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

Section des Unités de recherche

AERES report on the research unit

Fruit Biology and Pathology

(Very Large Unit issued from the fusion of UMR0619,
UMR1090 and EA3671)

From the

INRA

University of Victor Segalen-Bordeaux 2

University of Bordeaux 1

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 : The Fruit Biology and Pathology

Requested label : Joint Research Unit (UMR)

N° in the case of renewal : UMR0619, UMR1090, EA3671

Name of the director : M. Thierry CANDRESSE

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

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Report

1 • Introduction

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

The visit of two days and a half took place on November 4th to 6th. The committee members had received, about three weeks ahead, a set of clear and well presented documents including the detailed assessments of the 2005-2009 period for the three units and the research projects of the three units (UMR0619, UMR1090 and EA3671) to be merged into a very large unit (TGU, Très Grande Unité). The visit took place as planned: presentation of the committee and the evaluation procedure, global presentation of the future unit by the director, presentation of each unit/team and discussion, meeting with the laboratory council, the administrative and technical staff, the PhD and post-doctoral fellows and the researchers/faculty members, and meeting with the University and INRA representatives.

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

The “Fruit Biology” (UMR0619, headed by Dominique Rolin) and “Genomics, Diversity and Pathogenicity” (UMR1090, headed by Alain Blanchard) units are located on the Bordeaux-Aquitaine INRA Center (Villenave d’Ornon) and share the same group of buildings and some of their experimental facilities. The team “Mycoplasma and Chlamydia human infections” (EA3671, headed by Cécile Bébéar) is located on the University Campus of Bordeaux 2. Altogether, the three units gather around 120 people, among which 98 permanent staff: 25 members of the different Universities from Bordeaux (7 from Bordeaux 1, 17 from Bordeaux 2 and 1 from Bordeaux 4 Universities), 21 researchers (19 from INRA and 2 from CNRS), and 52 engineers, technicians and administratives.

The “Fruit Biology” unit has a long experience in studying tomato, and notably the molecular, cellular and physiological mechanisms involved in fruit organogenesis and in the elaboration of fruit quality, with the aim of elucidating the mechanisms controlling fruit size and composition and identifying primary and secondary metabolites with nutritional and anti-oxidant properties. The three teams of this unit focus on organogenesis and endoreduplication, functional genomics of fruit development and regulation of fruit metabolism, respectively. The two teams of the “Genomics, Diversity and Pathogenicity” unit target different types of pathogens : phytoviruses with a particular focus on two Potyviruses, the Plum pox virus (PPV) and the Lettuce mosaic virus (LMV), and pathogenic mollicutes. The scientific activities of the “Genomics, Diversity and Pathogenicity” unit cover five main areas, two of which being common to the two teams: etiology, genetic diversity and detection of pathogenic viruses or phloem-limited bacteria, and host-pathogen interactions. The three other areas are developed independently by one of the teams: Evolution and expression on mollicute genomes, implementation of new strategies of resistance to potyviruses-biosafety, and biotechnological application of plant viruses. The EA3671 team studies two bacterial genera, mycoplasmas and Chlamydiae involved in human infections.

The UMR0619 and UMR1090 form the “Institute of Plant Molecular Biology” (IBVM) and they jointly created the Institut Fédératif de Recherche “Integrative Plant Biology” (IFR103) in 2001. IFR103 currently federates the entire plant science community of Bordeaux, with nine research units located on three sites (INRA campuses of Villenave d’Ornon and Pierroton and the University Bordeaux 2 campus). In the past years, besides the reinforcement of crossed collaborations, the two UMRs jointly contributed to the development of technological platforms (cytology-imaging, metabolomics). In parallel, the Mollicutes team of UMR1090 has maintained a long lasting collaboration with the EA3671 team, which led to the proposal of merging these two teams into a new Mollicutes team for the forthcoming contract.

A few weeks before the starting of the AERES evaluation process, the decision was taken to create a Very Large Unit (TGU) merging UMR 0619 and UMR 1090 (already including EA3671), as a natural evolution of the IBVM. The proposed TGU, named “Fruit Biology and Pathology” will have two locations, the IBVM on the INRA campus and ex-



EA3671 team on the University of Bordeaux 2 campus. The proposed TGU is structured in five research teams, the three teams of UMR0619 and the two teams of UMR1090, with the Mollicutes team integrating the EA3671.

- **Management team :**

The directorship proposed for the TGU “Fruit Biology and Pathology” includes a director and a deputy-director. The proposed organization chart, besides the five research teams already mentioned, includes the joint lab between INRA and the university of Tsukuba (Japan) and five technological platforms or resources: cytology-imaging, metabolomics and fluxomics, transcriptome and TILLING, monoclonal antibodies production and the Chlamydiae reference center.

Due to time constraints (the very short delay between the starting of preliminary discussions on the opportunity to create the TGU at mid-September and the deadline for submission of the reports to AERES at mid-October), it was decided that the two UMR would present the independently prepared dossiers (scientific reports and projects), with the common addition of a detailed analysis of the reasons for creating such a TGU. This analysis (Strengths, Weaknesses, Opportunities and Threats) will serve for the development of the detailed common scientific project of the TGU which will be prepared during 2010.

- **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)	13+4+5*	24
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	9+12+0*	20
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	5+5+2*	3
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	19+33+4*	52
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	2+3+0*	2
N6: Number of Ph.D. students (Form 2.7 of the application file)	8+7+2*	8
N7: Number of staff members with a HDR or a similar grade	14+4+4	30

*UMR0619+UMR1090+EA3671

2 • Overall appreciation on the research unit

- **Summary :**

The current units that will make up the TGU (UMR0619, UMR1090 and EA3671) have achieved pioneering work on various aspects of plant development and plant-pathogen interactions which gives them a large international recognition in their respective fields: fleshy fruit development, plant viruses and plant, animal and human pathogenic mollicutes. This can be assessed through the good overall publication record of the teams (a total of 304 articles in peer-reviewed journals), their excellent ability to gain funding from both the National Research Agency (13 projects) and the European Union (13 projects) and their involvement in 10 bilateral cooperation programmes. A strong involvement in teaching and student training can be emphasized, although the number of PhD students and post-docs could be increased. The founding UMRs have played and still play an important role in structuring the local community



of plant sciences, in particular by sharing unique biological resources and offering platforms at the cutting edge of technology.

The overall functioning of the teams is good and the quality of the management is particularly worth mentioning. The decision of merging the three existing units to create a TGU has been taken less than three months ago, bringing together about 100 permanent staff. Two major strategic issues have to be addressed in the near future to make concrete the existence of this TGU: building up a common and integrated scientific project, and setting up the most efficient and relevant organization to bring this project to completion.

- **Strengths and opportunities :**

The three components of the future TGU have common strengths such as the high publication record and of the management, and a very good national and international visibility in their respective fields: (i) fleshy fruit development, quality and metabolomics on the tomato model, (ii) non-cultivable pathogens (phytoplasmas and viruses) that are responsible for important plant diseases, and (iii) human and animal pathogenic mollicutes. The recent establishment of a joint lab between UMR0619 and Tsukuba University offers a good opportunity to share genomic resources and develop common projects with the Japanese tomato consortium.

All teams have access to high level infrastructures (e.g. containment greenhouses) which have few equivalents elsewhere, and to several local technical platforms at the cutting edge of technology (e.g. for metabolomics and imaging) that will support the various projects of the teams. The development of a high-throughput enzymatic phenotyping platform and the building of a new S2 confinement greenhouse represent joint and ambitious projects which are already launched.

The creation of the TGU is a clear opportunity for a better visibility of the plant science field in the Bordeaux area and an increased attractiveness for students and post-docs. On the basis of their significant common history in scientific cooperation as well as in collaborative strategic planning, resource identification and resource allocation, UMR0619 and UMR1090 wish to extend their partnership within the TGU. The integration of the two mycoplasma groups within the same team will give a better visibility to the plant-animal-human mycoplasma research in Bordeaux and will further enhance the potential for high impact projects.

The TGU federates people with different scientific backgrounds (plant physiology and metabolism, agronomy, plant bacteriology and virology, clinical bacteriology) thus providing excellent scientific complementarities and enabling multidisciplinary approaches towards the development of projects on systems biology. Based on its "multi-tutelages" status and its geographical situation, the TGU has a good opportunity to further improve its research, training and teaching activities.

- **Weaknesses and threats :**

A common and main weakness of all teams is the very small number of PhD students and post-docs with regard to their training capacities (number of HDR). The difficulty in attracting young non-permanent researchers to fully exploit the resources now available should be analyzed and overcome.

The strong commitment of several teams in the development of technological platforms and their opening to a wide community is again worth mentioning. This might be considered to some extent at the expense of their own research activities, but such platforms clearly represent a considerable asset for research. A fine balance, adapted to each platform, is required between continuing methodological development, research on biological questions, and external service contracting.

The creation of the TGU is still "virtual" and the forthcoming year will be critical for a more concrete development of this project. While proximity to the University Hospital appears critical for the research, teaching and medical duties of the personnel of the present EA3671, the fact that all members of the TGU will not be grouped on a single site might hinder the building of common projects and the cohesion of the new TGU.

A strong anxiety generated by the TGU project has been expressed during the interviews the committee had with the different groups of permanent personnel and should be taken into account by the management team. Though the general feeling is rather positive for the creation of the TGU, most people do not yet see the added value of such a big structure and they fear both added bureaucracy and decreased reactivity. Such anxiety relies largely on the very



recent decision to create the TGU and the lack of communication that ensued. This situation needs to be corrected to preserve the very good atmosphere which prevails in the current units.

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

In the forthcoming months, it will be essential to communicate with all personnel categories on the TGU project and to reassure them on the place everybody will find in the new organization. Being able to demonstrate the added value brought by the very large unit and involving all staff members to build scientific as well as organisational aspects of the project will represent essential steps to improve the cohesion and facilitate the adhesion to the TGU project. A special attention should be paid to the organization of common support services, including the administration level, to coordinate already existing forces and implement the best practices. The creation of specific working groups in these areas (secretariat, maintenance, greenhouses), comprising people from all three existing units and acting as forces for proposal might be a good way forward on this issue.

Efforts should be made in the future unit to develop synergies between people working on plant science and microbiology and between the different microbial models (plant, animal and human pathogens) to successfully exploit all possibilities offered by the created tools and resources. The teams should be encouraged to pursue their efforts to publish more and in higher level journals. At the TGU level, a common policy to promote the independence of young researchers and the emergence of new topics should be defined.

The lack of students is a general problem of the current UMRs. The TGU could provide an opportunity to install an international PhD program, that should be widely advertised and connected to a system whereby putative candidates for hiring are invited for selection. This would also increase the visibility of the institution as a whole, on important levels - regional, national, international.

- **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	43
A2: Number of other researchers (recorded in N3, N4 and N5) who are active in research	23
A3: Ratio of members who are active in research among permanent researchers $[(A1)/(N1 + N2)]$	1
A4: Number of HDR granted during the past 4 years	4
A5: Number of PhD granted during the past 4 years	18

3 • Specific comments on the research unit

- **Appreciation on the results :**

The three components of the future TGU have a long lasting experience in their respective research fields. UMR0619 has a leadership in the study of early fruit development, cell cycle regulation, endoreduplication, genomics and metabolomics on the tomato model, and has strong established links within the INRA Tomato network. UMR1090 is unique in France in bringing together expertise on two groups of non-cultivable pathogens (phytoplasmas and viruses) that are responsible for important plant diseases, and the integration of EA3671 bringing recognized expertise in human pathogenic mollicutes will further expand the impact of the studies on mollicutes. The practise of translational research, going back and forth from the lab to the field or to the hospital has provided these units with an excellent visibility in both basic and applied research aspects. The quality and impact of the results is also highlighted by the ability of the teams to establish numerous national and international collaboration networks.



The units have a good to very good overall publication record in the 2005-2009 period: 97 publications for UMR0619 (including 1 PNAS, 3 Plant Cell, 5 Plant J, 16 Plant Physiol, 5 Planta, 5 J Exp Bot), 142 publications for UMR1090 (including 1 Cell, 1 Nature Nanotech, 1 Plant Cell, 1 PNAS, 1 Plant Physiol, 1 TIPS, 1 PLoS Genetics, 1 Advanced Mat, 2 J Virol), and 65 for EA3671 (including 1 PLoS Genet, 7 Clin Microbiol Inf, 6 J Clin Microbiol and 4 Antimicrob Agents Chemother). The scientific production of the three units is also made up of 3 books, 67 book chapters and 49 invited conferences to national and international meetings. The three current units already have joint publications (1 PLoS Genetics, 2 MPMI, 1 Virus Res) and joint presentations in national (8) and international (8) congresses. In total, 18 PhD theses have been defended (8 in UMR0619, 9 in UMR1090 and 1 in EA3671).

Several databases have been created and are open to external users: MeRy-B (plant metabolome data), MMDB (tomato phenotyping annotation database), AgroBi VTC Fruit database (tomato "omics" data), Tomacyc (metabolic data and networks in tomato), Molligen (comparative genomics of mollicutes) maintained in collaboration with the Bordeaux Centre for Bioinformatics.

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

Members of the different units have given 32 invited lectures at international conferences (10 for UMR0619, 15 for UMR1090 and 7 for EA3671). They also contributed to the organization of national (11) and international (12) meetings. Some of them received awards from the International Organization of Citrus Virologists and from the International Organization for Mycoplasmaology, and presentations at meetings have been awarded as best oral communication (3) or best poster (4). A member of the Mollicutes team has been elected recently as chair of the International Organization for Mycoplasmaology and a member of EA3671 participated in the board of directors of this organization.

The units host a small number of foreign visitors and post-docs, a situation which could be improved. The recent creation of a joint lab between UMR0619 and Tsukuba University will facilitate the exchanges of people between France and Japan: a Japanese assistant professor joined UMR0619 for a two-year period, French students are being sent to Tsukuba for their lab practical courses and an INRA scientist will spend a six-month stay in the Gene Research Centre of Tsukuba University in 2010.

The ability to successfully apply for competitive funding at the national level is excellent, with 6 ANR projects in UMR0619 and 7 for UMR1090. In addition, 3 projects were funded by hospital programmes for clinical research in EA3671, which also received specific support from the National Reference Center for Chlamydiae infections. Support has been obtained from the Aquitaine Regional Council for equipment and PhD salaries. At the international level, the success of both UMRs to raise funds from the European Union is impressive, with 13 projects from the FP6 and FP7 programmes. Most of these competitive grants have been obtained in the frame of local, national and international collaborative networks. A significant number of international bilateral cooperation projects (10) has also been funded.

As to socio-economic partnership, UMR0619 has two main partners in the Region Aquitaine, the "Bassin du Grand Sud-Ouest" and the "Groupement d'intérêt économique Fruits et Légumes". UMR1090 is active in technology transfer of diagnosis and typing methods. It is involved in a global licence agreement signed between INRA and the SEDIAG Company, dealing with the detection of phytopathogenic organisms, and collaborates with the company PHYTINOVE. During the four-year period, four patents have been filed (1 from UMR1090 and 3 from EA3671).

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

Each unit is well organized and the quality of management is excellent. Both UMRs have common services including administrative staff and technical services. Different boards and committees have been set up to help the management and discuss the unit strategy, the "Conseil de service" acting as an advisory board. A special attention has been paid to the communication outside and inside the units, via web sites including an intranet to share information between unit personnel. Various levels of scientific animations occur at the unit and IFR levels including weekly internal seminars and seminars given by French or foreign guests. Young researchers (PhDs and post-docs) are encouraged to take more initiatives to stimulate the scientific life of the unit. In the planned TGU, a more integrative view of the work performed in the different teams will greatly help the emergence of cutting edge projects.



The three components of the future TGU are significantly contributing to teaching. Besides courses at various levels and teaching responsibilities taken in charge by University staff, several researchers contribute to Master and Licence teaching.

The contribution to the structuration of the research at the local level is excellent as the UMR0619 and UMR1090 have launched, together with the other units of the plant science community of Bordeaux, the IFR103 "Integrative Plant Biology". Both UMRs and EA3671 have developed and offer to the local, national and international science community invaluable technological and biological resources. These include several platforms (IBISA labeled): cytology-imaging presently run jointly by UMR0619 and UMR1090, transcriptome-TILLING and metabolomics-fluxomics run by UMR0619 and monoclonal antibodies production run by UMR10901. Besides the MicroTom mutant collection created by UMR0619, large collections of wall-less phytopathogenic bacteria and viruses are available at UMR1090 and EA3671 maintains human pathogenic mycoplasmas and Chlamydiae as a Chlamydiae National Reference Center. The metabolome-fluxome facility is a good illustration of success as this high-throughput metabolite-based phenotyping platform has developed locally (Centre de Génomique Fonctionnelle de Bordeaux), at the national level (Métabolome-Fluxome French network) and with key European players in the field (within the META-PHOR EU STREP project).

- **Appreciation on the project :**

As already mentioned, the very recent decision to propose the creation of the TGU has not allowed the candidates to work properly on a common scientific project for this new unit. However, the project brings together the UMRs without significant modification of the perimeter of the existing teams, with the exception of the fusion of EA3671 with the Mollicutes team of UMR1090. The individual scientific projects of the existing teams thus form the basis of the unit project. They cover five main research areas: the relationship between cell size, fruit size and fruit composition, the biosynthesis of health-related compounds in fruit, the exploration of fruit quality with systems biology, plant viruses and mollicutes. With a few exceptions (as detailed below in team evaluations), these project are well constructed and appear relevant according to the know-how of the teams and the national and international context. One originality of the project lies in the scientific challenge of going from plant physiology and metabolism to systems biology. Another one is the practise of translational research, going back and forth from the lab to the field or to the hospital to target important plant and human diseases. There is no doubt about their feasibility during the next 4 year period.

However, a strong effort is still required in the forthcoming months to build up and consolidate a common scientific project for the TGU. The scientific dynamic already exists and more interactions are expected to develop over time. The proposed organization chart for the TGU represents a sound basis to begin substantive work on the organization of the new structure and to define a common policy for the allocation of resources.

The creation of a high profile TGU represents an exciting challenge that all team leaders, the management team and the institutional stakeholders (INRA and Bordeaux 1 and 2 Universities) are clearly ready to face. The committee unanimously supports this initiative but strongly recommends to the management team to improve its communication on the project within the units and to associate all categories of personnel to the construction and planning of this endeavour.



4 • Appreciation team by team and/or project by project

Intitulé de l'équipe : Fruit organogenesis and endoreduplication

Responsible : Christian Chevalier

- 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)	2	2
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)	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)	4	2
N7: Number of staff members with a HDR or a similar grade	4	3

- Appreciation on the results :

The team, belonging to the former unit "Biology of the Fruit", has developed two major themes: i) the study of candidate genes involved in the control of tomato floral determination and fruit organogenesis, and ii) the characterization of early fruit development with a focus on the role of endoreduplication. The panel felt that the team should attempt to address the central question 'what is the role of endoreduplication in fleshy fruit development and the determination of fruit quality?', perhaps by attempting to devise a screen for mutants in the tomato mutant populations, perhaps by TILLING for mutations in primary candidate genes. TILLING would allow for the discovery of weaker alleles to avoid problems associated with specific genes being essential for fruit development. In the part of the program dedicated to investigating the flower to fruit transition the panel felt that the team would be well advised to shuttle between Arabidopsis (where work is quicker) and tomato (where there are key questions to address).

The publication record is very good with 19 articles during the 2005-2009 period (including 8 in excellent journals: Plant Cell, Plant Journal, Plant Physiology), and several very useful reviews (Ann Plant Rev, Progress in Botany). The impact factor could be a little higher but the committee appreciated that team members did try first for higher impact journals.

Three PhD students have graduated during the review period, 4 theses are underway, and 6 Masters projects have been completed. The team/team leader undertakes a significant amount of external reviewing of manuscripts and grant proposals.



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

The team is clearly doing work that fits well with the interests of the community working on the cell cycle in plants and the team leader has produced important reviews and been invited to present the work of the team at international seminars. There are very good collaborative interactions with other European groups, supported by the EU-SOL project. Obviously, the team activity is coherent with the other groups in the same unit. There have been significant oral presentations by the team members: nineteen, of which 11 were at international meetings, and two invited seminars at non-French scientific institutions for the team leader. The poster presentations at meetings are good at 14, but the number of presentations at international meetings is rather small (9); this illustrates a problem perceived by the panel, that team members were not being encouraged to attend international meetings and training courses enough. These are activities which would enhance the visibility of the team.

The quality of the scientists within the team is good, although essentially all are French. The number of students is quite low and there is only one post-doc in the team at present, plus one visiting scientist. The joint Franco-Japanese laboratory is an important new asset.

The ability to raise funds is clearly very good, including two Marie Curie fellowships, two ANR projects and participation in EU-SOL, a 30 member consortium which brings very significant interactions with other European partners and industry, both French and European.

There is a patent filed on floral conversion in strawberry. There is also industrial interaction through EU-Sol. However the panel felt that there were opportunities to increase the interactions of the team with industries, considering the proximity of Limagrain, and their interest in tomato. One suggested activity could be the holding of 'open days' for industry so the whole 'fruit biology' project could make contacts and show industry what the various teams could deliver and the resources available for research on tomato.

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

The management of this team is exceptional. However, the panel felt that the strong management of the team had a tendency to lock the individual researchers into the defined objectives and removed the opportunity for individual researchers to follow up unexpected observations and pursue curiosity-driven aspects of the research.

The contribution of the team to teaching is outstanding. In one particular domain, biological imaging, the present implication of team members in the functional microscopy based at Neuroscience, Bordeaux II, is a useful strategy for accessing competence, for innovation and for training: this association reinforces attractiveness.

- **Appreciation on the project :**

The team has strong scientific foundations which will guarantee its existence in four years and ensure that interesting scientific questions are being addressed. To make their research of greater strategic relevance, the team members could try to think of strategies to address the really big questions in fleshy fruit development. They, and their colleagues in the unit, have all the tools and resources necessary to address such big questions.

The allocation of resources seems very equitable. All team members seemed very satisfied.

The development of cutting edge projects could be encouraged further by giving younger researchers more support to follow up unexpected observations and to mix more with scientists in the international arena, by attending workshops, courses and scientific meetings. Obviously, individual researchers must be strongly encouraged to propose and to pilot novel research applications within the team framework.

- **Conclusion :**

- **Summary :**

Fruit organogenesis and endoreduplication is a very good team that could promote their visibility more by judicious use of Arabidopsis to address some questions in flower to fruit transitions, and who could encourage the participation of younger scientists in the international scene to strengthen the research at Bordeaux.



– **Strengths and opportunities :**

The main strengths of the team are the program management and the clarity of objectives. The opportunities are the resources available through the platforms for research on early stages of tomato fruit development.

– **Weaknesses and threats :**

Competition from research on Arabidopsis fruit development may take some of the novelty from the research on tomato.

– **Recommendations :**

The panel felt the research could go faster and be more cutting edge at times by shuttling between Arabidopsis and tomato. The team leader should encourage a culture of curiosity-driven research related closely to the training of the younger members of the team, which should support the emergence and vigor of new scientific talent within the team. Specific suggestions are:

- Send students on international workshops and courses of relevance to their studies.
- Invite international visitors through a seminar program.
- Hold an annual open day for plant biotech and agro industries.

Intitulé de l'équipe : Functional genomics of fruit development

Responsible : Christophe Rothan

- **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	2
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)	1	1
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	4	4
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)	2	2
N7: Number of staff members with a HDR or a similar grade	2	2

- **Appreciation on the results :**

The aim of the team, belonging to the former unit "Biology of the Fruit", is to investigate the mechanisms involved in the interaction between fruit growth and quality (biochemical composition) in tomato. These studies are highly relevant, because fruit size and composition are major traits all partners of the tomato market (breeders, farmers, industry, consumers) are interested in.



The general strategy is to identify genes associated with growth and/or quality, through transcriptomic or candidate gene approaches. Original results were obtained on ascorbate (vitamin C) biosynthesis, and on the identification of a poorly characterized gene playing an important role in cuticule deposition.

In addition, this group has devoted a very significant part of its activity to set up genetic resources (MicroTom mutant collection) and technological platforms (transcriptome and TILLING platforms) of major interest for the tomato community.

However, one weakness of the past activity is that most studies on selected target genes (e.g., PIN, TOR, most candidate genes identified through transcriptomics) have not yielded any publication yet, and are still ongoing. Furthermore, it is unclear whether any one of these genes will constitute a priority for the group in the future.

Taking into account the difficulty of tomato as a model system, and the strong methodological investments made at the expense of pure research projects, the overall scientific production of the group is very satisfactory, with 13 articles during the 2005-2009 period, including 5 in excellent journals (Plant Physiology, Plant Journal), 4 invited talks in international conferences, and 3 PhD thesis. Furthermore, a patent is pending on the cuticule-related gene, which could provide an interesting outcome for valorization.

- **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 good but could certainly be improved. Except a few invited talks at tomato-related conferences, the international visibility of the group in the overall plant science field remains quite low, although the potential is present.

The ability to recruit high levels scientists, post-docs and students from abroad is quite limited (despite the stable partnership cited below). Only a few PhD students and post-docs are active in the group. One exception is the exchange of staff between the group and Tsukuba University, in relation with the new joint lab with INRA which is a five year commitment.

The ability of the team to raise funds is excellent. Both the efforts to apply to calls for proposals and the success rate of the applications are remarkable (9 proposals accepted since 2005). The setting up of genetic resources (MicroTom mutant collection) and technological platforms (transcriptome and TILLING platforms) should be acknowledged.

The existence of stable collaborations with foreign partners is a clear strength of the group. It has been able to get involved in key scientific networks at both local, national and international levels (within the Fruit Biology UMR and INRA, or in the frame of ANR and EU-funded projects). Several articles result from collaborations with the other groups of the UMR, and with other INRA groups. Although most partnerships are dependent on project funding, the collaborations within INRA are certainly stable. Moreover, a striking illustration of both quality and stability of partnership is the role of the group as co-founder of a joint INRA-University of Tsukuba (Japan) laboratory.

Two patents are pending. The MicroTom mutant collection is also of interest for private companies involved in tomato breeding. The group seems to be able to attract workers from these companies. This should be strengthened in the future since it may constitute a key advantage for developing the collection and the TILLING platform, even for pure research.

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

The overall organization of the team is well perceived by the staff, as for the whole Fruit Biology unit. One risk is associated with the heavy load of collective duties, in particular in relation with the platforms. This will require a well-defined strategy in the future to maintain an efficient balance between these duties and involvement in research.

The scientific animation remains essentially local. Opportunities for emergence of cutting edge projects are mostly related to possible fruitful interactions with the two other groups of the UMR concerning transcriptomics, and to the large-scale valorization of the MicroTom mutant collection and TILLING platform. This would also correct the current imbalance between the strong investment of the team in the creation of these collections and the ability to



exploit them. However, there seems to be little space for new initiatives by young researchers, especially due to the low number of PhD students and post-docs.

The contribution of the team members to teaching is low, as compared with the two other groups. This is explained by the fact that most scientists are pure researchers. The team provides a good contribution to local organisation, through positioning of technological platforms in the network of research facilities in the whole Bordeaux area.

- **Appreciation on the project :**

Altogether, the project appears to be relevant, original and feasible. One positive aspect is that the group will improve its panel of available tools and strategies for functional analyses (e.g., fruit specific promoters, TILLING mutants). Work on ascorbate and cuticle biosynthesis will be pursued, which is fully justified. The proposed new round of transcriptomic studies should be performed in close cooperation with the two other groups of the UMR, to strengthen the critical mass involved in the exploitation of this huge amount of data.

The project is in line with the previous studies and does not include real cutting edge project. One possible exception is the valorization of the MicroTom mutant collection and TILLING platform. Depending on the actual efforts devoted to this aim, this could certainly contribute to providing highly novel findings.

- **Conclusion :**

- **Summary :**

This team has been able to carry on major developments concerning collective resources and platforms and a sustained research activity on relevant topics, with good quality publications. Two very positive aspects are its involvement in large national and international networks, and its ability to be funded.

- **Strengths and opportunities :**

The strengths are related to the relevant topics addressed, excellent partnership and resources and platforms. The efforts toward more refined functional analyses (TILLING, promoters) are important for improving the quality of research and gaining access to high quality journals. The valorization of the MicroTom mutant collection and TILLING platform is a major opportunity.

- **Weaknesses and threats :**

Too few students and post-docs, who do not have enough connections with “top level” scientific community, appears as the main weakness. Although renewed transcriptomic approaches will certainly be of major interest, these are not expected to provide original and decisive data on functional characterization of key growth/quality genes before several years. Thus, the group must set up a strategy aiming at securing more short-term studies that will warrant a sustained scientific production in the near future.

Although the mutant collection, combined with the TILLING platform, is certainly a master opportunity for the group, the strength of the approaches using these facilities appears to be below that required. This fully justifies the request for a new scientist (genetics) position. However, the group as well as the whole UMR must also envisage all internal solutions that could in practice reinforce these approaches, given their high priority.

- **Recommendations :**

The group does not currently have the strength to carry on all proposed projects at a really significant level. The risk of dispersion is high. A more stringent selection should be made on the candidate genes for functional analysis, to favour those enabling an original and (possibly) fast scientific production. More ambitious projects (e.g., new transcriptome approaches, forward genetics, TILLING) should be tightly coordinated with the two other groups of the Fruit Biology par of the unit, to be able to set up a decisive critical mass for exploiting highly novel outcomes from these projects.



Intitulé de l'équipe : Exploration of metabolism and its regulation during fruit development

Responsable : Dominique Rolin

- **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)	7	7
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	4	3
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)	5	6
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)	4	2
N7: Number of staff members with a HDR or a similar grade	8	7

- **Appreciation on the results :**

Over the last four years, the major project of this team, belonging to the former unit "Biology of the Fruit", has concerned the development of the metabolomics platform at Bordeaux, an initiative driven notably by the group leader over the last decade. This project, requiring gradual assembly of the necessary technological, human, and administrative resources, has been crowned with considerable success. At the national level, the group has been a major driver in the development of metabolomics networks in France, where Bordeaux is now among the very premier centres for plant metabolomics.

Recent grant awards and participation in French (6 ANR projects) and EU networks (2 from FP6 and 1 from FP7) testify to the group's excellent visibility at the European scale. This focus on method development has inevitably impacted progress on biological questions, but there have been significant high quality publications (29 in total) in plant science (i.e. 1 Plant Cell, 6 Plant Physiol, MPMI, 4 Planta) as well as technical journals (i.e. 2 J Agr and Food Chem, 2 Metabolomics) and this trend is likely to accelerate given the tools that are now available. The team also contributed to the development of a web-based application to store and analyze metabolomics data (MeRy-B).

- **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 been able to attract established researchers, as shown by the recent recruitment of Yves Gibon, formerly working at the MPI for Molecular Plant Physiology at Golm, Germany, and still maintaining useful collaborations there. The links with Japan are also encouraging and, as already mentioned, the European visibility of the team is excellent.

Development of the metabolomics platform has clearly opened up an important source of funding and members of the group regularly attend national (5 invited conferences) and international (5 invited conferences) meetings as part of their participation in networks. They are also active in knowledge transfer through workshops and organize conferences at the national level. A specific strength of this platform is that it integrates chemical analysis with data storage and bioinformatics at the CBiB (Bioinformatics Center of Bordeaux).



One problem requiring attention is the lack of early stage non-teaching researchers focused on biological questions that exploit the technical tools now available. A particular concern is the drop in the number of PhD students over the last four years. The current number is well below group capacity given the number of HDRs in the team, and it is highly recommended that the appearance of the group and its research programs is reinforced at the level of the Doctoral School.

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

The management of the team is excellent. The group leader has been able to bring together the complementary expertise of INRA engineers and junior professors within common projects. Authorship of publications is generally shared between several team members. The biological research impetus of the group risks being weakened by the high number of university staff heavily involved in teaching. On the other hand, a contribution of specialist INRA researchers to the teaching of cutting-edge techniques at Masters level could contribute to increasing the group's attractiveness to potential PhD candidates.

- **Appreciation on the project :**

On the whole, the project appears pertinent and the level of publication of this and other groups within the forthcoming TGU will certainly benefit from the platforms now in place or soon becoming fully operational. Care needs to be taken to balance technical know-how in chemistry with sufficient biological expertise to exploit the technological potential within projects driven by scientific questions.

In this regard, the focus on primary metabolism during tomato development is justified and will benefit from the newly-established high-throughput enzyme profiling platform. The group would seem to be well equipped to place a little more emphasis on the tomato fruit as a potential sink for compounds other than sucrose, and to analyze the question of metabolite import versus in situ synthesis, for example in collaboration with the Functional Genomics group. The study of epigenetics such as histone and DNA methylation or siRNA in the regulation of primary metabolism is risky, though it cannot be excluded that this project will yield some interesting results.

- **Conclusion :**

- **Summary :**

In summary, the necessary technical tools and permanent personnel are in place and the project can be expected to generate interesting results over the next four years.

- **Strengths and opportunities :**

The team established a panoply of techniques on enzyme and metabolite profiling and flux analysis that is more or less unique at the national level, and also competitive at the international level.

- **Weaknesses and threats:**

The difficulty in attracting young non-permanent researchers to fully exploit the resources now available is the main weakness. Fine balance is required between continuing method development, research on biological questions, and external service contracting.

- **Recommendations :**

The team should focus available researchers on core projects and continue to explore alternative routes to attract PhD students.



Intitulé de l'équipe : Plant viruses

Responsable : Thierry Candresse

- **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	1
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	8	8
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	7	2
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	13	13
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	2	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	3	2
N7: Number of staff members with a HDR or a similar grade	7	8

- **Appreciation on the results :**

The team, belonging to the former unit "Genomics, Diversity and Pathogenicity", is involved in applied and fundamental research with two main areas of investigation: (i) aetiology, diagnosis and characterization of infectious diseases and their agents (viruses and viroids) and (ii) interaction between plants and potyviruses using as models Plum pox virus (PPV) and Lettuce mosaic virus (LMV), both of which are responsible for important crop losses, with the final goal to develop and/or select potyvirus-resistant plants. These topics benefit from many local, national and international funds raised by the team.

The long standing expertise of the team in classical virology has led to the development of new or improved detection or genotyping techniques, the description and characterization of several new viral agents and to the analysis of the molecular variability of selected viruses.

The team has used genomic and genetic approaches for identifying host factors involved in plant-potyvirus interactions. It has characterized, on one hand, a new member of the RTM gene family responsible for plant resistance to potyviruses by restricting their long distance movement and, on the other hand, the potyviral determinant associated with resistance breaking. In parallel, the team has also investigated the biological relevance of the interactions between potyviruses and eIF4E, a plant susceptibility factor. This study led to the novel discoveries that also the host eIF4G initiation factor is involved in potyvirus infection and that, in addition to Vpg, also the viral CI helicase is involved in eIF4E-mediated resistance.

The results obtained by the team have generated a high number of scientific publications (79). Beyond several high impact publications resulting from external collaborations (1 Cell, 1 Nature Nanotech, 1 PNAS, 1 Plant Cell, 1 PloS One), most of the articles appeared in refereed virology and plant pathology journals (i.e. J Gen Virol, Arch Virol, Phytopathology, Virus Res, MPMI, Plant Disease, J Plant Pathol). The publication list also includes 27 book chapters and 33 articles in non-peer-reviewed journals. The results of the team have propitiated only 4 invited conferences in international meetings, but numerous oral communications have been given in national (19) and international (32) meetings.



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

The quality of the team's research projects is attested by the impressive number of funds raised (6 ANR, 8 EU projects, etc.) and by its involvement in extensive collaboration at the national and international level. The team has a good international reputation and visibility, as evidenced by the participation in several EU-funded research projects (ERA-NET, FEDER, FP6 Resistvir, Transvir and Smashybio, FP7 KBBE and People), bilateral cooperation programs (8), and the invitation of several of its members to contribute chapters in international publications (books and encyclopedias) and to take part in international congresses. Members of the team have contributed to the organization of 3 international and 4 national scientific meetings.

The lack of post-doctoral fellows and the relatively low number of PhD students (only 4 PhD theses have been defended during the four year period) is a major weakness of the team, although the involvement of team members in teaching at the Master level should provide opportunities to attract good students.

One patent has been filed during the period.

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

The organization of the team and its management are very good, with four integrated research projects linked by strong exchanges and collaborations, a fifth transverse package being dedicated to biotechnical applications and collaborative projects. This organization with interlinked packages facilitates technology transfer from knowledge-based approaches, insuring the flow of basic research results towards practical applications and the transfer from model systems (*Arabidopsis*) to important crop plants (*Prunus*).

Some members of the group are responsible for teaching units of Masters degrees from the University of Bordeaux 1 and 2 and SupAgro Montpellier. Many undergraduate students from various formations have been trained in the team.

- **Appreciation on the project :**

The project is intended to consolidate the current research but includes also novel cutting-edge aspects, i.e. ecogenomics for viral biodiversity studies in a yet untouched biotope of Antarctic islands, and TILLING approaches for selection of resistant plants.

The activity of detection and characterization of new viral agents will be pursued in the future as it is a permanent demand of INRA partners (Plant Protection Services, growers) and is of great interest for the community of plant virologists. It will comprise a highly interesting novel project on the description of the viral biodiversity in so far non-explored natural flora. Deep sequencing approaches will be used for these aetiological studies (eco/metagenomics).

The identification of rare PPV resistance alleles in *Prunus* species in particular will be achieved by a tilling approach, thanks to the development of a peach tilling platform. The project will comprise the analysis of the eIF4E- and RTM-mediated resistance at the molecular and cellular levels and, the identification of new host interacting factors and recessive resistance genes.

The team is a recognized pioneer in the development of pathogen-derived resistance to PPV in *Prunus* and in the evaluation of the biosafety of transgenic plants. These issues will be pursued in the frame of SharCo, a EU-funded project coordinated by the team. In SharCo, new strategies will be implemented for conferring reliable resistance mediated by siRNA or miRNA constructs and for the gain of resistant genotypes from regenerated somatic tissues.

- **Conclusion :**

- **Summary :**

The team has obtained remarkable results in the study of plant-potyvirus interactions, which are promising both for the understanding of host resistance mechanisms and for the detection of natural resistance in plants. The project for the coming years is of good quality and well planned. It is intended to consolidate the current research but



includes also novel aspects, i.e. ecogenomics for viral biodiversity studies in a yet untouched biotope of Antarctic islands, and TILLING approaches for selection of resistant plants.

– **Strengths and opportunities :**

The team is undeniably a leader in the study on the plant-potyvirus pathosystem. It has a good international reputation and visibility, as evidenced by the participation in several EU-funded research projects, and the invitation of several of its members to contribute chapters in international publications (books and encyclopedias) and to take part in international congresses.

The team has also the capacity to undertake multidisciplinary approaches to achieve its goals, and to develop valorisation projects based on their expertise with plant viruses. The quality of the team's research projects is attested by the numerous funds raised (ANR, EU projects, etc...) and by its involvement in extensive collaboration at the national and international level.

– **Weaknesses and threats :**

The lack of post-doctoral fellows and the relatively low number of PhD students is a major weakness of the team, although the involvement of team members in teaching at the Master level should provide opportunities to attract good students.

Despite the wealth of original results obtained, the team publishes mainly in journals of middle or low impact. This depends primarily on the type of research carried out, the results of which are difficult to allocate in non phytopathologically-oriented journals. However, unravelling the mechanism that involves plant initiation factors in potyvirus infections should allow the team to publish in journals of wider general interest.

– **Recommendations :**

An effort should be made by the plant virus team to recruit more PhD students and post-docs. As the team aims at identifying additional host factors playing a role in pathogenicity, it should take care not to disperse forces and to preserve the coherence of the scientific project.

Intitulé de l'équipe : Mollicutes

Responsables : Joël Renaudin and Cécile Bébéar

- **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)	4 ¹ 6 ²	9
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	4 ¹ 0 ²	4
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	4 ¹ 3 ²	0
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	11 ¹ 4 ²	15
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	1 ¹ 2 ²	3
N6: Number of Ph.D. students (Form 2.7 of the application file)	4 ¹ 2 ²	4
N7: Number of staff members with a HDR or a similar grade	7 ¹ 4 ²	10

1. Mollicutes team of UMR1090

2. EA3671 team



- **Appreciation on the results :**

The results have been appreciated separately for the Mollicutes team belonging to the former unit “Genomics, Diversity and Pathogenicity” and the EA3671 team.

The **Mollicutes team** is expert in a small community working on these atypical bacteria (without cell-wall and with a very small genome), and recognized at the international level for both its fundamental and field work (as judged by citation scores of their papers).

Research of the team has led to major outputs in the last period:

- sequencing of different genomes: *Spiroplasma citri*, *Mycoplasma hominis* (in collaboration with the team of CM Beb ar of EA3671, which led to the publication of a paper with a high impact factor), *Flavescence dor e* phytoplasma.
- development of molecular tools for genetic manipulations of these bacteria.
- development of an ex vivo model for studies of *Spiroplasma*-insect interactions.
- development of molecular tools to detect and discriminate phytoplasma diseases of grapevine.
- obtention of results allowing to propose a hypothesis for the origin, transmission, and epidemics of flavescence dor e disease of grapevine.

The team has produced 62 publications during the period. In terms of quantity, the productivity is good for two out of the three thematics, but low for the third thematic on “interactions of plant mollicutes with their hosts”. In terms of quality, the proportion of excellent publications increased over the last years. The team has created, in collaboration with the Center of Bioinformatics of Bordeaux, an internationally recognized database (MolliGen), and has built a collection of 100 reference phytoplasma, which is useful for the epidemiologic studies.

During the evaluation period, 5 PhD, several masters, and 3 HDR theses were defended. The team showed thus a good dynamics in the training of young scientists.

The **EA3671 team** developed both fundamental (sequencing and annotation of the *M. hominis* genome and comparative analysis with *M. genitalium* and *U. parvum* published in a high impact journal) and applied research in connection with hospital duties (molecular typing and diagnosis of mycoplasmas and chlamydial infections). The team has a high number of publications (65) which are, although mostly descriptive, published in the best journals in the field.

The team hosts the CNR Chlamydiae reference collection, and three patents were deposited for the diagnosis of *M. pneumoniae*.

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

This aspect has been appreciated separately for the Mollicutes team belonging to the former unit “Genomics, Diversity and Pathogenicity” and for the EA3671 team.

Members of the **Mollicutes team** were invited to 9 conferences and received 3 awards including one from the International Organization of Citrus Virologists and one from the International Organization for Mycoplasmatology.

The team had one post-doctorant during the four year period. Although the number of HDR increased to 7 during the last evaluation period, only 4 PhD students (one from abroad) are presently preparing a thesis. Several scientists have been invited (2 for FUNDECITRUS) and two PhD students have spent 4-5 months in the team. The team should improve its ability to recruit PhD students, post-docs and scientists from outside Bordeaux.

The team has an excellent ability to raise funds for two out of three thematics. An exception is the third thematic “interactions of plant mollicutes with their hosts”, which involves the smallest group, and for which no



research contracts were obtained. The team obtained support from two ANR programs (one as coordinator), from two projects involving CIRAD, from two projects with AFSSA, from projects funded by INRA and through many industrial contracts for the third theme (etiology and epidemiology).

Members of the team participate in different international networks: International Phytoplasmologists Working Group (IPWG), ERANET and COST. Numerous stable collaborations have been built with foreign partners especially for theme 3. An exception is the thematic “interactions of plant mollicutes with their hosts”, which is not involved in international collaborations.

Numerous contracts have been obtained with the industry especially for the thematic on “etiology and epidemiology of phloem restricted diseases” (wine industry, Fundecitrus).

Members of the EA3671 team have an internationally recognized expertise as proved by the number of invitations to international conferences (14 during the last period). The team appears attractive for PhD students, and hosted 3 post-docs in this period. Students, post-docs and scientists were not attracted from abroad.

The team obtained several contracts with the pharmaceutical industry and was involved in different clinical research studies. It also benefited from CNR funding, but did not obtain any ANR or European project funding over the last period. Members of the team participate in the “International Organization for Mycoplasma” and collaborate with several laboratories (USA, Tunisia, Sweden, Denmark, Japan...).

In link with its hospital activity, the team had several contracts with the pharmaceutical industry and contracts for clinical research.

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

This point has been appreciated separately for the Mollicutes team belonging to the former unit “Genomics, Diversity and Pathogenicity” and for the EA3671 team.

The **Mollicutes team from UMR1090** is organized into three thematics, one of which has, however, been dramatically neglected in the past. Only one researcher and one engineer (plus PhD students), were involved in the thematic “interactions of plant mollicutes with their hosts”. This thematic has thus a low scientific output, an inexistent input from contracts, and no relation to international networks.

Half of the researchers have teaching duties in Licence and different Masters. The former director of the Unit, A. Blanchard, was the coordinator of a Master in Biology and Health and is now Vice-President of the Bordeaux 2 University. Four team members are involved in specific formations. One member of the team is involved in an IFR103 technological platform (“Imaging-Cytology” platform).

Members of the EA3671 team have teaching responsibilities within specific formations (Licence, Master, DES Biologie médicale) and are also involved in clinical studies, but keep a strong involvement in research.

- **Appreciation on the project :**

(project of the new Mollicutes team resulting from the fusion of the Mollicutes team from the former unit “Genomics, Diversity and Pathogenicity” and of the EA3671).

The new team has chosen to go on working on the same three themes as in the previous contracts, with no reduction in the number of models or change in the distribution of forces:

- Theme 1 “Evolution and expression of mollicutes genomes” includes several projects. Those on metabolic networks of mollicutes and comparative genomics are likely to federate people working on plant, animal and human mollicutes and to enable publishing in high impact journals. However, the committee questions the relevance and expected output of a subproject concerning the functional study of a potential mycoplasma-specific membrane ATPase.

- Theme 2 “Interaction of mollicutes with their hosts” includes two new promising projects (to be conducted with external collaborations) on human mollicutes. The first project on mollicute interactions with insects



is well defined and will combine in vitro, in vivo and ex vivo approaches. The second project, however, dealing with “Plant responses to mollicute infection” lacks clear concepts and visions, and the approaches to be used to analyse plant-pathogen interactions are unclear.

- Theme 3 “Etiology and epidemiology of phloem and human bacterial diseases” is clearly applied and responds to needs of professionals and plant protection services.

The allocation of resources to the different sub-projects needs a serious readjustment. An effort of the whole team is required to set priorities and to reallocate resources accordingly.

An original project of the team is to develop systems biology approaches for metabolic networks of Mollicutes. The facilities of the future Unit, which harbors an excellent metabolic profiling platform, will support these approaches. However, the project lacks approaches for “cutting edge” research. With the whole genome sequences of several animal and plant pathogenic mollicutes in hand, the team possesses fantastic tools that should be exploited more. Mining of the sequence data and comparative genomics would probably allow to identify motifs and sequences for pathogenicity factors that are common (or specific) to plant- and animal mollicutes. Similar approaches in the past have enabled characterisation of the common motifs allowing effectors from plant pathogenic oomycetes and animal pathogenic plasmodia to target the host cell metabolism in a similar way. Further exploitation of the mollicute genome sequences would probably allow the team to develop and/or to confirm an international leadership in mollicute research.

- **Conclusion :**

- **Summary :**

The team is expert in its field and recognized at the international level. It achieved several outputs during the last period (sequences of different genomes included in the Molligen database, molecular tools). The scientific production is of good quality, which should be increased particularly on the thematic dealing with host-mollicute interactions. The team needs to increase its attractiveness for post-doctorants and PhD students. There are major differences between groups inside the team regarding the level of definition of the project, the productivity, the international collaborations and the ability to raise funds.

- **Strengths and opportunities :**

The team has an internationally recognized expertise on plant, animal, and human mollicutes, for which tools and genomic sequence data are now available. It has developed several fruitful national and international collaborations and participates in different networks. Members of the team have tight links with medicine, industry and local partners.

An increase in critical mass will enable groups within the team, like the human mycoplasma group, to apply for common national and international projects.

- **Weaknesses and threats :**

Members of the team will be dispersed on two different geographical locations, and scientific and administrative logistics might become difficult. The cost to maintain high level infrastructures (containment greenhouses) is very important.

The project requires new competences in bacterial physiology and systems biology, and the team does not attract enough post-doctorants and PhD students.

There is a risk of dispersion in too many sub-projects, among which some (e.g. “Plant-mollicute interactions”) have not sufficient support within the team.

- **Recommendations :**

The team has to maintain the established equilibrium between fundamental research (higher impact of papers) and field work (requests from the agronomy institute and from clinicians and other professionals).



The sub-project “Plant-mollicute interactions” needs to be clearly positioned and reinforced within the team. A scientific and challenging long-term strategy has to be defined. The group involved in this sub-project has excellent tools and a nice model, and should take advantage of working in the same Unit as plant scientists analyzing plant-virus interactions. The whole team has to make a serious effort to reinforce this group, and to invest in research that will allow to respond to the essential question of what determines disease (or, probably, resistance). The team has access to all facilities to engage into a challenging project on this topic, and it has to use this opportunity before it is too late. An in-team readjustment of forces will probably allow this group to develop collaborations, which will facilitate fund raising and increase scientific productivity.

The team has to increase its attractiveness for post-docs and PhD students.

Care should be taken to avoid dispersion in too many projects, by selecting the most relevant and original ones at the scientific level.

A successful deciphering of metabolic networks will require additional competences in microbial physiology, systems biology and fluxomics. The feasibility of this sub-project should be seriously evaluated.

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	B

Nom de l'équipe : *FRUIT ORGANOGENESIS AND ENDOREDUPPLICATION*

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

Nom de l'équipe : *FUNCTIONAL GENOMICS OF FRUIT DEVELOPMENT*

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



Nom de l'équipe : *EXPLORATION OF METABOLISM AND ITS REGULATION DURING FRUIT DEVELOPMENT*

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

Nom de l'équipe : *PLANT VIRUSES*

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

Nom de l'équipe : *MOLLICUTES*

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



Monsieur Pierre GLORIEUX
Directeur de la section Unités de recherche
AERES

Bordeaux, le 22 février 2010

Monsieur le Directeur,

Je vous transmets les observations de Monsieur Thierry CANDRESSE, Directeur du projet « Biologie du fruit et pathologies », faisant suite au rapport du Comité de visite de l'AERES.

Je vous prie de croire, Monsieur le Directeur, à l'assurance de mes sincères salutations.

Le Vice-Président du Conseil Scientifique,

A handwritten signature in black ink, appearing to read 'A. Blanchard'. The signature is fluid and cursive.

Alain BLANCHARD

TGU FRUIT BIOLOGY AND PATHOLOGY, Bordeaux
INRA and Universities Bordeaux 1 and Bordeaux 2

COMMENTS ON THE AERES PRELIMINARY EVALUATION REPORT

Global evaluation of the teams and of the TGU FBP project

The teams wish to thank the Panel members for their availability, the very good atmosphere during the evaluation process and the in depth analysis of the huge document and of the recently initiated TGU project. Although the report represents a very important effort on the part of the Panel, we are however a bit disappointed that numerical indicators are in many instances erroneous. There seems also to have been only limited effort to homogenize comments between teams, with the consequence that quite diverging comments are at times made for teams showing comparable performance parameters.

The Panel seems to generally consider that the number of PhD students and Post-docs is too low and that efforts should be made to improve this situation. While we generally agree that increasing these numbers is desirable, we wish to stress that the figures quoted by the panel, in particular concerning Post-docs or other non-permanent scientists or engineers, significantly underestimate the real numbers.

After noting that the teams coordinated or participated in 13 ANR-funded projects and 13 EU-funded projects, the Panel concluded that the teams have a "very good national and international visibility" and that their ability to successfully apply for competitive funding is "excellent". We are of course very pleased of these comments but wish to stress that the correct figure is in fact 21 ANR-funded projects.

The Panel provides a very positive evaluation of the project to create a TGU by joining together UMR0619, UMR1090 and EA3671, and indicates, as was our own analysis, that this project provides a clear and important opportunity to increase the visibility of Plant Sciences in Bordeaux. We fully agree with the Panel that the project presented needs to be further developed and improved, a task that had not been feasible in the short time between the decision to go ahead with TGU project and the Panel visit. Efforts in this direction have already started and will be further developed during 2010, taking care to involve all personnel in the development of this collective project.

We are also pleased to note that the Panel has highlighted that the integration of the two mycoplasma groups within the same team will give a better visibility to the plant-animal-human mycoplasma research in Bordeaux and will help to increase its attractiveness by building a critical mass with a strong potential to apply for common national and international high impact projects. It is true that team members will be positioned in two different locations but these are relatively close to each other and a lot of the researchers of the two former teams has teaching duties at the site of University Bordeaux 2, providing further opportunities for interactions. As a consequence, we do not believe that this dual location will prevent us from deriving a very strong synergistic effect from the integration of the two Bordeaux mycoplasma groups within the same team.

UMR BF 0619, Team 1 Fruit organogenesis and endoreduplication

Members of the “Fruit organogenesis and Endoreduplication” team and its Group Leader are pleased of the overall very positive comments on our scientific activities. We acknowledge the relevance of the Evaluation Committee scientific recommendations, to which we entirely subscribe and intend to make full use of. We have indeed already taken steps in this direction as part of our proposed project.

As a general comment for the TGU constituting teams, the Evaluation Committee estimated that the amount of PhD students in our group remains low and we agree with this assessment. Eventhough we have hosted 7 PhD students (3 still ongoing) over the evaluated quadriennial period, we intend to further increase our efforts to attract the best students in Master 2 for a PhD in the Plant Science field.

The Evaluation Committee reported on its perception on a strong team management that prevents the scientific development of young researchers, and especially prevents students to attend international meetings and be in contact with the international scientific community. Members of the team wish to express their disagreement with this view and argue against this subjective comment. Related with the participation in international meetings, an important figure is the number of oral communications given by the team members: 19, with 8 being given in national meetings and 11 in international meetings and congresses (of which 5 were in foreign countries). Even if some of the international meetings were indeed organised in France such as the FESPB meeting in Lyon (and even in Bordeaux such as the EU-SOL workpackage meeting), they were true international events where all of our students did exchange with the international scientific community. Similarly for poster presentations, the correct figure is 14, with 5 being given in national meetings and 9 in international meetings and congresses (and indeed only 2 were in foreign countries).

Back to the perception that the “strong management of the team locks the individual researchers into the defined objectives”, we have been taking into account the previous recommendations of the 2006 Evaluation Committee that asked us to focus on clear objectives as to avoid dispersion. Within the context of our missions in the Plant Science Division of INRA, we believe we managed to do so, focusing on fruit organogenesis and control of cell cycle/endoreduplication in the context of fruit development, as acknowledged by the present Evaluation Committee. That said, the members of the team do not feel they are “locked” into the defined objectives. New arising ideas have been proposed within the team framework as part of the project, such as the study of the interplay between organogenesis, cell cycle and hormonal control within the IMA gene project (as supported by the EU Marie Curie Reintegration Grant for the newly recruited Assistant Professor F. Delmas) or the study of the putative connection between KRP expression and FW2.2, the major QTL for fruit size. This latter project is totally novel and original and may even be sensed as “risky” in terms of feasibility and outcome.

Finally we would like to stress the team composition and the involvement of the staff in teaching and training. Our team hosts five researchers with heavy teaching duties and only two so-called “full-time” researchers (but who are involved in fact in collective tasks: Imaging/Cytology platform and Team and Unit management). Although our respective duties take us away from effective research, the Evaluation Committee acknowledged our “very good” publication record which could not be so without the high motivation of the team members and their ability to train highly dynamic Master and PhD students.

UMR BF 0619, Team 2 Functional genomics of fruit development

The team FGFD thanks the evaluation committee for very valuable comments that already triggered fruitful scientific discussions within the team and will help strengthen its project for the coming years. Our team noted with satisfaction that our efforts to build new original projects as well as our insertion into international networks and projects, publications in

quality journals, generation of tools and resources and their valorisation through patents have been acknowledged by the committee.

We were however rather surprised by some comments such as “The international visibility of the group in the overall plant science field remains quite low“ (p. 13) and the “Scientific animation remains essentially local “ (p. 14).

Over the last years, our team has pioneered in the UMR Fruit Biology most of the national and international relationships with other groups working in our field of research. The strong involvement of our team in national and international projects, underlined by the committee, can only be the result of tight scientific relationships and exchanges built over the years with members from the plant science community in France, Europe and beyond. For example, our team (3.5 full-time researchers) has been involved in 5 international projects (3 EU projects) over the last 5 years and is currently responsible for (i) the workpackage on early fruit development and composition in the EUSOL project, which also involves several leading groups from Europe (PRI Wageningen, MPIMP Golm, CSIC Valencia), (ii) the workpackage on functional analysis in the EU ERA PG project TomQML involving 6 partners from leading research centres in Europe and 1 US partner, and (iii) the creation of the joint lab TIL with the University of Tsukuba from Japan. Several co-publications with national and international partners have recently been published and we expect to amplify this trend in the future.

Of course, and we fully agree with the comments from the committee, we have to keep a balance between our work on fruit development and quality in tomato, which requires broad approaches but corresponds to the specificity of our model (fleshy fruit) and to the objectives set up by INRA, and the fine functional analysis of candidate genes, which can yield results of broader impact in plant sciences and may therefore strengthen our links with groups working on other plant models (e.g. Arabidopsis). This is our challenge for the future.

UMR BF 0619, Team 3 Exploration of metabolism and its regulation

The team « Exploration of metabolism and its regulation during fruit development » thanks the committee for its positive evaluation. We fully subscribe to recommendations of the committee. Thus, we will explore alternative routes to attract PhD students and post docs, but as other laboratories in France we are facing difficulties to attract the best students in the field of Plant Sciences. Regarding the suggestion to take into account C and N import into the fruit, we will address the question of metabolite import via a modelling approach in the frame of a collaborative project starting this year. To prevent dispersion, and in particular to focus on biological questions, we will persist in developing our core project, systems biology of fruit quality, collectively.

UMR GDPP 1090, Plant Virus Team

The team would like to thank the Panel members for their time and efforts. Although we are a bit disappointed by the paucity of recommendations made by the Panel to further improve our activity (see below), we notice with pleasure the very positive evaluation of the team visibility, leadership and expertise, of its management and organization and of its scientific output over the past four years.

The team has invested significant efforts in the development of a translational research scheme. The structuring of our activities into integrated workpackages, with the aim to facilitate technology transfer from knowledge-based approaches into practical applications is an important part of our strategy. The very positive Panel perception of these efforts and of our scientific project for the next four years provides important reinforcement and feedback.

The reports indicates in two places that a "lack of post-doctoral fellows and the relatively low number of PhD students is a major weakness of the team". The numbers of past and future post-docs and PhDs of the team quoted by the panel are however completely wrong :

- **four PhDs** were defended over the past four years, **not 2** as quoted
- **two "future" PhDs** have started in the team, **not 0** as stated
- the team had **6 post-docs** during the past four years, which hardly qualifies as a "lack of post-docs"
- The team has currently **four post-docs**, all of which will still be present in January 2011. Two of these were listed in the forms but are not quoted by the Panel, two were not listed since these positions have been filed in the past 3 months.
- In addition, the team had **4 engineers on contracts** during the past 4 years and will have at least **two** in January 2011 (none identified by the panel). An additional technician on a CDD contract will arrive in March 2010.

Thus the team, which has 9 scientists and 4 engineers is currently reinforced by 11 people (4 post docs, 4 contract engineers and 3 PhDs). Although it is always possible to have more Post-docs and PhD students (and we intend to further our efforts on this aspect), we overall feel that the comments made by the Panel are inaccurate and do not reflect the real situation nor the attractiveness of the team.

Concerning the publications, the Panel noted a "high number" of them but, at the same time, indicates that these appeared "in refereed virology and plant pathology journal" and/or in "journals of middle or low impact". We agree with the Panel that increasing the number and impact of the team publications is a general and important goal, which will necessitate further efforts to access more generalist journals, given that almost all journals of our field are in a 1 to 4 impact factor range. We wish however to stress the very important efforts made during the past 4 years in that direction, which have already resulted in an overall increase, as compared to the previous 4 year period, of 67% in the number of publications in refereed international scientific journals and, in particular, in a 150% increase in the number of publications with an impact factor of between 3 and 5.

Lastly, the Panel notes in two places that our project on meta/ecogenomics to study viral biodiversity represents "novel cutting edge aspects" but seems to restrict these efforts to the currently funded Evinco project in the Kerguelen Islands. While it is true that this project serves as the support of our initial efforts in viral eco/metagenomics, we are by no means planning to limit our efforts to such remote and isolated ecosystems and our overall goal, as was indicated to the Panel, is to apply such approaches to environments and questions more tightly linked with INRA's missions and objectives.

UMR GDPP 1090, Mollicutes Team

The team thanks the Panel members for their time, efforts, and recommendations.

We are pleased by the positive evaluation of the team regarding its productivity and its expertise, which is internationally recognized through international organisations, collaborations, and networks.

However reading the report might leave the reader with a partial view of the team results. The outputs are not limited to accumulating sequence data and developing tools and models that are prerequisites for studying the biology of these fastidious bacteria. The mollicutes team has also produced original data on the evolution and biology of these pathogenic organisms. There is no doubt that combining URM1090 and EA3671 in the frame of TGU will create a unique Mollicute pole with multiple expertises in plant, animal, and human pathogenic mollicutes and with enlarged visibility and attractiveness at the national and international levels. The combined results of these two entities highlight their high productivity; indeed the work of 14 scientists (8 from UMR1090 and 6 from EA3671, including 10 with teaching duties) resulted in 127 publications (14 with IF>5 and 51 with IF>3).

Theme 1. Genomics

"relevance and expected output of a subproject concerning the functional study of a potential mycoplasma-specific membrane ATPase"

The subproject related to a potential mycoplasma-specific membrane ATPase is a typical example of a biological project directly born from comparative genomics. Indeed, the cluster of seven genes encoding this potential ATPase is the only cluster of genes in common to all of the horizontal gene transfers described among ruminant mycoplasmas. This suggests that the dissemination of this cluster through horizontal transfer is a remarkable trait of mycoplasma evolution. This ATPase might represent a specific evolution of the F1 subunit of bacterial F0-F1 ATP synthase. We already have several tools for this study including specific antibodies and mutants and the project is conducted in collaboration with UMR CNRS-University of Bordeaux 5095 that has internationally recognized expertise in this field.

Deciphering metabolic networks of mollicutes: *"The feasibility of this sub-project should be seriously evaluated"*

Through an in silico reconstruction and comparison of metabolic pathways, the project aims at identifying specific features related to the biology of various mollicutes. For example comparing energy metabolism of distinct urogenital mycoplasmas or comparing sugar metabolism of phytoplasmas and spiroplasmas; this study is conducted in collaboration with the CBIb (Bioinformatics Centre in Bordeaux) and M. Dejongh (Hope College, Holland, MI USA). At this stage, the purpose is not to characterize the whole metabolome and fluxome of these organisms, which indeed would require additional competences and additional human resources. In the future, however, these developments could be envisioned in the frame of the TGU.

Theme 2. Mollicute-host interactions

We agree that *"the scientific production...should be increased"*. However there is some confusion in the report between the whole thematic "Mollicute-host interactions" and the two sub-projects "interactions with the vector insect" and "plant response to mollicute infections". As a whole the 2005-2009 scientific production of this theme comprises 12 publications including 2 in MPMI.

Interactions of mollicutes with the vector insect

The insect transmission of spiroplasmas or phytoplasmas is the key element governing the host range and epidemiology of these bacteria. By combining genomic and proteomic data, a breakthrough was achieved with the finding that plasmid-encoded determinants play a key role in insect-transmission of *S. citri*. Efforts were therefore pursued using various approaches

to analyze the molecular mechanisms of interaction between mollicutes and their insect vectors. The project required new skills that were found with the hiring of 2 new people in 2006, with expertise in membrane biochemistry and cellular biology. The results obtained have recently led to several publications that were not listed in the 2005-2009 report: (Duret *et al.*, Microbiology 2010, PMID: 20019079; Labroussaa *et al.*, Applied and Environmental Microbiology 2010, in press; Breton *et al.*, Applied and Environmental Microbiology, submitted 25-01-2010). As indicated in the report, several people from this group have also been involved in the research activities of Theme 1.

Plant response to mollicute infection.

We agree with the committee that "*The sub-project "Plant-mollicute interactions" needs to be reinforced*" However we do not believe that this thematic has been "*dramatically neglected*" as it has benefited of reasonable resources (financial support, greenhouse facilities and technicians, Masters students, 1 PhD). In terms of human resources, the group has been and is still working in collaboration with UMR619 as indicated by shared publications (André *et al.*, MPMI 2005; Pracros *et al.*, MPMI 2006). Since then, the group has continued working in collaboration with UMR619 on the deregulation of key enzymes of sugar metabolism and on the role of DNA methylation on the regulation of expression of floral development genes in stolbur phytoplasma infected tomato.

"The group involved in this sub-project has excellent tools and a nice model". The tomato/Stolbur phytoplasma model was chosen because stolbur was found to be naturally vectored to tomato in France, and more generally, depending on years, to constitute a non-negligible pest for field-cultivated Solanaceae, even if these cultures are dead-end hosts in the epidemiology of stolbur. Because tomato (i) is easily inoculated with phytoplasma by grafting and shows nice symptoms when infected with stolbur, (ii) is an established model species in plant biology with available genetic resources, genome sequence and transformation protocols, and (iii) is the model chosen by UMR619, tomato was selected as our experimental host plant. However, it has to be realized that phytoplasmas are currently not cultivable, and therefore it is not possible to construct phytoplasma mutants, and only natural isolates variability is available to carry out experiments. Also, phytoplasmas cannot be transmitted mechanically and on tomato the apparition of symptoms require some (3-8) weeks depending on strains and culture conditions, thus turning susceptibility tests into time- (and therefore space-) consuming experiments.

In general, studies related to plant response to bacterial infection rely on the use of host plants that differ in their sensitivity/resistance. Very few tolerance/resistance phenotypes have been described for phytoplasmas. These include a *Malus* species resistant to the apple proliferation phytoplasma (Kartte & Seemuller, 1991) and a wild tomato variety resistant to the BLTVA phytoplasma (Thomas 1992). In our hands, however, resistance to BLTVA (using a different strain from the two field strains that were used in the work of Thomas 1992) could not be reproduced. We are currently screening collections of wild relatives of tomato for resistance/tolerance to phytoplasmas, as mentioned in the project part of the report. These studies precisely aim at producing tools that will serve as bases for the emergence of a long-term project.

Currently the team may seem somehow isolated (no collaborations). However, the confinement of the phytoplasma within the phloem raises biological questions (plant defenses within the phloem, alteration of phloem physiology) that might form a basis to collaborate with other groups exploring the same questions (phloem-restricted viruses for instance).

At this stage however, we agree with the committee that a long-term strategy is not clearly defined. Therefore, according to the panel's recommendations and within the next six months, a discussion will be conducted in the TGU context to set up the bases for a scientific long-term strategy in this thematic. The following hypotheses will be discussed: (i) strengthening the thematic through re-allocation of human resources within the team, knowing that this will not provide additional competences (ii) reinforcement of the thematic through hiring new personnel with expertise in the theme (iii) Closing this thematic, knowing that UMR 1090 is the only French laboratory working in this field. This discussion will be engaged associating the scientific council of the INRA SPE division.