2006 for an operational budget which was 56% of the 2009 one and (ii) the tutelage sustainable is at the same level as in 2006. However the result at the international level is quite disappointing, but may be, at least partly, explained by the international situation. The participation to the RTRA scientific cluster is noteworthy.

- **Participation to international or national scientific networks, existence of stable collaborations with foreign partners :**

The participation is excellent at the national level, involving collaborations with more than 10 french laboratories which led to 20 joint publications. Although 25 publications arose from collaborations (mainly bilateral) with international partners, the number of stable foreign collaborations is quite low.

The involvement of teams from the unit in the RTRA network, which is the only one in France devoted to plant and agronomical sciences, is important (6 projects). The involvement in international programmes is rather good in the difficult international climate for fundamental plant sciences.

– Concrete results of the research activity and socio-economic partnerships (optional):

Two patents have been obtained. Considering the high impact of the research for the adaptation of crops to adverse conditions (drought, salinity, heavy metals, low nitrate…), the patent output may be improved.

- **Appreciation on the strategy, management and life of the research unit :**

– Relevance of the research unit organization, quality of the management and of the communication policy:

The unit has been reorganized and the quality of management is excellent. Different committees have been set up to help the management (see Introduction), which is regularly seeking advice from the unit council. Special attention has been paid to the communication within the unit, via a web site including an intranet and the publication of an electronic letter. Very good relationships exist with the local partners.

– Relevance of the initiatives aiming at the scientific animation and at the emergence of cutting edge projects:

The unit has been very active for a long time in the framework of the french national initiative “La Fête de la Science” and has proposed these last four years (i) guided tours and workshops for post-bachelor students and (ii) the “Science Caravans”, which involves about 10 PhD students from the unit for one week each year to visit classes from 5 secondary schools. Other various initiatives include a one week workshop for middle school students.

On average, one seminar is given every week, organized by a group of people composed of one representative per research team; the abstracts of 2008 and 2009 seminars can be seen on the unit website. However, more seminars from external speakers are needed and the creation of a journal club is suggested.

A more integrative view of the work performed in the different teams will greatly help the emergence of cutting edge projects. This particularly applies to new projects in signalling studies including electrical signalling, which are developed in many teams of the unit.

– Contribution of the research unit staff members to teaching and to the structuration of the research at the local level:

The unit is significantly contributing to teaching. Teachers-cum-researchers teached for more than 1000 hours per year; moreover, several researchers contributed to Master and Licence teaching for an overall amount of 436

hours over the 2005-2009 period and 34 Master 2 have been carried out in the unit.The unit Director is Deputy Director of the doctoral school.

The contribution to the structuration of the research at the local level is very good as the unit has launched together with the LEPSE laboratory, the Institute for Integrative Plant Biology (IBIP), which the LPF laboratory joined recently. The main objective of IBIP is to characterize the determinants of phenotypes, which result from genotype and abiotic environment interactions. Studies on aquaporin functional phosphorylation and on various proteomes in response to environmental stresses are performed together with LPF. Moreover, two members of the unit (one of them left) are at the origin of the Daphne IFR, which gathers IBIP, four other Montpellier laboratories, one from Perpignan and one from Avignon.

It is the committee's feeling that it is not sufficiently informed about the activities and projects of the two other IBIP laboratories to give a well-argued advice on the possible creation of a large IBIP unit. Significant interactions exist between the three IBIP teams (B&PMP, LEPSE and LPF) and it is up to the team members to estimate the possible added value of a merger. This also precludes any advice on the opportunity to develop quantitative genetics and genetic variability approaches in the unit.

- **Appreciation on the project :**

  - Existence, relevance and feasibility of a long term (4 years) scientific project:

The scientific projects are mostly well constructed and integrated; taking into account the know-how of the unit and the national and international context, the overall project appears to be particularly relevant. There is no doubt about its feasibility during the next 4 years period. However the projects of two teams (out of nine) need to be significantly reconsidered.

The Intracellular Dynamics of Membrane Proteins group, which has developed a solid background in cell biology and imaging techniques, should be encouraged to focus on topics that can allow strong collaborations with other teams within the unit, such as trafficking of membrane transporters during salt stress. As it stands, the Silicon Metabolism in Plants project is not satisfactory in the scientific context of the unit. On the other hand, developing the metabolic platform project, which is in line with both the unit and the Supagro campus scientific policies, would be a very good opportunity for the project leader of this team.

  - Existence and relevance of a policy for the allocation of ressources:

Infrastructure expenses are covered by the tutelage sustainable and teams function with the grants they have obtained. 20 % of all the contracts constitute a "mutual fund" which is used (i) for equipment investments and (ii) to help teams less successful with their applications as well as starting teams. The whole fund or part of it may also be distributed among the research groups on a personnel proportional share basis. A yearly debate within the group leaders committee and the laboratory council determines the fund utilization. The majority of ITA personnel is working in common services; those who are in research groups are all associated with a collective task.

  - Originality and existence of cutting edge projects:

The originality of the project lies in the scientific challenge of going from functional genomics to systems biology. Developing a modelling approach should constitute a priority: to promote system biology studies, the unit's project already includes this approach, which is planned to be used in three areas: metabolic gene networks, electrical signals and leaf water transport. The unit's project is also characterized by two cutting edge aspects. On the one hand, the system biology approach proposed by the Integration of Nutritional Functions team should reveal new areas to be developed. On the other hand, biophysics is a strong commitment in the unit and the electrophysiology modelling proposed by the Electrical and Calcium Signalling team could lead to new interesting developments and important breakthroughs.

4 • Appreciation team by team and/or project by project (to be pasted as many as needed)

Team E1 : Plant adaptation to metals

Project leader : M. Pierre BERTHOMIEU

- **Staff members (on the basis of the application file submitted to the AERES) :**

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)	2	2
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	2	2
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	0	0
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	1 = 0,8 ETP	1 = 0,8 ETP
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	0	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	3	1
N7: Number of staff members with a HDR or a similar grade	1	1

- **Appreciation on the results :**

The group focused on metal tolerance and metal accumulation in plants. The group has faced a transition period just before and at the beginning of the contract with the departure of several researchers, including the former team leader and the arrival of the new head. Therefore, the main achievements of the renewed team were its demonstration that Arabidopsis halleri increased tolerance to zinc is linked to an overexpression of defensins, small proteins only known up to now to play a role in plant innate immunity, together with its QTL approach and the analysis of the natural variation of zinc tolerance in A. thaliana. One of the identified QTLs was successfully cloned and identified as AtFRD3, encoding a citrate transporter of the MATE family pointing the importance of root to shoot zinc translocation. Also, in more applied short term projects, the analysis of the genetic determinants controlling cadmium accumulation in lettuce revealed contrasted phenotypes.

The scientific production of the group has resulted in 17 peer-reviewed publications with 3 describing original data on zinc tolerance in the model A. halleri (1 Plant J., 1 Plant Science, 1 J. Appl. Microbiol.), 4 from the work conducted by former members of the group on nickel accumulation and the role of nicotianamine (1 Plant J., 1 J. Exp. Bot. 1 Transgen. Res., 1 J. Anal. Atom. Spectrometry), 5 from previous work of new team members on sulphate and selenate transport and also salt stress, 4 from previous work of team members before their arrival at B&PMP and 1 review on HKT of the team leader (TIPS) and 3 book chapters. This very heterogeneous production, in term of topics and quality of the journals reflects a part of the history of the group. However, this good publication record indicates the capacity of the group to remain productive in a context of limited possibilities to launch new PhD and post-doc projects.

- **Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners:**

The group has both a strong commitment to teaching activities for two permanent teachers and several side projects contracted with national companies. However, its international audience is presently limited and should be increased by the efforts of the team to focus its scientific strategy.

- **Appreciation on the strategy, management and life of the team :**

The team is now structured and stabilized and this brings scientific cohesion to tackle its focused project for the next contract. The team leader is a young professor very active in teaching, training and in the life of the research unit. His leadership is well recognized by all the members of the group and the committee is confident that he will demonstrate his ability to make the group attractive for PhD students and successful in grant applications and to increase its international visibility.

- **Appreciation on the project :**

The project for the next contract will primarily consist of further investigating defensins and their role in inducing zinc tolerance at the whole plant level and the cellular level in A. halleri. The committee recognizes the anteriority of the group in showing that the role of defensins in zinc tolerance is not circumstantial and the originality of this approach in the highly competitive field of the genetic basis of plant tolerance to metals. The committee supports the strategy aiming at dissecting the molecular basis underlying the high expression level of defensins in A. halleri but also recommends to take advantage of all the genetic tools available in A. thaliana to test some of the hypotheses that the group is willing to address using direct genetic approaches in yeast. The cellular localization of zinc accumulation and its possible co-localization with defensins in some cell compartments could be better addressed using more precise imaging techniques. Another bottleneck is the difficulty to develop genetic transformation in A. halleri, which will be a major challenge to tackle for the team.

- **Conclusion :**

The committee encourages the group to pursue the validation of its recent results on natural variation and QTLs of zinc tolerance in A. thaliana in good journals and to group efforts to gain new knowledge on the roles, structure-function relationships and possible interactions of defensins in the context of zinc tolerance in A. halleri. It also anticipates that the investigation on defensins may lead to fruitful collaborations with groups studying their functions as antimicrobial weapons.

Team E2 : Aquaporins

Project leader : M. Christophe MAUREL

- **Staff members (on the basis of the application file submitted to the AERES) :**

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	4	4
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	2	0
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	1 = 0,8 ETP	1 = 0,8 ETP
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	0	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	3	1
N7: Number of staff members with a HDR or a similar grade	2	2

- **Appreciation on the results :**

Over the 2005-09 period, this established team has made several important contributions with high international impact to understanding the integrated function of aquaporins in Arabidopsis. It has provided clear evidence, based on structure–function studies, that the gating of plasma membrane aquaporins (PIPs) is controlled by intracellular pH and calcium. The team members have identified methylation as a novel post-translational modification of aquaporins and two enzymes involved in this methylation have been characterized. In parallel they have shown multiple adjacent phosphorylation sites located in the C-terminal tail of PIPs and for the first time they were able to establish a link between phosphorylation and aquaporin subcellular localisation. The team also showed the response (down-regulation) of water transport to various abiotic stresses involving ROS production. Another key achievement was the investigation of the integrated function of aquaporins in the whole plant by using a large set of natural Arabidopsis variants as well as transgenic lines. They provided the first genetic evidence that PIPs contribute to the hydraulic conductivity of inner tissues of leaves. These various studies have led to many publications in top-journals. The level of the team's activity is very good, with 22 publications in first-rate journals (Plant Physiol., Plant Cell, J. Biol. Chem., Ann. Rev. Plant Biol., Curr. Op. Plant Biol. etc), invitations to seminars, and one patent. The team leader has high international visibility as evidenced by his contribution to international meetings as invited (15) or selected (9) lectures.

- **Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners :**

The aquaporin team has good interactions with other teams of the unit due to their expertise and interacts well within the Integrative Biology Institute for Plants (IBIP) for functional proteomics and ecophysiology studies, with several groups in France and abroad. This is reflected in the publication record: 11 papers (out of 22) have been published with collaborators external to the team. The team has had great success in attracting grants from a variety of national (three ANR), European (one Marie Curie Program) and international (Chinese and Russian collaborations) sources. Research valorisation led to a patent and an industrial collaboration (Biotechmarines).

- **Appreciation on the strategy, management and life of the team :**

The team leader is a productive and energetic researcher. He seems to be supported by all the members of his group and has the required authority/charisma. Over the past four years he successfully demonstrated his ability to

run the aquaporin team. This team is well structured with four subgroups dealing each with a specific topic on aquaporin. Over the 2005-09 period, the team welcomed 7 PhD students, and 6 post-doctoral researchers. All of them have published between one and four papers. The team has regular lab meetings, fertile in internal communications, and welcomes the « intracellular dynamic of membrane proteins » group to its lab meeting. The contribution to international meetings is excellent with 16 lectures as invited speaker and 9 selected oral communications.

- **Appreciation on the project :**

For the coming years, the aquaporin team will extend the scope of its molecular physiology studies on aquaporins. The project's strength lies in the large array of expertises the team has developed over the years (Structure-function and proteomic analyses of membrane proteins, protein trafficking, physiological parameters of water transport) and the willingness to integrate these various aspects at the plant functional level. Some emerging directions have been mentioned such as the development of quantitative proteomics (collaboration with M. Rossignol (LFP) or the automation of pressure chamber measurements, which should open the way to quantitative genetics approaches to root hydraulics, or the will to pursue a modelling approach to describe root water uptake, leaf/root relations and plant hydraulics. A novel aspect presented in the project is the role of aquaporins in CO2 transport. If this role is confirmed, this part of the project might also lead to important breakthroughs. As a whole, the project is clear, well presented and focused on Arabidopsis and the PIP family. Some questions will be developed in partnership with appropriated partners who will bring the needed expertises.

- **Conclusion :**

The team has a strong historical background on aquaporins. During the evaluated period, the team has greatly contributed to understanding the integrated function of aquaporins in Arabidopsis. During the 2005-2009 period, the team has obtained several grants and has been very productive, both quantitatively and qualitatively, with research publications in excellent international journals, a review and methods article. The project is clear, well focused and likely to lead to important results. The group has (i) an excellent capacity to attract funding for hiring post-doc and PhD students, a consistent and competitive project, (iii) an excellent scientific management and (iv) strong and clever collaborations with FLP (quantitative proteomics) and ecophysiologists to develop integrative biology of plant hydraulics and CO2 transport. It is recommended to keep the team and project well focused and try to further improve the publication qualitative level.

Team E3 : Ion channels

Project leader : M. Hervé SENTENAC

- **Staff members (on the basis of the application file submitted to the AERES) :**

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	7	7
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	3	1
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	3	3
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	0	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	3	3
N7: Number of staff members with a HDR or a similar grade	4	4

- **Appreciation on the results :**

The group has as its core subject the functional and physiological characterisation of Shaker-like K channels in plants. In addition, work is carried out on HKT cation transporters and, more recently, on the nitrate efflux systems from the NAXT family. Over the past decades the group has established itself as one of the foremost laboratories in the field of structure function analyses on plant K channels and it is globally recognised as a leader in this field. During the review period a large number of publications was achieved in the review period (n= 23) with two research papers in high ranking (impact factor ~10) journals (Lebaudy et al 2008 and Su et al 2005). However, within this large group, several permanent staff members have a poor publication record.

- **Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners :**

The group leader has been invited frequently to give invited lectures. Although this included one at the main (tri-annual) plant membrane transport workshop, most contributions were to small and/or local meetings. The number of contributions to prestigious meetings would be expected to be higher for a group of this stature and size! For other (permanent) members of the group oral contributions to international meetings are virtually absent and, since this is an integral part of career development, endeavours should be initiated to increase this number.

No recruitment has taken place from external sources over the review period and permanent staff, apart from one member, is entirely of French nationality. Several junior staff members (PhD/postdoc) have been recruited from abroad and successful funding for these non-permanent staff members was obtained.

A large number of domestic interactions is in place and this number is likely to be maintained or increased. Long term (funded) international collaborations are in place for example with Spain and the UK. In addition, a large number of longstanding international collaborations have been maintained over the current review period.

- **Appreciation on the strategy, management and life of the team :**

The research team is organised around the group leader and several senior staff members who carry (partial) responsibility for sub-projects. The latter includes supervision of non-permanent staff and active input into strategic decisions within the group. The overall teaching load is small compared to academic departments, but within the B&PMP institute it is probably on a par with other groups. A respectable number (n=6) of theses was concluded and active participation is evident in masters courses and development of plant biology curricula in the Montpellier University. In addition, the group leader and permanent members are involved in multiple outreach activities such as lectures to non scientist audiences and to school pupils in order to increase appreciation for scientific research.

- **Appreciation on the project :**

The team has performed groundbreaking research in the review period, particularly where structure function of K channels is concerned. The next logical step is to study the regulation of these mechanisms, particularly at the post-translational level, for example to identify interacting kinases. The proposed research for the coming period to a large extent follows these lines and will no doubt be successful. Where the HKT project is concerned, further functional analyses are planned and these too are likely to culminate in high ranking publications. In contrast the work on NAXT transporters is less well defined and the integration of this project (anion efflux) in a group working on cations is less clear. Work on the ectomycorrhizal K transporters, although perfectly feasible, is equally unlikely to yield great impact especially since the physiological relevance of K transport in such associations is low.

- **Conclusion :**

The team has performed very well, particularly where publications are concerned, and has maintained its world leading status in plant K channel research. The planned research builds on past strengths and is likely to be equally successful. Strengths include an excellent publication record, world reputation where work on plant K channels is concerned and multidisciplinary approach. As weaknesses the lack of integration of the NAXT work needs mentioning. The research on mycorrhizal K transport, though logically in the right context, has not yielded high impact publications and is unlikely to do so in the future. A further point of concern is the fact that although there is an overall excellent publication achievement, several permanent staff members have (very) poor publication records.

Team E4 : Intracellular dynamics of membrane proteins

Project leader : Mrs Nadine PARIS

- **Staff members (on the basis of the application file submitted to the AERES) :**

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	1	1
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	0	0
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	1	1
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	0	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	1	1
N7: Number of staff members with a HDR or a similar grade	1	1

- **Appreciation on the results :**

The Intracellular Dynamics of Membrane Proteins group has been created in B&PMP at the end of 2006 on the basis of a project already developed by the group leader at the University of Rouen. During the period 2005-2009 the group was made of one CR and one PhD; in addition, two IE partly participated in the project. The main theme concerns the role of VSRs (Vacuolar Sorting Receptors) in sorting and targeting proteins to the lytic vacuole. More recently the group has decided to focus on two VSR proteins, VSR2;1 and VSR2;2 which, based on databases information, are induced under abiotic stress. It is an interesting topic in the context of B&PMP which has developed many projects on plant responses to abiotic stresses. Novel tools, such as specific antibodies and fusion proteins, have been obtained to follow the expression of VSRs and specific motifs involved in trafficking have been identified at the molecular level. A trafficking model through VSR has been proposed but has still to be validated. Concerning these last results a publication in a high ranking journal is being revised. Overall the group has a good publication list and level, 8 publications in international journals and a book chapter. However, the committee is astonished that most of the publications during these last four years are not related to the main topic developed by the group.

- **Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners :**

The group is quite well-known in the domain of plant membrane trafficking as attested by the regular invitations to the group members to give seminars in Institutes and selected oral communications in congresses. The impact of the publications in the scientific community is good but it mainly concerns results that were obtained previously to the period 2005-2009. The committee is concerned about the integration of the team into the unit since little collaboration has been developed with other B&PMP teams. This is specially a concern considering the small size of the team. In contrast, there is a strong collaboration with the DAP-PHIV platform in CIRAD allowing developing new techniques in cellular biology and imaging.

- **Appreciation on the strategy, management and life of the team :**

This is a small team and therefore people management does not seem to make any difficulty. However, managing two research projects, one of which with very broad objectives, might represent a serious problem.

Considering the strong expertise in cell biology techniques, it would be advisable for this team to define more focused projects in collaboration with other B&PMP teams.

- **Appreciation on the project :**

The project is in part the continuity of the present work, proposing to go further into the role of VSR2;1 and VSR;2 during salt stress. Different resources have already been obtained (mutants, fusion proteins, cell biology techniques) allowing to study the trafficking of VSR and their regulation. The committee agrees that this research topic is interesting and recommends to run this project in collaboration with another B&PMP team working on salt stress.

The second part of the project is a new research program on vacuole remodelling during salt stress and, in particular, the role of VSR2s in this process. A study on membrane dynamics is interesting regarding the main topics developed in the Institute. However this is a broad domain which does not seem to be compatible with the small size of the group and the absence of major sources of funding. Many studies performed at B&PMP have pointed to the essential role of endomembranes in the regulation of membrane transporters at the plasma membrane or vacuolar membrane. Therefore, this part of the project should be focused on a small number of transporters studied in the Institute.

- **Conclusion :**

The group has developed a solid background in cell biology and imaging techniques and a good expertise in membrane trafficking and the role of VSR in this process. New promising tools have been developed. However, there are few publications concerning this main topic. It seems very important to the committee that the group validates the results already obtained by a publication in the next two years. Both parts of the project are interesting but not realistic considering the small size of the team. The committee recommends emphasizing the topics that can result in strong collaboration with other B&PMP teams, such as the trafficking of membrane transporters during salt stress.

Team E5 : Integration of nutritional functions

Project leader : M. Alain GOJON

- **Staff members (on the basis of the application file submitted to the AERES) :**

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	5	5
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	2	0
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	1	1
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	0	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	1	0
N7: Number of staff members with a HDR or a similar grade	2	3

- **Appreciation on the results :**

Over the 2005-09 period, the group was dedicated to the molecular characterization of the N and C signalling pathways governing root NO3- uptake in Arabidopsis thaliana. New regulatory genes (NRT1;1, HIN9) and new regulatory mechanisms have been identified. They have showed for the first time that root NO3- transporters are not

only targets, but also components of the N signalling pathway regulating root N acquisition. And for the first time they propose a very original model where NO3- transport regulates directly root development by demonstrating that NRT1.1 acts as a NO3- sensor modulating lateral root development through the transport of auxin. These various studies have led to many publications in top ranking journals (2 PNAS, 5 Plant Physiol, 3 Plant Cell, 1 J. Biol. Chem., 1 Curr. Opin. Plant Biol., 1 Plant J. etc…), and several invited lectures. The group has also trained 6 PhD students during the evaluating period, all of them associated with 1 to 5 publications. Four of them have found post-doctoral positions and two of them are working in private companies.

- **Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners :**

This group has built an impressive collaboration network at national and international levels as well as within the unit and the Integrative Biology Institute for Plants (IBIP). This is reflected by the publication record where 17 papers (out of 21) have been published with collaborators external to the group. The group was successful in attracting several grants to support their work from a variety of national (2 ANR, INRA and CNRS projects), and European (1 EU Integrated Project, 1 Marie Curie Program) sources.

- **Appreciation on the strategy, management and life of the team :**

The “integration of nutritional functions” group is well structured with four subgroups led by a dedicated scientist and corresponding to specific topics dealing with C and N signalling or N transporters or root development. The dynamic in the group appears excellent. Over the 2005-09 period, the group has also welcome 6 post-doctoral researchers. All of them have published between 1 and 5 papers. The group has regular lab meetings and fertile internal discussion. The contribution to international meetings could be improved since only 5 invited lectures and 6 selected oral communications were listed for the whole team. The group is very well managed and the project leader has demonstrated his ability to oversee the group in a very balanced and productive way and to provide the appropriate freedom to nurture the scientific development of each his young researchers.

- **Appreciation on the project :**

For the coming years, "the integration of nutritional functions” group will extend the scope of its molecular physiology studies of the regulation of mineral N acquisition in Arabidopsis by investigating both physiological and developmental components of this function. The project strength relies on a large array of expertises they have developed over the years (transcriptomics, forward/reverse genetics, molecular/pharmacological approaches, labelling studies). Some emerging directions have been mentioned as systems biology approaches for identifying C/N regulatory gene networks and the structure-functions of NO3 transporter (NRT1) for unravelling the structural bases of the dual transport/signalling function of NRT1.1. The project is clearly and well presented; some questions will be developed in collaboration with the appropriated partners.

- **Conclusion :**

The group has a strong historical background on targeting genes involved in NO3- uptake and on deciphering the regulatory gene network associated with the corresponding signalling mechanisms. During the evaluated period, the group has contributed important work on understanding the integrated function of NO3- transport in Arabidopsis and its regulation. The group has been very productive, both quantitatively and qualitatively. It has (i) an excellent capacity to attract funding for hiring post-doc and PhD students, (ii) a consistent and competitive project, (iii) an excellent scientific management and (iv) a strong and intelligent collaborative network. The committee would recommend to the project leader to pay attention to the dispersion of the different projects (system biology of gene network, structure function of transporters, root and shoot development…) to maintain scientific interactions among the group and to keep a critical size in human resources for each project.

Team E6 : Mineral nutrition and oxidative stress

Project leaders : M. Frédéric GAYMARD & M. Jean-François BRIAT

- **Staff members (on the basis of the application file submitted to the AERES) :**

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)	1	1
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	4	4
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	0	0
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	2 = 1,6 ETP	2 = 1,6 ETP
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	0	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	1	0
N7: Number of staff members with a HDR or a similar grade	3	3

- **Appreciation on the results :**

The group initially studied function and cellular responses to iron overload in plants. It has a well-established international reputation in the field. It showed that ferritins, while not being an iron source for development, are of key importance in the defence machinery against free iron-induced oxidative stress. Thus, its studies are now mainly focused on the interactions between iron and reactive oxygen species (ROS). During the review period, the group has obtained important and innovative results showing that (i) ferritin stability depends on proper allocation of iron from vacuole to plastid, (ii) ferritin function is essential for iron sequestration to avoid oxidative stress, (iii) nitric oxide (NO) rapidly accumulates in plastids after iron treatment and (iv) the circadian clock regulator TIC is required for the expression of iron-regulated genes, independently of the clock.

A significant number of publications was achieved (17) in journals such as Plant J (2), Plant Physiol (1), J Biol Chem (1), Biochem J (1) and Molecular Plant (1). Among these, two review articles in Curr Opin Plant Biol are noteworthy. The group is currently participating in two ANR projects (2008-2010) and in a KBBE France – Germany – Spain trilateral project (2009-2011). Three PhD Theses have been defended.

- **Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners :**

The impact of the team is evident from the invited lectures in international meetings given by the group leader, who has also participated in an international evaluation committee of 6 Institutes of the CSIC (Spain). Three post-doctoral researchers have been recruited from abroad during the review period and scientific collaborations have been established with laboratories in the US and in Italy. An important network of national collaborations (Paris, Dijon, Evry, Gif-sur-Yvette, Versailles) has also been set up.

- **Appreciation on the strategy, management and life of the team :**

The group is headed by two scientists, including the Director of the unit and a good cohesion exists in this relatively small team, which appears to be well managed. The group is significantly involved in teaching and this is reinforced by the presence of a senor-lecturer in the group. The unit heads are also contributing to the structuring of the research at the local and national level (Deputy-Director of the SIBAGHE Doctoral School, member of the scientific

council of the Montpellier 2 University, Deputy-Director of the INRA Plant Biology Department, member of the scientific council of the INRA Genetics and Plant Improvement Department…).

- **Appreciation on the project :**

The project is organised along three main lines. The first one aims, in the framework of the study of NO as a second messenger, at defining the source of NO in the chloroplast. This is a very challenging issue in the current context of ignorance about the actual source of NO in plants. The study of NO-dependent protein modifications should shed new light on NO involvement in the iron signalling process. The second one deals with the interactions between iron and ROS metabolisms to control biomass production. This combines microarray analysis on ferritin mutants, selection of candidate genes and phenotypic analysis of the corresponding mutants via a high-throughput phenotyping system, which will be performed in collaboration with the LEPSE unit. Again, important new data about genes and metabolites involved in the cross-talk between iron and ROS, may arise from this integrative study. The project includes also the positional cloning of dgl and brz in pea. This should give new information on a systemic signalling of the iron status from the shoot to the root. A collaboration has been established with the Genetics and Plant Improvement unit in Versailles and the Plant Genomics unit in Evry, which optimizes the feasibility of the project and the identification of the genes may be expected in the next future.

- **Conclusion :**

During the review period, the team has performed very well and has opened very interesting research lines. Based on the group competences and the established collaborations, the project appears to be fully feasible and is likely to lead to important breakthroughs in the field. Taking into account the size of the team, a focusing effort may be necessary. The next four year period should confirm and reinforce the international reputation of the group.

Team E7 : Electrical and calcium signalling

Project leader : M. Jean-Baptiste THIBAUD

- **Staff members (on the basis of the application file submitted to the AERES) :**

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	2	2
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	1	0
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	0	0
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	0	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	1	0
N7: Number of staff members with a HDR or a similar grade	1	1

- **Appreciation on the results :**

The "Electrical and Calcium Signalling" group has very recently emerged (March 2009) from the "Ion Channels" group and as such has not yet any results in its own right. So the present reports focuses on the recent achievements of the group members. This group is currently composed of a DR, a CR, two postdoctoral fellows and a PhD student. The group leader has been a contributor to the publications of the "Ion Channels" group as senior author in two cases and as coauthor of eight publications. He worked on different aspects of the functional characterisation of ion channels from the Shaker family. The main contributions concern the study of AKT2 regulation by phosphorylation and

heteromerisation of channel subunits. The group leader is also the coordinator of the ANR "Transportome" program consisting of the screening of ion transport proteins in heterologous systems (involving two other partners in ISV and URGV). He is also in charge of a prominent electrophysiological platform at B&PMP. The CR who joined the group has developed skills in cell calcium imaging to investigate the intracellular compartments involved in calcium signalling. He is first author or coauthor of six publications related to his previous research before his integration in B&PMP at the beginning of 2008. Overall the committee appreciates the quality of the work of the group members and the ability to work within a network.

- **Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners :**

This new group has a good reputation in the domain of ion channel biophysics and a large research network is already formed on the aspects which will be investigated in the future. Their work concerning Shaker channels and calcium signalling has been regularly selected for oral presentations but only at the national level. This may have been partly due to the E3 group composition and thus the emergence of the E7 group should be an excellent opportunity for the group leader to improve his international standing.

- **Appreciation on the strategy, management and life of the team :**

It appears difficult to give an advice at this level for this recently created group.

- **Appreciation on the project :**

There are two distinct parts to the project: identification of proteins involved in the regulation of Shaker channels, especially via (de)phosphorylation processes. Some actors such as CIPK-CBL and CDPK have already been identified. This is an interesting and focused program which will be developed in collaboration with well recognized international teams. The committee is confident that this project is feasible and likely to be fruitful. The second project "ELEXIGNAL", for which the group leader has obtained significant funding from RTRA, is highly original and innovative in its concept. The ambition is to reveal the molecular components of long distance electrical signalling which has been reported to occur during various (a)biotic stresses. It is proposed to study the role of Shaker channels in electrical signalling and the cross-talk between electrical and calcium signalling. The information will be gained from the use of reverse genetics, calcium imaging and from an innovative whole-plant electrophysiology setup. The ambition is to further describe how ion channels at the cellular level contribute to long distance electrical signalling and develop this knowledge into an integrated model of plant excitability. Clearly electrical signals merit to be revisited in the light of the recent advances made in molecular genetics. However, the proposed work does not consider the contribution of anion channels and Ca channels which will greatly hamper development of accurate mathematical models. In addition, the absence of a clear physiological role of most electrical signalling in plants is potentially a major weakness.

- **Conclusion :**

The members of this new group have good publication records from their previous research. For the proposed work they have obtained specific funding and established a network of collaborations to further develop their research strategy. The exploration of the links between calcium signalling and ion fluxes is a very interesting domain in the B&PMP context. The committee is confident that the "Transportome" part of the project, concerning Shaker channels regulation, will lead to further insights in this domain. The "ELEXIGNAL" is very innovative and could be a breakthrough in long distance signalling in plants. However, the committee recommends that the project stays firmly grounded in a physiological context rather than in the development of new simulation processes per se.

Team E8 : Transport and signalling of Fe

Project leader : Mrs Cathy CURIE

- **Staff members (on the basis of the application file submitted to the AERES) :**

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)	1	1
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	3	3
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	3	1
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	0	0
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	0	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	1	0
N7: Number of staff members with a HDR or a similar grade	1	1

- **Appreciation on the results :**

This team studies the molecular mechanisms underlying iron (Fe) homeostasis in plants. Iron is an essential micronutrient for all living cells but can become noxious when present in excess. The complex processes plants have evolved to take up Fe at the root level, to mobilize it to the aerial tissues, to distribute it in intracellular compartments and to control these different steps in response to limiting, replete or excess Fe conditions are still far from being understood. The team contributed in the past to major advances on the mechanisms of Fe acquisition from the soil. It focused in the last four years on the actors of Fe transport and the control of this transport in plant adaptation to Fe deficiency conditions. These actors include transporters responsible for Fe circulation/distribution in plant tissues and intracellular compartments, and regulatory circuits controlling the root Fe uptake machinery.

The main achievements of the team concern:

1- The development of a new histochemical method of Fe staining (Perls/DAB) for imaging of Fe distribution in plant tissues and organelles.

2- The exploration of the role of nicotianamine in Fe homeostasis and the study of Fe speciation.

3- The functional characterization of candidate families of transporters including YSL, NRAMP, IRT1 and FRD3.

4- The characterization of transcriptional and post-translational regulation of IRT1.

The quality and impact of the original results of this small team is illustrated by 18 publications in refereed journals from excellent to very good level including 1 EMBO J, 1 PNAS, 3 Plant J, 1 Plant Physiol, 1 Cur Opin Plant Biol, 2 J Exp Bot, 1 Planta, 1 Biochem J, 1 Ann Bot. The publication list also includes one book chapter. Members of the group gave 7 invited lectures in national and international meetings and presented 6 selected oral communications. Four PhD theses have been defended during the period and one is in progress.

- **Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners:**

Taking into account the small size of the team, its international impact is good, with 3 invited lectures and 6 selected oral communications in international meetings. Members of the team co-organized two interbational meetings held in Montpellier, and were invited to give 8 seminars in France and abroad.

The team was able to attract a high number of post doctoral researchers (6) and students (from various levels including 5 Phd students, 3 M2, 5M1 and 5L students) and was very successful in competitive funding in obtaining 4 ANR grants, 1 ToxNuc-E project and one HSFP career award. The group is involved in solid national collaboration networks.

- **Appreciation on the strategy, management and life of the team :**

The team is well structured, its scientific cohesion and its strong dynamics appeared clearly during the oral presentations. The contribution to teaching and training is impressive taking into account the small number of permanent members, with 168 teaching hours delivered by researchers and 20 students from all levels trained during the past four years.

- **Appreciation on the project :**

The project, intended to consolidate the current research, also includes novel aspects and will be developed along to main axes. The first one will focus on Fe uptake and its regulation, with studies of IRT1 biochemistry and dynamics, and the unraveling of transcriptinal regulatory networks targeting IRT1. IRT1 will also be used as a model to unravel the mechanisms of endocytosis in plants (role of monoubiquitination, identification of proteins driving IRT1 internalization and sorting). The second axis will target various aspects of Fe distribution and compartmentalization (Fe atlas, Fe speciation, role of nicotianamine, candidate transporters).

This original and ambitious project combining protein biochemistry, cell biology, genetics and metal chemistry will undoubtedly shed new light not only on the molecular mechanisms of Fe transport in the plant, but also on the general mechanisms of membrane traffic and endocytosis. The establishment of a physiological atlas of Fe at the tissue and cellular levels will also constitute a valuable tool to serve as a reference for the study of Fe homeostasis in plants.

- **Conclusion :**

The team has obtained remarkable results in the study of Fe homeostasis in plants, which are promising for the understanding of the regulation mechanisms controlling Fe uptake from the soil, Fe circulation in the plant and Fe distribution within tissues and cells. The project for the coming years is of excellent quality and well planned. The group has also developed original methods for Fe staining in plant tissues and organelles and has generated powerful chemical and genetics tools, the combination of which constitutes a strong and original basis for further studies. The absence of permanent technical staff in the team might hamper the development of new methodologies and the capitalization of corresponding expertise. It is recommended to take into consideration that (i) the part of the project concerning the study of endocytosis would benefit from stronger interactions with the E4 team and (ii) the genetic approaches undertaken might generate new and multiples areas of interest and the team will have to make choices and set priorities to avoid excessive dispersion of its forces and keep its leadership.

Team E9 : Plant sulphur molecular physiology / Silicon metabolism in plants

Project leader : M.Jean-Claude DAVIDIAN

- **Staff members (on the basis of the application file submitted to the AERES) :**

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)	1	1
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	0	0
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	0	0
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	0	0
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	0	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	0	0
N7: Number of staff members with a HDR or a similar grade	1	1

- **Appreciation on the results :**

The work performed by the group concerned sulfur transport and metabolism. The group has, despite a very limited size at the end of the evaluating period, validated its interesting and original results in several publications in good international journals. The work concerning sulfur transport and mobilisation has resulted in 7 peer-reviewed publications with 4 describing original data (3 Plant Physiol., 1 J. Biol. Chem) and 2 reviews (1 Curr. Op. Plant Biol., 1 C. R. Acad. Agrc.). The sulfur project was eventually terminated at the end of 2007 and all the members but the project leader moved to other groups in B&PMP. The fact that a good publication record was eventually presented after the group was effectively discontinued, demonstrated the quality of the research performed.

- **Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners:**

The group showed very limited attractiveness and exposition despite a few national and international collaborations. The group has also not been able to get appropriate funding to sustain its research nor to create or participate in national or international networks.

- **Appreciation on the strategy, management and life of the team:**

The group's dissolution precludes any evaluation in this context.

- **Appreciation on the project:**

JC Davidian presented to the committee an alternative research project based on the study of silicon transport and mobilisation in hard wheat through the coordination of a network of several national laboratories. The committee has several concerns about the feasibility of this project. First, it involves a single person group that has an already high teaching load and is also responsible for a project to establish a metabolomics platform for B&PMP. Second, the committee had difficulty to evaluate the feasibility of this new project in this original context of a multi-lab network since no precise objectives (like for instance potential deliverables), nor any planning (with milestones for instance) were presented. Likewise, no detail of the funding or personal resources dedicated to this project was presented. Finally, the committee did not clearly understand the integration of the project in the B&PMP scientific policy since both the aim and the approaches were quite divergent from what is done by the other groups involved in mineral

nutrition. JC Davidian is also responsible for metabolomics platform initiative that could clearly benefit the whole unit and would also represent a very good opportunity for B&PMP members to benefit from JC Davidian's strong expertise in plant physiology. However, the committee would have liked to see how and which B&PMP group projects would have been integrated into this platform and also how this metabolomics program would interact with the phenolics platform of SPO. Finally, the committee has some reservations on the choice of the equipment since a GC/MS or GC/TOF would be more adequate than a LC MS/MS for the anticipated metabolomic analyses.

- **Conclusion:**

The comittee would like to congratulate JC Davidian for having brought the work on sulfur transport to a successful ending. JC Davidian has a strong expertise that could benefit the B&PMP unit. However, in its current form, his project is very isolated in the B&PMP context and has no funds or manpower to fullfill its ambitions. As presented, the committee feels that the Silicon project is not satisfactory. The committee strongly suggests that either it is kept as a side project such as including it into a SupAgro teaching program or to develop it with more molecular and/or biochemical approaches with the help of other B&PMP groups (like Gojon or Berthomieu's). In contrast, the committee feels that the metabolics platform initiative would be a very good opportunity for JC Davidian, since this project is in line with both B&PMP and the supagro campus scientific policies.

Note de l'unité	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A+	**A+**	**A**	**A+**	**A**

Nom de l'équipe : *PLANT ADAPTATION TO METALS*

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
B	*A*	*B*	*non noté*	*B*

Nom de l'équipe : *AQUAPORINS*

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A+	*A+*	*A+*	*non noté*	*A+*

Nom de l'équipe : *ION CHANNELS*

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A+	*A+*	*A+*	*non noté*	*A+*

Nom de l'équipe : *INTRACELLULAR DYNAMICS OF MEMBRANE PROTEINS*

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
B	*B*	*B*	*non noté*	*B*

Nom de l'équipe : *INTEGRATION OF NUTRITIONAL FUNCTIONS*

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A+	*A+*	*A*	*non noté*	*A*

Nom de l'équipe : *MINERAL NUTRITION AND OXIDATIVE STRESS*

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A+	*A+*	*A+*	*non noté*	*A+*

Nom de l'équipe : *ELECTRICAL AND CALCIUM SIGNALLING*

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A	*non noté*	*non noté*	*non noté*	*A*

Nom de l'équipe : *TRANSPORT AND SIGNALLING OF FE*

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A+	*A+*	*A+*	*non noté*	*A+*

Nom de l'équipe :*PLANT SULPHUR MOLECULARE PHYSIOLOGY / SILICON METABOLISM IN PLANTS*

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
B	*A*	*B*	*non noté*	*C*

UNIVERSITÉ MONTPELLIER 2
SCIENCES ET TECHNIQUES

La Présidente

Montpellier, le 29 mars 2010

Monsieur Pierre GLORIEUX
Directeur de la section des unités de recherche
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Monsieur le Directeur,

Je souhaite remercier le comité d'expertise pour l'évaluation de l'unité "**Biochimie et Physiologie Moléculaire des Plantes (BPMP)**" pour la qualité du rapport d'évaluation fourni à l'issue de la visite du comité d'expertise

Comme nombre d'autres sites universitaires en France, le site de Montpellier est en cours d'évolution avec la récente création d'un pôle de recherche et d'enseignement supérieur (PRES), ayant deux missions essentielles : accompagner les trois universités montpelliéraines dans un processus de fusion et assurer la mise œuvre de l'opération Campus.

L'Université Montpellier 2 est caractérisée par une activité de recherche fondamentale et pluridisciplinaire fortement associée à la majorité des organismes nationaux de recherche. Dans le respect de nos engagements, cette évolution s'est traduite récemment au sein de notre établissement par la création de Pôles de Formation et de Recherche (PFR) permettant d'accroître la visibilité de notre activité scientifique à l'échelle nationale et internationale.

Le PFR EVAP (Eau, Vie, Agroalimentaire, Planète) auquel le laboratoire BPMP est rattaché, est l'un des cinq PFR créés qui ont pour missions :

- de promouvoir l'excellence de la formation, de la recherche, de l'innovation et de la culture scientifique sur les champs thématiques qu'il porte, d'en renforcer la visibilité internationale et d'organiser les interdisciplinarités en interne et avec les autres PFR;
- de promouvoir la mise en cohérence des politiques de formation et de recherche en son sein ;
- de mutualiser en son sein, les plateaux techniques, les ressources documentaires, mais aussi d'harmoniser les services en charge de la communication, des relations internationales et de la valorisation, des structures de recherche impliquées dans le pôle, dans le cadre de la politique de l'établissement;
- de fournir aux services centraux de l'établissement les données pertinentes en matière de formation et de recherche, mais également d'insertion, de valorisation, et de gestion des ressources humaines, nécessaires au pilotage de l'établissement en matière de politique pédagogique et scientifique.

1809-2009
Bicentenaire de l'UM2

Le pôle EVAP recouvrant le large secteur de “l’agro-environnement” représente un des principaux atouts du site de Montpellier, avec une visibilité au niveau mondial tant en recherche fondamentale que finalisée. Dans le cadre de son projet de développement 2011-2014, l’Université Montpellier 2 affiche une forte volonté de s'investir, plus encore que par le passé, au sein de ce pôle dans le continuum associant biodiversité et biologie végétale (botanique, génétique fonctionnelle, écophysiologie, polymorphisme…). Cet investissement se traduit également par une augmentation de notre offre de formation dans le domaine qui sera constituée, dans le cadre de la prochaine habilitation, de cinq parcours au sein de la spécialité « Biologie des plantes », du Master « Sciences pour l’environnement ».

En réponse aux recommandations exprimées, l’Université Montpellier 2 en tant que tutelle universitaire principale de ce laboratoire, sera particulièrement attachée et soutiendra la mise en place d’actions visant à renforcer l’interaction entre les différentes équipes de cette unité comme entre les laboratoires de la communauté montpelliéraine, notamment au travers des thématiques scientifiques transversales « racines » et « signalisation ».

Enfin, au sein de l'UMR BPMP, l’Université Montpellier 2 entend soutenir de nouvelles approches de biologie des systèmes en favorisant notamment les collaborations locales avec les équipes de mathématiciens/modélisateurs du site. Ce soutien s’inscrit notamment au sein d’un programme pluridisciplinaire, intitulé « Modélisation et simulation du vivant et de l’environnement », développé au titre de la politique scientifique de notre établissement.

Je vous prie d’agréer, Monsieur le Directeur, l’expression de mes respectueuses salutations.

Danièle HÉRIN
Présidente de l’Université Montpellier 2

Biochimie et Physiologie Moléculaire des Plantes
UMR CNRS / INRA / SupAgro / UM 2

Montpellier, 20 Mars 2010

Objet: Réponse de l'Unité au rapport d'évaluation de l'AERES

Tout d'abord, l'ensemble des personnels de l'UMR B&PMP tient à remercier les membres du comité d'évaluation pour la qualité de leur rapport, qui constituera un support précieux pour continuer de faire évoluer l'UMR B&PMP vers encore plus de visibilité et de reconnaissance au cours du prochain quadriennal. Nous sommes en accord avec la plupart des conclusions, des remarques et des suggestions. Nous commenterons toutefois brièvement trois points d'ordre général.

Concernant la visibilité internationale et l'attractivité de chercheurs étrangers « seniors », nous avons parfaitement conscience qu'une attention particulière devra être portée à ce point à l'avenir. Toutefois, cette critique ne nous semble pas être spécifique à notre Unité, mais représenter un problème plus général de la communauté nationale de « Biologie végétale ». Les causes sont certainement multiples et mériteraient une analyse globale, plutôt qu'une introspection Unité par Unité. Au niveau de l'Unité notre action pour accroitre cette attractivité internationale a été (i) de définir une ligne scientifique claire, (ii) de mettre sur pied un dispositif attractif et original (assemblage de plateaux techniques de biophysique et de commodités de phénotypage de plantes par exemple), (iii) de présenter les travaux de l'Unité à des congrès internationaux et d'inviter des intervenants étrangers à nos séminaires hebdomadaires (19 depuis janvier 2008). Il est cependant toujours possible de faire mieux ! Des actions seront donc entreprises pour augmenter la connaissance et la reconnaissance de l'Unité à l'étranger. Cette reconnaissance est actuellement hétérogène entre les équipes avec des « étendards » à reconnaissance internationale très forte, comme souligné dans le rapport, mais aussi avec quelques équipes plus faibles. Soutenir ces dernières, et veiller à une meilleure intégration de certaines d'entre elles pour les amener à ce niveau de reconnaissance plus élevé fera donc logiquement partie de notre stratégie au cours du prochain contrat.

Concernant la nécessité de renforcer l'interaction entre les différentes équipes, nous adhérons pleinement à cette remarque et des initiatives ont déjà été prises dans ce sens avec, comme suggéré par le comité, (i) la création d'un journal club animé par un jeune CR, en plus des séminaires hebdomadaires, (ii)) la réunion régulière des non permanents (thésards et post-docs) des différentes équipes pour discuter entre eux de leurs travaux et de leurs lectures scientifiques, et (iii) le dépôt d'un projet fédérateur « racines » auprès du RTRA, porté par B&PMP, et regroupant plus d'une dizaine d'équipes de Montpellier, dont quatre de notre Unité, parmi lesquelles l'équipe « Dynamique des protéines membranaires ». D'autre part la suggestion du comité que B&PMP s'engage dans l'élaboration d'un projet transversal « Signalisation » recevra toute notre attention au cours du prochain contrat.

Enfin, au titre de l'enseignement, le rapport d'évaluation ne fait état que des 436 heures assurées par les chercheurs (page 9). L'investissement de l'UMR dans l'enseignement dépasse de beaucoup ces 436 heures affichées puisque sur la période du précédent contrat (2005-2009), c'est environ 5000 h d'enseignements qui ont été dispensées par les enseignants chercheurs de l'Unité.

Jean-François BRIAT
Directeur de l'Unité B&PMP