BIA - Biopolymères, interactions assemblages

Rapport Hcéres

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

Section des Unités de recherche

AERES report on the research unit

BIA Biopolymers, Interactions, Assemblies

From the

INRA

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Le Président de l'AERES

Didier Houssin

Section des unités de recherche

Le Directeur

Pierre Glorieux

December 2010

Research Unit

Name of the research unit: BIA Biopolymers, Interactions, Assemblies

Requested label: UR INRA

N° in the case of renewal: UR 1268

Name of the director: M. Jacques GUEGUEN

Members of the review committee

Committee chairman

M. Jean-François GERARD, INSA, Lyon

Other committee members

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Observers

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Ms Monique AXELOS, INRA

Report

1 • Introduction

- Date and execution of the visit

The visit was held from December 8th 08.30 to December 9th, 2010 17.00 in the facilities of the BIA laboratories located within the INRA campus of Nantes. Time was dedicated to presentations of the BIA research unit past activities and scientific project by J. GUEGUEN, Director of BIA and the nine different teams (report and project) during several sessions.

The visiting committee had also a meeting with the head of the CEPIA INRA Division and with the President of the INRA Angers-Nantes Center.

Meetings took place with different delegations: i/ researchers, i.e. scientists and engineers, ii/ technicians (AT, TR, AI), and iii/ PhD students, post-doctoral fellows, and non-permanent employees.

A discussion was also held with the BIA Director and the three deputy directors before internal meetings of the visiting committee.

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

The BIA laboratory was established on Jan. 1st, 2005 from the association of four research units of the INRA-CEPIA Division in Nantes. BIA has a staff of around 185 persons, 125 as permanent employees and from 30 to 35 PhD students as well as about 10 post-doctoral fellows. The consolidated budget of the BIA laboratory ranges from 10 to 12 M€ per year.

The scientific activities of BIA are organized within nine thematic teams and two transdisciplinary teams which are dedicated to application-related objectives in the agri-food sector: i/ control of the quality of finished products (food and non-food products), ii/ control of the qualitative variability of raw materials and their by-products. The BIA intends to develop multi-scale and pluridisciplinary approaches to take into account the role of supramolecular biopolymer assemblies in raw materials and processed products. This research is fully consistent with INRA and the CEPIA Division's priorities which emphasize an integrated research between agriculture and the food sciences and new possibilities in plant chemistry. Four main research themes are run:

Theme #1: Biosynthesis and assembly of biopolymers in planta at different physiological stages.

Theme #2: Interactions between animal or plant biopolymers in model, cell-free and biomimetic system

Development of model macromolecular nano- and mesostructured systems.

Theme #3: Materials, matrices: formation, organisation, properties, mobilities of small solutes (micronutrients)

Theme #4: Allergies to food proteins.

To provide support to the different teams and to further methodological research, the BIA laboratory established cross-disciplinary structures, such as the 'Bioinformatics and Data Management' team in 2008 and the 'Biopolymers and structural biology' platform IBiSA-certified in 2010.

- Management team

The BIA Director is assisted by advisory bodies such as the management board with three deputy directors, the council of team leaders, the Unit Council, and group leaders with the responsibility on the implementation of data processing tools and the development and monitoring of training, as well as prevention and "quality" assurance plans.

According to the recommendations from the previous evaluation committee in 2004, a specific human resource development plan was drawn up and implementation has already begun.

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

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	36.2	36.2
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	21	-
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	79.8	79.4
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	12	
N6: Number of Ph.D. students (Form 2.7 of the application file)	64	
N7: Number of staff members with a HDR or a similar grade	25	24

2 Overall appreciation on the research unit

- Summary

The BIA Research Unit develops a multidisciplinary approach in a very dynamic way. As a consequence, the laboratory has a strong position within the scientific community of food materials. The quality and originality of the work in the past period and for planned research projects depend strongly on the team, i.e. there is a significant heterogeneity between research groups. Nevertheless, the research themes for the whole laboratory and their division into different teams are well defined in most of the cases.

- Strengths and opportunities

The BIA Unit has a strong track record in the structural characterization of plant biopolymers and in the structure-properties of food materials. The teams have several opportunities to link their competence in the structural characterization of plant biopolymers with fundamental questions in plant biology. The BIA Laboratory is involved in numerous networks as leader or partner which allows new competences be brought to the research projects such as plant genetics, biology, nutrition, etc. The scientific position and involvement in networks bring to the research unit a certain attractiveness towards PhD students despite the lack of university staff.

The Unit has strong human resources both as researchers, engineers, and technicians with high level of scientific and technical competences. In addition, the laboratory has a high level of equipment which are managed in relevant and well-established platforms such as BIBS. This potential allows the research unit to be able to be considered as major actor in its scientific community and to investigate new topics.

Socio-economical aspects are taken into account in the research projects and numerous collaborative projects are developed with industry and other institutions.

- Weaknesses and threats

The BIA Research Unit includes numerous teams with some common research interests, methods, and approaches and also acts at a lot of interfaces (genetics, microbiology, nutrition, physics, chemistry, human sciences). The position of the Unit as well as the one of each team is difficult to define precisely. In addition, the size and the management of the teams varies widely and the management of each one differs especially in the prioritization of recruitment of new researchers, engineers, and technicians. The research topics appear often to be defined from an application perspective, rather than by hypothesis driven science. The developed approaches are for some of the topics relatively conventional, and in some cases the unit would likely benefit from the development of partnerships with teams that have a greater comprehensive understanding of the basic phenomena which govern the generation and properties of the structures and morphologies at different scales. Since this multi-scale approach is a strong focus for different teams with the unit, the cultivation of on-going partnerships with biophysics groups would likely enhance the quality and impact of the proposed research. In addition, few new methodologies are offered to bring innovative insights and subsequent developments. The BIA also needs to maintain its positioning within highly competitive topics such as nanosciences as many strong groups have been active for many years in such a field and additional expertise and equipment are required to develop a relevant and original research. The BIA mainly develops scientific collaborations at the national level although some teams have strong participations within relevant international networks.

Because a part of the work is technology driven, there is a high need for well-trained personel to maintain and run facilities, and the fact that several engineers and technicians have retired or will quit in the next future, may lead to the weakening and loss of essential technical expertise.

No permanent researchers with teaching duties from the Nantes University are involved in or with the BIA staff. This is in part due to the fact that the BIA activities are not really corresponding to the teaching activities at University, and therefore decreases the attractiveness of the laboratory for young scientists.

- Recommendations

The heterogeneity of the quality and originality between teams could be overcome through a deeper co-ordination of the different projects. This could be done by approaching the projects according to a better policy in frame with what has already been proposed by the Unit. Except for a good few teams which put a considerable effort to align their activities with the overarching map of the Research Unit, this coordination remains required. The quality of the work needs to be improved by introducing innovative approaches both at the experimental and theoretical levels. Complete comprehensive understanding of the basic phenomena will contribute to position BIA activities at a better level. Collaborations and positioning with the other INRA groups and laboratories should be improved to provide a better recognition at both national and international levels. In addtion, for some of the topics under study at the BIA Unit, collaborations should be developed with other communities such as soft matter and materials sciences as well as biophysics.

Strengthening the link between the teams and external groups active in the field of plant genetics could lead to important developments and further increase the quality of the research outputs.

The BIA Unit should maintain a better balance in numbers between the researchers and technical staff, i.e. engineers and technicians, in order to keep its ability to have the best expertise for running and upgrading the equipment platforms and to develop new and innovative analytical techniques and methodologies.

The link between the BIA Laboratory and the University of Nantes needs to be improved to be more attractive for young scientists such as Master and PhD students as well as for the participation of BIA scientists in the creation of a strong local centre for teaching in food science. BIA involvement could be considered in the field of plant science and nutrition (pre-natal)(Nantes Hospital) as well as food processing. The later topic could be more easily achieved through the setup of the Structure Fédérative de Recherche on biopolymer engineering for structuration of matrices and materials.

- Production results

A1: Number of permanent researchers with teaching duties (recorded in N1) who are active in research	0*
A2: Number of permanent researchers without teaching duties (recorded in N2) who are active in research	36,2
A3: Ratio of members who are active in research among staff members [(A1 + A2)/(N1 + N2)]	1
A4: Number of HDR granted during the past 4 years	5
A5: Number of PhD granted during the past 4 years	34**

(*) About 30 researchers have teaching activities for 346 h (186 Master II courses)
(**) 25 Ecoles Doctorales Univ. France + 9 Foreign Univ. (co-supervised + co-tutelle)

The scientific production of papers and communications varies significantly between the different teams both in terms of quality and quantity. The specific comments for each team are reported in the following parts of this report. Nevertheless, the average scientific production per researcher can be considered as good even though it still could be improved upon considering the talents and potential of the BIA personnel. Average quality of publications could also be improved. One can balance the comments on the quality of the papers taking into account the different fields of research which could explain the heterogeneity of the impact factor of the journals in which the papers are published. In fact, the impact is very different for example from biology to material processing.

The same comments could be made for communications in international conferences and invited lectures. From the list of invited conferences, it is quite clear there are high profile researchers which are recognized at the international level in their fields of work. Nevertheless there are too few of these.

The number of supervised doctoral students is low when compared to other laboratories displaying the same potential in terms of number of PhD supervisors, equipments, etc. According to the researches run at BIA, one can expect a large interest for PhD candidates. The fact that the laboratory is not fully involved in the local teaching activities at Nantes University cannot completely explain this low number of supervised and sponsored PhDs.

3 • Specific comments

- ## Appreciation on the results

The research done at BIA Research Unit is very relevant to food science. The impact in the field of plant biology derives from the strong position of the unit in the structural characterization of plant biopolymers, and could be further improved by the introduction of molecular genetics tools. The originality of the work comes from the multidisciplinary and interdisciplinary approaches and from the strong expertise in food science and in topics at the interface with other sciences. The quality of the papers goes from good to very good and excellent. Nevertheless, as mentioned previously, the quality of the production and the originality of the research, and as a consequence, the impact of the results vary greatly from one team to another. A better matching of the policy of some teams to the collective one proposed at the level of the BIA unit could overcome this heterogenity, lead to a better impact of the results, and position the Research Unit as a leading place for food science at the national and international levels.

The BIA Research Unit develops strong partnerships both at national and international level, which are relevant to the scientific topics under study. Again, the various teams have different levels of participation with these networks as for most of the teams, the involvement corresponds to a simple participation whereas for a few of them, the team has the leadership of the project as a result of its recognized expertise. A better definition of the general scientific objectives for the whole unit will allow targeted strategic collaborations with the leading places of interest to acquire new expertise and to attract high level scientists.

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

The awards obtained by staff members, including invitations to international conferences and symposia, are limited to few BIA members.

The BIA Research Unit didn't attract any high level scientist from abroad for sabbatical stays. In fact, the policy of BIA to improve its attractiveness is not clearly addressed and there are some topics out of the main expertise of the laboratory and at the interfaces with other sciences that require new competences. The same comments could be made for foreign post-doctoral and PhD students.

The BIA research has the indisputable ability to be successful in gaining competitive funding at the national and European levels such as for the Agence Nationale de la Recherche or Fonds Unique des Industries, although this varies from one team to another. Given the applied nature of much of the research, one might expect more participation in the work from Industry.

The laboratory is strongly involved in local and national networks and on a more limited level international networks, i.e. European ones. The BIA unit was involved in several European projects during the last four years but mainly as participants rather than leaders of such networks. The setting of the networks remain limited to a project and there is no clear policy for establishing networks on the basis of long-term scientific objectives.

- Appreciation on the management and life of the research unit

The proposed research unit organization is relevant to the scientific objectives and the planned involvements at the local level such as the participation in the research federation. The number of teams could be reduced to define their specific scientific topics according to the basic scientific questions addressed in order to have a better positioning in the scientific community and to contribute to the integration of all the teams within the collective policy based on the three themes. As proposed, the BIA research unit needs to establish a real scientific board based on the team leaders to be responsible for developing a cohesive and effective centre wide ethos and vision. Such a council should also define the scientific priorities in order to help the emergence of innovative approaches and develop a better management of resource allocation between the teams.

The BIA board managed in a proper way the research unit with an emphasis on the human resource development plan to follow the recommendations of the previous evaluation committee. One can mention the very positive role of the Director of the unit who contributes to improve the recognition of the BIA activities and to manage the changes. For the next period, the involvement of the previously mentioned scientific council will be involved in the decisions on funding and human resources management. According to the structure of the INRA BIA laboratory, the involvement of the whole staff in important decisions for the research unit will be required especially for nomination of the new head. A collective process of nomination could strengthen the internal community of the laboratory.

The contribution of the research unit staff members to teaching is very limited as there are no researchers with teaching duties at BIA. The management board of the laboratory have made particular efforts to involve the BIA scientists in local academic life with a special attention to the emergence of coordinated teaching activities related to BIA research expertises. The association with GEPEA UMR and discussions with the University of Nantes will contribute to the definition of a master course which will attract more PhD students and professors or assistant-professors from universities to BIA. These efforts from the management board to be involved in teaching activities are in frame with the overall goals of the research unit which are to coordinate the research at the local level with other laboratories from CNRS and INRA. The present situation could easily improve since the BIA unit has the leadership on the relevant project consisting of setting a research federation (SFR) on biopolymer engineering for structuration of matrices and materials with the GEPEA CNRS Unit.

- Appreciation on the scientific strategy and the project

The project for the last period took into account the scientific evolutions as well as the comments of the previous evaluation committee and demands from the INRA institution by re-organizing the research unit according to a reduced number of teams. As a consequence, the scientific questions from the general research objectives are well addressed and the project appears relevant. As mentioned before, the long-term scientific project could improve by addressing more fundamental scientific topics and from the development of a global comprehensive approach to the related basic phenomena including the introduction of theoretical modeling. The introduction of molecular genetics tools could complement the outstanding expertise in the biochemical characterization of plant polymers and allow to address fundamental questions in plant biology. These goals could be achieved in-house from a stronger involvement of the team leaders as scientific leaders but also through well-identified collaborations at the national and international levels. Such a strategy could also allow cutting edge projects to be addressed, which do not clearly appear in the project.

The allocation of resources is not well defined in the project as the resources result mainly from the projects which will be sponsored by the various agencies such as ANR or FUI/FCE calls. This situation requires a better scientific policy to co-ordinate the involvements of the various teams in order to focus on the topics in which the BIA Research Unit wants to have a leadership. The policy for human resources is more clearly defined team by team. Nevertheless, as mentioned before, we suggest that special attention be paid to the technical staff manpower as the defined research objectives require strong and continuous technical expertises for running the equipments and platforms.

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

The evaluation concerns the teams which will continue their research activities and not the ones which are not be considered in the BIA Laboratory project.

4.1 - E2-ELIPS: Lipoprotein and protein-polysaccharide structures (leader: D. MARION)

- Staff members

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	1.8	3
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	1	-
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	3	4
N5: Number of engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	0	
N6: Number of Ph.D. students (Form 2.7 of the application file)	2	
N7: Number of staff members with a HDR or a similar grade	1	2

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

Research activities are divided into two parts i/ assemblies and reactivity of oxylipids, ii/ endomembrane rearrangement during wheat endosperm development. They aim to establish the mechanism of protein modification by oxylipins and to study cutin formation during the development of plant organs. These data are useful for better control, among others of quality and variability of raw materials. Thus, partnerships have been established both in the field of green biotechnology (Biocutin contracts) with processors of raw materials (FUI QualiNble, ANR Malteco, CIFRE with the French Institute of beverages, brewery and malting). Regarding the partnership, there are primarily with another INRA UMR (Bordeaux, Clermont-Ferrand, Sophia-Antipolis) and the CNRS. The filing of a patent in 2009 on the activity of recombinant proteins currently being upgraded with INRA Transfert should help to develop private partnerships.

The number and quality of publications are correct (18), i.e. 1.5 per year per researcher publishing, 4 were carried out in partnership with other internal teams. Nevertheless, there is no invited conference at international conferences over the period. One can notice that the participation of young scientists as PhD or post-doctoral students is very low. During the period, the team benefited from the arrival of one research engineer (IR2) and recently in 2010 of an experienced senior scientits DR2 due to internal restructuring. This new composition should help increase the scientific output of the team and to recruit more PhD students.

- Appreciation on the scientific strategy of the project

The proposed project will integrate biosynthesis and assembly of grain reserve components (protein, starch) in its approach, following the integration of Véronique Planchot in 2010. The two components are: i/ Biological and physico-chemical mechanisms controlling the formation and assembly of storage macromolecules and ii/ Starch-protein matrix in developing grain in relation to cereal quality and end-uses. They are broken down into three areas:

Developmental oxidative stress and metabolic pathway - Relationships within the starchy endosperm

Formation and assembly of cuticular layers in relation to grain dehydration and grain / endosperm texture

Structure and formation of the starch-protein matrix in relation to endosperm structure / texture.

At a whole, the project addresses different aspects of wheat endosperm development and should allow the team to build up a strong position in this field.

This unique positioning relative to other teams who generally work on models like Arabidopsis and tomato, facilitate new partnerships already targeted (public: UMR INRA / Montpellier Supagro, Institute of Physics of Rennes, UMR CNRS Paris 5, Institute of Plant biology at Orsay, Iowa State University, and private: Biogemma Limagrain Arvalis, IFBM). Access to the BIBS platform and the various technical analysis of lipids and proteins and molecular biology present in the unit will probably facilitate success. In the short term, several research contracts already underway or in preparation should provide the necessary financial support to the recently enlarged team which needs to increase its attractiveness.

- Conclusion

  - Summary

This team results from the restructuring of research themes of the BIA Laboratory due to the closing of the E3 AE/PME team and has the support of the BIA management board for its scientific project.

  - Strengths and opportunities

The ELIPS team has strong competences on endomembrane rearrangement during wheat endosperm development. The proposed integration between biochemical and genetic approaches should be considered a strength of the project. The team could benefit from the increase in its staff (one HDR more) and the support from the BIA management board for recruitement of two new CR permanent scientits and one technician.

  - Weaknesses and threats

The main weaknesses of the ELIPS team are its small size and its lack of international recognition. The scientific production in the past period was correct and the number of doctoral students was quite low. This could be due to a too large diversity in the projects.

  - Recommendations

An increase of the ELIPS staff is required to reach the objectives of the research project. If such a goal is not achieved, the project should be refocused to be equate better with the human resources, i.e. projects need to be prioritized. The scientific production and recognition at the international level could be improved from the participation to national and international networks.

4.2 - E4-PVPP: Plant cell walls & their polysaccharides (leader: L. SAULNIER)

- Staff members

N1: Number of researchers with teaching duties (Form 2.1 of the application file)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	5.8	7.6
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	3	-
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	8.8	9.8
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	5	
N6: Number of Ph.D. students (Form 2.7 of the application file)	10	
N7: Number of staff members with a HDR or a similar grade	6	6

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

The group has gained international recognition for both its know-how and accomplishments in cell wall analysis and also for the development of in-vitro models for cell wall assembly. This is reflected by the number of national and international collaborations that the group is involved in. This is also reflected by the very high number of research publications that they produce and general high quality of these papers. The team has a demonstrated ability to raise funds from competitive sources including national and EU calls. Nevertheless, the success in obtaining these competitive grants results more from invitations to join consortia rather than being at the initiative of such networks.

- Appreciation on the scientific strategy of the project

The general management and accountability structures appear to be of good quality. A greater emphasis on nurturing creativity among scientists could be expected. This might involve identifying key national and European research priority areas of relevance to the team and organizing informal brainstorming sessions around these as they emerge. These workshops could take a problem solving approach to identify new initiatives and applications.

- Conclusion

  - Summary

This is a very strong and productive team that has contributed significantly to the understanding of cell wall structure and function, particularly with regard to pectins and arabinoxylans. The group is one of the strongest in Europe for cell wall polysaccharide analysis and this is reflected in the strength and breadth of their collaborative work, where their expertise is sought by other groups. Area 1 (Biosynthesis and Cell Wall Organization) is one of the strongest components, and involves in-planta analysis of cell wall biogenesis. This is largely led by the strong analytical know-how of the research team. Area 2 (Cell Wall Biomimetic Systems) is a highly challenging area in our opinion. The team has made some potentially important observations regarding cellulose pectin interactions. The Comittee fully agrees that understanding the assembly and interactions of cell wall components is important to develop a thorough understanding of the material as a whole. Nevertheless, it will be very difficult to recapitulate these processes sufficiently well in fully in-vitro systems. Area 3 (Enzymatic Degradation of Cell Walls) makes use of the teams great analytical expertise to characterise the processes of cell wall degradation either with relevance to the food and feeds industry of the biofuels sector. This is reflected by their success in being involved in national and international collaborations, and this looks like a good area of focus for the team. Area 4 (Impact of the Cell Wall on Functional Properties of Plant Products) is about cell walls and fruit ripening. It seems to the Comittee that this was an area with a lot on interest and activity in the 1990s, but seems to have rather passed its hayday. That isn't to say that there isnn't still valuable work to do, but it is not currently a hot spot for cell wall research.

  - Strengths and opportunities

The analytical strengths and capabilities of the group are currently in high demand as there is a general reinvigoration of cell walls research around the world. This increased activity comes from realisation that cellulosic plant biomass will be a key feedstock for sustainable biofuels and biorenewables. There are clearly opportunities in this area, and the team is highly active in this sector with involvement in national and international projects. Their strength around arabinoxylans may be important in this context. The expertise in the area of cell wall deconstruction and biofuels ought to be of real benefit to the emerging cellulosic biofuels and biorefineries sector in France and Europe.

  - Weaknesses and threats

Although the publication rate is encouragingly high, of good quality and gives good evidence of colaboration, few of the papers are in highest impact journals in the field. In addition, amongst those that are in medium/high impact journals, only a few have members of the team as senior author. It may be useful to give some strategic planning to ensuring higher impact outputs from the team's work. This may be challenging as much of the effort is related to Food Science, an area that does not have many high impact journals associated with it.

  - Recommendations

The committee recommends that the team focuses their activities on its strengths. In fact, its analytical capabilities are very strong and they are widely known for the work that the team develops, but the team would benefit from taking on some bigger questions in order to better define their profile in fundamental research terms. One lack is a strong molecular genetic component to the team and its thinking. The analytical expertise so finely developed in the team might be better directed towards bigger fundamental questions by increased expertise in the area of molecular genetics. This may result in higher impact publications. Conversely, the groups skills might also benefit from being chanelled towards better defined targets of socio-economic relevance. Such a drive is evident in many of those studies dealing with fruit ripening and cell wall degradation.

4.3.- E5-NANO: Nanostructured assemblies (leader : B. CATHALA)

- Staff members

N1: Number of researchers with teaching duties (Form 2.1 of the application file)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	4	4.8
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	4	-
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	3	4
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	0	
N6: Number of Ph.D. students (Form 2.7 of the application file)	1	
N7: Number of staff members with a HDR or a similar grade	1	2

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

The NANO team at BIA is a young team as it was created in 2008. The researches of the team deal with the organization at nano and microscale of biopolymer assemblies in order to improve plant biomass utilization and to design innovative materials from renewable resources. The research projects are organized within three topics:

Model and biomimetic assemblies, i.e. cell wall models and thin films

Nanostructured surfaces, i.e. multilayered surfaces and enzymatic soft lithography

Nano and microstructured particles, i.e. cellulose-based pickering emulsions and microbeads fabrication by microfluidics

From the strong expertise of the BIA Laboratory in plant cell walls and cellulose-based nano-objects such as cellulose whiskers, the team developed fucntional materials and devices such as semi-reflective layers for enzymatic detection which lead to papers in high impact scientific journals and were patented. Grants were obtained from the INRA, the ANR Agency, and the EU to develop microfluidics and nanostructured surface processing facilities. The team developed attractive and high quality research which needs to be more attractive at the international level. In fact, the 'nanomaterials' area is a very competitive domain in which leaders at the national and international level are well identified including for bio-based nanomaterials and nano-devices. The team didn't clearly position its activities within the nanoscience community and the main nodes in France as well as within the other national laboratories involved in bio-based nanomaterials.

- Appreciation on the scientific strategy of the project

The scientific project of the team has two objectives, i.e. to strengthen the existing research projects and to widen the activities to include new insights. The team proposes to develop multifunctional and/or active nano and microstructured assemblies for biomimetic models and biobased materials (surfaces or particles) as well as new biomimetic models which will reproduce the functionality(ies) and not only the architectures. The team is aware of its present weaknesses according to its wish to extend partnerships including industrial collaborations to a better audience and to strengthen the collaborations within the team as well as to improve the human and equipment potential.

- Conclusion

  - Strengths and opportunities

The team has given in a quite short period of time interesting contributions to the field of biomimetic models of plant cell walls with papers and patents that confirm the expertise of the research unit in this area. Some of this work has an original character at the national level and reflects the leadership of the BIA unit in plant cell walls. This offers the opportunity for the team to develop innovative approaches and nanomaterials. In addition, the team could handle the leadership or be involved as essential partner in collaborative projects at the national and international level.

  - Weaknesses and threats

The scientific project is defined without well-defined drivers of research projects run within the team as well without a defined link with the general project of the research unit. These two points are very important regarding to the size of the team and the strong competition in nanosciences which require different scientific expertises. For some of the projects, the research strongly depends on equipment which is not necessarily available in the laboratory and/or are just used without a comprehensive approach. In addition, despite the team's young age, the scientific production is not very large.

  - Recommendations

The 2012-2015 project is rather large and complex with activities ranging from the development of biomimetic structures to the production of nanostructured particles. The work can potentially lead to new discoveries in the field of plant biology but it appears that the major focus will be in the development of novel methods for the generation of agricultural products-based nanostructured particles that may find application in the production of different goods. Nevertheless, drivers of research projects need to be defined in order to present a common approach for the team which could be well-integrated in the general scientific policy of the research unit. Basic understanding of the related phenomena for generation of nano-objects is required to take part as a research group with a specific expertise in the nanosciences competition. Such a satisfactory level of understanding could be achieved through an extension of scientific collaborations to other laboratories involved in soft matter physics and nanotechs.

4.4 - E6-ISD: Interfaces and dispersed systems (leader: M. ANTON)

- Staff members

N1: Number of researchers with teaching duties (Form 2.1 of the application file)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	10.9	10.1
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	3	-
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	7.4	8.8
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	0	
N6: Number of Ph.D. students (Form 2.7 of the application file)	18	
N7: Number of staff members with a HDR or a similar grade	6	6

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

The aim of the project was to generate assemblies with controlled properties, to assess the structure and stability of dispersed systems, and to study the protection, partitioning and reactivity of solutes in dispersed systems. It has two aspects: i) construction of the assemblies from native molecules or from extraction of pre existing assemblies and ii) evolution of these assemblies during applications that may be both food and non food. For food applications, the team is interested in protection, distribution and release of nutrients or polyunsaturated fatty acids (oxidation).

The scientists from the team have achieved these goals with some high quality research that includes a number of international collaborations. They have produced a high number of refereed publications of generally good but not outstanding quality in the field. The team has been stable apart from the loss of the leader and has built a good reputation, showing that they have the skills necessary to take the team forward into the new project.

Members of the team have been invited to a good number (23) of national and international conferences. They currently have six PhD students and have been successfully funded through a number of national and international projects which include their involvement in a number of international scientific networks and collaborations.

- Appreciation on the scientific strategy of the project

The new project aims to construct assemblies at different scales and then to follow the evolution and fate of assemblies during their application. For food applications this involves following breakdown during in vitro digestion with a view to optimise delivery of lipids and minerals. They are very focussed on what is required and know what resources need to be put in place to achieve their goals. This is leading research and should make this team the leaders in this cutting edge food science arena.

- Conclusion

  - Summary

In summary, the team is building on its already excellent track record in constructing multi-scale assemblies by looking at their evolution during digestion. They have well articulated and relevant health drivers for the production of the assemblies.

  - Strengths and opportunities

Strengths and opportunities results from the size of the team which has made an effort to structure its multidisciplinary activities. The numerous collaborations and participations in local, national, and international networks also contribute to maintain the multi disciplinary nature of their team.

The strong technical support based on a large variety of equipment available to contribute to the research is also a major advantage for this team compared to its competitors as well as the participation of the scientists from the team in teaching activities in Master's programme. This will contribute to future recruitements of additional young scientists such as PhD and Master students.

  - Weaknesses and threats

The team should focus on the food applications and not get involved in topical pharmaceutical applications even if the team feels that the generic science makes them relevant. In addition the team should make every effort to introduce more mathematical modelling into the work, especially with regard to the kinetic experiments for a better understanding of the mechanisms. Such effort could be made from approaches developed in soft matter science and materials science.

  - Recommendations

The scientific project of the team and the way to run it are relevant and in line with past work. The questions in food applications are well addressed whereas in non food applications the input is not clear and the scientific questions not clearly identified. Additional work should be addressed in this field. Collaborations in soft matter and material sciences could be the way to take the opportunity to enrich the existing methodologies

4.5 - E7-MC2: Materials processing and behaviour (leader: G. DELLA VALLE)

- Staff members

N1: Number of researchers with teaching duties (Form 2.1 of the application file)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	3	3
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	4	-
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	6.8	8.8
N5: Number of engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	0	
N6: Number of Ph.D. students (Form 2.7 of the application file)	9	
N7: Number of staff members with a HDR or a similar grade	4	4

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

The team developed solid scientific results published in high impact polymer and plant science journals and high impact food science journals. Work on gas cell growth in biological matrices is still the international benchmark for researchers in this area. The overall number of peer-reviewed publications is good to very good with well distributed authorships including all team members. A number of productive partnerships with the interfaces group and the starch enzymes group have been sustained.

There is plenty of evidence of the high profile status of several scientists, in starch structure, in structure-property relations of aerated biomaterials, and in the properties of biomaterials. The team has a strong record of research training of non-permanent staff, with many of these doctoral students and postdocs contributing to the development of new knowledge (e.g., peer-reviewed publications). Funding at either national or international levels is abundant which testifies to the group's ability to attract funds either individually or collaboratively. Based on patents, industrial partners and invited presentations to industry groups, there is strong evidence of socio-economic impact for this team.

- Appreciation on the scientific strategy and the project

The team aims to build on its strengths by undertaking some cutting edge activities in the processing of starchy materials. The proposed new activities complement research activities occurring in other teams, although the modeling of food breakage in the virtual masticator would likely benefit from a consideration of potentially appropriate models from researchers in the soft matter community. Linkages with GEPEA will enhance the opportunities for industrial uptake of the research outcomes.

- Conclusion

  - Summary

This is a productive and recognized team, with strong expertise in understanding the nature of starchy materials and their processing for food and non-food uses, and with emerging expertise in modeling of these materials, both during processing and linking structure to end-product properties. Good industrial contacts will be further strengthened by links to GEPEA.

  - Strengths and opportunities

The team possesses a very clear expertise in starch as a biomaterial including its characterization and its end-use properties modelling. Further structural characterizations of starch and establishment of linkages with ONIRIS will ensure that the team will be active participants in Themes 2 (Towards Smart Biopolymer Materials) and 3 (Towards Chewing of Solids Foods), respectively. The modelling approach based on knowledge engineering is original. The MC2 team has a strong expertise in this field applied to bread.

  - Weaknesses and threats

The team's previous expertise in materials performance and food quality does not provide the optimal background for the virtual masticator studies.

  - Recommendations

The team will need to limit the dispersion of its research activities and should focus more on the themes for which the team has an established international recognition. While maintaining its collaboration network, the association with the GEPEA laboratory and with the ISBM research federation define additional opportunities to optimize the processing parameters studies and to develop non-conventional approaches in food materials.

4.6 - E8-FIP: Protein functions and interactions (leader: J.M. CHOBERT)

- Staff members

N1: Number of researchers with teaching duties (Form 2.1 of the application file)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	2	2
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	3	-
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	3.8	2.8
N5: Number of engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	0	
N6: Number of Ph.D. students (Form 2.7 of the application file)	11	
N7: Number of staff members with a HDR or a similar grade	2	2

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

Two research topics are covered by the team: i/ Interaction properties of milk proteins, ii/ Allergy to milk proteins. The work was carried out under numerous international collaborations, mainly with countries of central and eastern Europe (PHC programs, ECO NET, SEE-ERA-NET in particular), which led the team to regularly receive students and postdoctoral trainees in the period. Three PhD theses were defended (0.75 per year) and the scientific production is very important (58 ACL so 5 on cross-cutting issues with other teams or 3.6 unit / year / researcher publishing). This is a very good performance according to the size of the team even if the number of its members decreased due to the departure of three people and no opening of new positions over the period. There is a large number of publications resulting from collaborations with foreign researchers. The level of the journals is of quite good quality even if there is a large number of authors for some of them, as a result of these collaborations. Regarding partnerships, in addition to participation in the PHC team that coordinates the program: "Study of antimicrobial and hypoallergenic products of lactic acid bacteria" funded by NATO, an ECO NET, which creates many international collaborations, the team participated also in the ANR Finginib where it is responsible for 2 workpackages. Conversely, national institutional collaborations are only few and the socio-economic partnership doesn't exist. One should also mention the low success rate in obtaining financial support through incentive programs from INRA (AIC or ANS).

- Appreciation on the scientific strategy of the project

The proposed project (which was not presented by the team leader) is focused on: i/ The appearance of protein digestibility in homogeneous or heterogeneous protein structures (new feature) ii/ The interaction of proteins with vitamin A and serotonin, and iii/ The link between protein modification and health. Such a project will require new internal collaboration (with ALL and ISD teams in particular) and external (ALIMH and VIM) and two new doctoral dissertations. The link between these three themes and the prospective medium-term evolution of themes of this group need to be clarified. The presentation suggested that opportunities for academic partnerships guided essentially changing scientific issues. Moreover, given the small number of staff it would be preferable to consolidate the existing lines of investigation rather than start a new one (protein digestibility).

The arrival of foreign students seems to be intended to meet the need of staff. Five theses are under way, with a thesis defence in 2010. Apparently, no new projects are either under preparation or accepted for funding this research.

- Conclusion

  - Summary

The team has a very different management and integration in the research unit compared to the other BIA groups due to a management policy which didn't fit the one from the BIA Board.

  - Strengths and opportunities

One of the strengths of this team is its ability to develop strong partnerships with countries of central and eastern Europe and memberships in international networks leading to an important academic scientific production.

  - Weaknesses and threats

The main weaknesses of this team are its very small (sub-critical) size and age of its staff as well as its low level of financial support. According to its management, the collaborations with the other BIA teams and at the national levell are very weak. The team has a management which conflicts with the one of the hosting research unit.

  - Recommendations

The evaluation committee recommends to refocus the project and to develop both in the team and at the BIA Laboratory level an internal debate on the future of the team in order if possible to avoid losing the scientific expertise recognized at the international level. The committee recommends also that the future of the technical staff (4 persons) involved in this team should be secured and clarified.

4.7 - E9-ALL: Allergy to dietary proteins (leader: S. DENERY)

- Staff members

N1: Number of researchers with teaching duties (Form 2.1 of the application file)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	3.9	3.9
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	0	-
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	8	8
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	0	
N6: Number of Ph.D. students (Form 2.7 of the application file)	3	
N7: Number of staff members with a HDR or a similar grade	1	1

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

The team "Allergy to Dietary Proteins" conducts research with two main objectives: i) characterization and properties of allergens and epitopes linked to allergy mechanisms ii) assessment of different strategies to reduce allergenic risk. Although many international research groups are working in the field of allergy, the ALL team has developed specificity through the study of wheat proteins. Original results have been achieved since the structure of allergens and IgE-binding epitopes, to mechanisms of allergy and impact processes. The ALL team is one of the few units in Europe working on such topics.

Different models of proteins have been studied : wheat, milk, egg. The respective contribution of these different models to the general objectives of the team are not clearly identified. Taking the size of the team and its expertise developed on wheat proteins into account, to focus on this kind of proteins only seems reasonable.

The allergy team is a young team. During the past 4 years the work conducted by this team led to the publication of 16 papers on the topics of allergy, 9 papers at international conferences and numerous national conferences. The team has achieved 9 invited talks in France since 2006, showing its profile mainly nationally. To increase its attractiveness, the team needs to expand its network of collaboration beyond the national level. Taking into account the size and the youth of the team, this activity is fully satisfactory. The "allergy" team has developed a very good national network including clinicians. This network is well organized at the local scale (Nantes).

The coordination (2) and participation (3) to projects funded by the French National Agency of Research in with academic and industrials partnership show the impact and the recognition of the research works performed by the team "allergy" at the national scale. Based on this good national network, international collaborations must now be developed.

- Appreciation on the scientific strategy of the project

The project proposed by the team "Allergy" is in continuity with the one of the previous period. The team will continue to develop its understanding of allergy mechanisms with a particular interest in how the structure of allergens influences their uptake and processing by intestinal cells. The ALL team is the only research team which turns its activities on immunology. As a consequence, the support from the research unit is required for being sure that the members of the team are not isolated. The project is very ambitious and focused on the study of the structures of the allergies from bio-probes within several projects (Predexpitope, Ovonutrial, goat milk, FUI Manoe), the mechanisms of allergy (Marinall, Real 2) from identifying new bio-probes, and the control of allergenicity (Manoe, Ovonutrial, goat milk, Marinall). This project seems too large considering the objectives and the size of the team and the different food allergies (milk, egg, wheat...) that the team proposes to study. The AERES committee recommends focusing on one kind of protein allergy and particularly on wheat proteins. The management of the team needs to limit diversification of the scientific themes and to keep a good balance between the studies on the structures of the allergens in wheat, eggs, and milk and the in vivo clinical studies in order to keep research directions fitting with the expertises on which the whole research unit is recognized. The human potential of the team needs to be maintained in order to keep the required expertises as two members will retire.

- Conclusion

  - Summary

The team "allergy" is a relatively young team which has developped a very good national network. Its research works on wheat allergy are original and they should now find international recognition. This is a very dynamic and active team with cross-disciplinary research priorities joining expertises and tools in immunology and immunichemistry, proteomics, cell and murine models, etc. Its own expertises are enriched from relevant and numerous collaborations mostly at the national level which contribute to position the recently created team in the scientific community and overcome the isolation of the team in the BIA research unit.

  - Strengths and opportunities

The team develops a lot of relevant collaborations at the national level to have an access to complementary expertises such as with allergists and to develop an integrative approach. One of the strengths of the group is its human potential defined by young and experienced scientists, engineers, and technicians which have joined it in the past period. The research of the team "allergy" is well integrated in the BIA unit and well identified at the national scale. The team "allergy" is a young team well supported by the BIA unit and the institute, offering a promising potential.

  - Weaknesses and threats

The required human potential should to be preserved in the future as experienced scientists will retire in order to be able to follow the planned scientific projects and to overcome the relative isolation of the group within the BIA Unit. Scientific production as papers and invited conferences coulod be improved and should be evaluated within a longer period of time. The team "allergy" should now develop collaborations internationally. The team must identify a core of expertise about the allergy to plant proteins and especially to wheat. In this context, the team must avoid development of different models of proteins and allergy which would expose it to becoming a mere service provider for clinicians with whom it collaborates.

  - Recommendations

The BIA management team should consider the fact that this integrated scientific approach requires a strong support In terms of expertises, i.e. human potential, i.e. the team needs to focus its project. The scientific production needs to be improved in the future following the involvement in many projects through collaborative networks both at the national and international level. This should facilitate its positioning relatively to the strong competition that typifies this scientific community and hence will contribute to its attractiveness.

4.8 - E10-BIBS: Biopolymers and Structural Biology Platform (leader: H. ROGNIAUX)

- Staff members

N1: Number of researchers with teaching duties (Form 2.1 of the application file)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	0	0
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	2	-
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	6.8	8.6
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	4	
N6: Number of Ph.D. students (Form 2.7 of the application file)	0	
N7: Number of staff members with a HDR or a similar grade	0	0

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

The team has provided evidence of original quality research in high-impact journals, although notably, the breadth of journals is extensive, perhaps reflective of short-lived partnerships arising from the team's commitment to service activities with users outside of BIA. The scientist leaders of the team regularly received invitations to international conferences, indicative of the influence of microscopy and mass spectrometry research at BIA in potentially shaping research directions at other institutions. Research training was evident but high level impact was low to date, e.g., no publications or presentations for the postdoctoral fellow or doctoral student that were listed as non-permanent personnel. The group displays an outstanding ability to acquire or raise funds to maintain structural characterization tools as cutting edge instrumentation for the benefit of all of BIA.

- Appreciation on the scientific strategy and the project

The team is deeply embedded in the activities of many other teams, as shown by the team's researchers spending one-third of their time in other teams within BIA. The method developments of the team have established the feasibility of the planned research and have actually helped frame specific activities in the research plans of other teams. The team is clearly committed to achieving the research objectives of the themes in the 2012-2015 period.

- Conclusion

  - Summary

This is a dynamic and productive methods-led team, whose major role is to provide analytical backup to other teams in the unit. The team includes facilities for NMR, mass spectroscopy, and various microscopy platforms. The team's commitment to continuous improvement of facilities ensures that it plays a key role in attainment of BIA's research objectives.

  - Strengths and opportunities

The team clearly has recognised expertise and this is evident through the wide range of partnerships and collaborations. This provides for a good source of impact in the form of publications, an outcome that should lead to more intra-BIA publications in the future.

  - Weaknesses and threats

Commitment on the part of all team members to raise funds to maintain research infrastructure places on-going demands on personnel. In order to ensure maximum commitment to attainment of BIA research objectives, a 50% commitment to BIA projects should be enforced.

  - Recommendations

The team should continue to be dynamic and productive as in the last period of time from the integration of new and unique analytical facilities to investigate the structure at different scales of the objects studied at BIA. These future developments will require additional human ressources on the BIBS platform in order to develop the best expertises for running such equipments but also for continuously upgrading the existing ones.

4.9 - E11-BIOINF: Bioinformatics and Data Management (leader: D. TESSIER)

- Staff members

N1: Number of researchers with teaching duties (Form 2.1 of the application file)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	1	1
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	1	-
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	4	4
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	0	
N6: Number of Ph.D. students (Form 2.7 of the application file)	2	
N7: Number of staff members with a HDR or a similar grade	1	1

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

The evaluation committee didn't consider the BIOINF platform as the other teams according to its goals and position with the BIA Research Unit. The BIOINF team is a young group, created following the recommendations of the previous evaluation of the BIA unit in 2008. The objective of the setting-up of this team was to increase the visibility of the expertise in bioinformatics and computer science within BIA. In fact, the BIOINF platform has the objective to help scientists form the BIA laboratory to co-develop experimental protocols and computing and statistics tools for investigating new fields and to take advantage of the generated data. The expertises deal with bioinformatics computer science and chemiometrics.

- Appreciation on the scientific strategy of the project

The Bioinformatics and Data Management team will, quite rightly contribute to all themes. Their objective is to help fulfil research needs in computing and statistics. More specifically they have the optimistic goal of i/ co-developing experimental protocols for exploring new scientific questions and ii/ making best use of data generated. It is not at all clear the way they intend to achieve this. It is clear that the team intend to build on "omic" approaches that they have developed, especially in the field of MS/MS. Whilst the team recognises the difficulties of dealing with the increasing complex nature of the bioinformatics data that the BIA project is likely to and indeed must produce, it is not clear how the challenge will be met.The BIOINF team has developed some collaborations at the local scale with the Nantes University. Two PhD students and one post-doc have participated to the research activities of the team. In two years, 10 scientific publications mainly in collaboration with other research teams have been published. Only two papers have been published in specific bioinformatics or computer science journals. This shows that the team has not found a good balance between research activity and service activities. To manage, exploit, and pool the analytical data generated, the team spent a lot of time to develop a specific tool called CaDUM that makes possible the data management of great sets of data. The AERES committee proposes that the development of such tools is probably relevant for the BIA Unit but is not a research activity, i.e. the specificity and the originality have not been highlighted.

- Conclusion

  - Summary

The BIOINF team still appears to be struggling to find its true position in the BIA unit and to maintain an equilibrium between research activities and service activities due to its small size.

  - Strengths and opportunities

For the BIA unit, it is a strength to take advantage of the BIOINF team expertises. It is not clear if the BIOINF members see opportunities for collaboration with other leading bioinformatics teams outside INRA.

  - Weaknesses and threats

The team has somehow failed to sell its services sufficiently well to the other teams within the unit. This may be due to a lack of understanding by other teams of the role that the group can play in data analysis. The other teams must be linked into the BIOINF group if the potential of BIA is to be fully realized. Very soon, the team will lose its expertise in chemiometrics due to the retirement of a scientist.

  - Recommendations

This team needs to be at the heart of what is going on in BIA projects if they are to make an impact internationally. If this is to happen then the group needs a strategy that actually achieves their primary objective. The BIOINF team could take advantage, as proposed in its project, of the software platform from the CEPIA Division for developing, adapting, and extending the CaDUM project. The BIA unit should lead a work at the scale of the unit about its research activities in computer science, taking bioinformatics but also knowledge engineering (MC2 team) into account. The team needs to be at the interface between BIA research and a wider network of computer scientists and applied mathematics in order to develop original tools and methods to the research needs of the unit.

Intitulé UR / équipe	C1	C2	C3	C4	Note globale
BIOPOLYMÈRES, INTERACTIONS ASSEMBLAGES	A	B	A	A	A
ISD-INTERFACES AND DISPERSED SYSTEMS [GUEGUEN-ANTON]	A+	A	Non noté	A+	A+
NANO-NANOSTRUCTURED ASSEMBLIES [GUEGUEN-CATHALA]	A	B	Non noté	A	A
FIP-PROTEIN FUNCTION AND INTERACTIONS [GUEGUEN-CHOBERT]	A	B	Non noté	C	B
MC2-MATERIALS PROCESSING AND BEHAVIOUR [GUEGUEN-DELLA VALLE]	A	A	Non noté	A	A
ALL-ALLERGY TO DIETARY PROTEINS [GUEGUEN-DENERY]	A	B	Non noté	B	B
ELIPS-LIPOPROTEIN AND PROTEIN-POLYSACCHARIDE STRUCTURES [GUEGUEN-MARION]	B	C	Non noté	B	B
BIBS-BIOPOLYMERS AND STRUCTURAL BIOLOGY PLATFORM [GUEGUEN-ROGNIAUX]	A+	A	Non noté	A+	A+
PVPP-PLANT CELL WALLS & THEIR POLYSACCHARIDES [GUEGUEN-SAULNIER]	A	A	Non noté	A	A
BIOINF-BIOINFORMATICS AND DATA MANAGEMENT [GUEGUEN-TESSIER]	Non noté	Non noté	Non noté	Non noté	Non noté

C1 Qualité scientifique et production

C2 Rayonnement et attractivité, intégration dans l'environnement

C3 Gouvernance et vie du laboratoire

C4 Stratégie et projet scientifique

Statistiques de notes globales par domaines scientifiques

(État au 06/05/2011)

Sciences du Vivant et Environnement

Note globale	SVE1_LS1_LS2	SVE1_LS3	SVE1_LS4	SVE1_LS5	SVE1_LS6	SVE1_LS7	SVE2 _LS3 *	SVE2_LS8 *	SVE2_LS9 *	Total
A+	7	3	1	4	7	6		2		30
A	27	1	13	20	21	26	2	12	23	145
B	6	1	6	2	8	23	3	3	6	58
C	1					4				5
Non noté	1									1
Total	**42**	**5**	**20**	**26**	**36**	**59**	**5**	**17**	**29**	**239**
A+	16,7%	60,0%	5,0%	15,4%	19,4%	10,2%		11,8%		12,6%
A	64,3%	20,0%	65,0%	76,9%	58,3%	44,1%	40,0%	70,6%	79,3%	60,7%
B	14,3%	20,0%	30,0%	7,7%	22,2%	39,0%	60,0%	17,6%	20,7%	24,3%
C	2,4%					6,8%				2,1%
Non noté	2,4%									0,4%
Total	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

*** les résultats SVE2 ne sont pas définitifs au 06/05/2011.**

Intitulés des domaines scientifiques

Sciences du Vivant et Environnement

• SVE1 Biologie, santé
- **SVE1_LS1 Biologie moléculaire, Biologie structurale, Biochimie**
- **SVE1_LS2 Génétique, Génomique, Bioinformatique, Biologie des systèmes**
- **SVE1_LS3 Biologie cellulaire, Biologie du développement animal**
- **SVE1_LS4 Physiologie, Physiopathologie, Endocrinologie**
- **SVE1_LS5 Neurosciences**
- **SVE1_LS6 Immunologie, Infectiologie**
- **SVE1_LS7 Recherche clinique, Santé publique**

• SVE2 Ecologie, environnement
- **SVE2_LS8 Evolution, Ecologie, Biologie de l'environnement**
- **SVE2_LS9 Sciences et technologies du vivant, Biotechnologie**
- **SVE2_LS3 Biologie cellulaire, Biologie du développement végétal**

REPUBLIQUE FRANCAISE

Etablissement public à caractère scientifique et technologique
placé sous la tutelle conjointe des ministres chargés
de la recherche et de l'agriculture

Unité
Biopolymères,Interactions,Assemblages
B.I.A.

Agence d'évaluation de la Recherche
et de l'enseignement supérieur

Réponse au Rapport de l'AERES de l'UR-1268-Biopolymères Interactions Assemblages (BIA)

Centre Angers-Nantes
Département CEPIA

▪ Commentaires généraux

Nous apprécions l'analyse détaillée faite par la commission qui souligne parmi les forces de l'Unité son dynamisme, son approche multidisciplinaire à l'interface chimie-biologie-biophysique et son positionnement reconnu dans le domaine de la structure des biopolymères, en particulier dans les matrices alimentaires.
La Commission reconnaît les efforts des quatre dernières années pour réorganiser l'Unité en cohérence avec ses objectifs scientifiques, pour acquérir un très bon niveau d'équipement (Plateforme BIBS labellisée IBiSA), pour développer des partenariats scientifiques à l'échelle nationale et européenne. Elle valide les orientations scientifiques du projet 2012-2015 et émet des recommandations pertinentes pour le prochain quadriennal.

<u>En terme de positionnement scientifique et thématique :</u>

La présence de nombreux experts étrangers dans le jury a contribué à la richesse de ce rapport mais explique aussi certains commentaires qui reflètent ***une connaissance imparfaite*** *de l'organisation de la recherche en France et tout particulièrement* ***des missions de l'INRA****. Tout en soulignant la pertinence de nos orientations, la commission considère comme une faiblesse le fait que le moteur de nos recherches résulte en général de questions liées à l'application et non à des hypothèses liées aux avancées scientifiques.*

Or, BIA est une unité propre INRA et ses recherches s'inscrivent donc dans la logique des missions finalisées de l'Institut (ERC: LS9). En outre, même si nos travaux concernent des objets d'intérêt socio-économique, l'acquisition de nouvelles connaissances est la préoccupation majeure de notre stratégie scientifique, attestée par des publications génériques.

La commission recommande de ***renforcer les liens*** *avec la* ***génétique*** *d'une part, la* ***science des matériaux et la biophysique*** *d'autre part.*

Les efforts déjà accomplis dans ce sens seront poursuivis. En particulier, des collaborations étroites, concrétisées par des publications, existent avec les départements « génétique et amélioration des plantes » (Angers, Clermont) et « biologie végétale » (Versailles, Bordeaux) de l'INRA et des unités du CNRS (Gif, Orsay, Lille) dans ces disciplines. Outre des collaborations bien établies avec différents laboratoires CNRS (CRPP, SIMaP…), notre ouverture vers la biophysique et la science des matériaux se traduit par notre participation à trois actions majeures au plan national :

- GDR INRA/CNRS Assemblage des macromolécules végétales (2005-2008) piloté par A. Buléon, qui a entretenu les collaborations avec le laboratoire Léon Brillouin et l'ESRF (Grenoble),

- GDR 2983 « mousses et émulsions » qui implique plusieurs partenaires de la physicochimie des systèmes dispersés (Univ Grenoble (LSP), Univ Paris-est (LMPDI)), Paris7 CNRS(MSC)), Paris Sud (LPS), Univ Rennes 1 (IPR))
- SOLEIL qui *donne accès aux équipements et compétences* de pointe en biophysique

En terme de structuration et d'animation scientifique

La structuration de l'Unité ne semble pas avoir été suffisamment lisible pour la commission qui n'a pas toujours perçu la complémentarité entre équipes.

Cette structuration s'appuie sur une **organisation en équipes** dont la **complémentarité thématique** permet **d'intégrer les connaissances aux différentes étapes de la chaîne alimentaire**, du gène au produit transformé. Ce schéma fonctionnel, développé pour renforcer la cohérence de l'Unité et les synergies entre équipes, s'appuie sur une démarche d'ingénierie inverse de l'aval vers l'amont, préconisée par le département Cepia (cf lettre de mission du DU) qui privilégie des études de physicochimie et des structures aux différentes échelles. Cette structuration fonctionnelle de l'Unité sera poursuivie car elle est fédératrice et constitue un contexte favorable aux collaborations entre équipes. Nous la rendrons plus lisible à l'avenir dans l'organigramme de l'Unité.

*La Commission insiste dans son analyse du bilan sur **l'hétérogénéité des équipes** en taille et au plan de la production scientifique. Elle relève aussi des disparités concernant la **politique de recrutement**.*

Cette hétérogénéité est le reflet (a) de parcours différents des équipes et (b) de leur complémentarité disciplinaire qui sont des caractéristiques essentielles de la dynamique scientifique de l'Unité.

(a) Certaines équipes, de taille plus importante et très structurées, s'appuient sur un historique important (ISD, PVPP, MC2) alors que d'autres, plus petites, plus récentes,(ALL, NANO, ELIPS) ont été créées autour de problématiques innovantes (allergie, nanosciences, matériaux biosourcés, biologie intégrative du grain).

(b) Cette hétérogénéité résulte aussi (1) de la politique scientifique de l'Unité pour mieux intégrer les fronts de science dans les domaines des « omiques » et de la biologie intégrative (PVPP, ELIPS), de la micromécanique du solide (MC2), des études multi-échelle des structures (BIBS), des assemblages nano, micro ou mésostructurés (Nano, ISD, MC2), de la modélisation-simulation (MC2, ISD, PVPP), (2) de l'existence d'équipes transdisciplinaires (BIBS, Bioinf) qui répondent à la logique de plateformes, encouragée par l'Institut et par la politique nationale de Recherche (cf IBiSA).

La commission note l'intérêt pour l'Unité de ces deux équipes transdisciplinaires. Nous sommes d'accord avec ses recommandations d'intégrer plus efficacement dans la stratégie scientifique des équipes thématiques la gestion des données et leur exploitation informatique.

L'hétérogénéité des équipes est donc la résultante de cette dynamique scientifique et organisationnelle; elle se traduit par une maturité différente des sujets traités et par conséquent par un impact variable des publications suivant les équipes. Elle permet aussi le renouvellement des thématiques **et ne peut être considérée de ce point de vue et à moyen terme comme une faiblesse.**

Quant à la **politique de recrutement**, elle a eu pour objectif de **soutenir le développement des fronts de science et d'aider à l'émergence des nouvelles équipes**. A l'exception de FIP, **toutes les équipes ont bénéficié de cette politique**, qui a été confortée par des efforts de redéploiement interne. Cette politique sera poursuivie, en particulier en soutien aux équipes de création récente (NANO,ELIPS).

La commission mentionne que « l'unité dispose de peu de nouvelles méthodologies pour développer des approches innovantes ».

Nous ne comprenons pas cette restriction, car des investissements très importants ont été effectués ces dernières années dans le domaine de l'analyse structurale des biopolymères aux différentes échelles (plateforme BIBS notamment), et sont engagés en appui du projet 2012-2015 en phénotypage chimique et structural haut débit (projet IBiSA), ainsi qu'en physicochimie moyen débit ou encore en modélisation et ingénierie des connaissances.

En terme de production scientifique :

Le bilan publicatoire global de l'Unité est de 351 articles référencés dans le WOS pour 36,2 chercheurs permanents. A l'exception des chercheurs recrutés au cours des deux dernières années, l'unité a 100% de publiants et 68% des articles sont classés en catégories « exceptionnel » ou « excellent » dans nos disciplines selon l'analyse bibliométrique jointe au rapport.

Le rapport de la Commission reconnaît ce bon niveau général des publications mais souligne l'hétérogénéité quantitative et qualitative de la production selon les équipes.

Outre les éléments de réponse mentionnés précédemment, l'hétérogénéité qualitative résulte aussi des différences de facteur d'impact des revues correspondant aux différents champs disciplinaires des équipes (par ex., entre Biologie et Sciences des matériaux ou de l'aliment). Les efforts engagés au cours des dernières années pour publier dans les journaux plus génériques et à facteur d'impact plus élevé, se traduisent par une forte progression du nombre d'articles classés en catégorie exceptionnelle en Polymer sciences (15/ 45) , en Plant science (13/ 33) et en Material science (5/ 20). Ces efforts sont poursuivis.
Nous regrettons que la Commission ne tienne pas compte des **autres types de production**, notamment en lien avec les acteurs socio-économiques et les organismes de politique publique, ou encore en direction des citoyens. Cette production non-académique, significative pour BIA, est à mettre au crédit de l'Unité pour ses missions en tant qu'unité propre d'un organisme de recherche finalisée.

En terme d'attractivité :
La commission reconnaît comme une force de l'unité la ***capacité à attirer des doctorants et des post-doctorants*** *de plusieurs laboratoires étrangers avec lesquels nous avons développé des collaborations, en Europe et dans le monde (Argentine, Canada, Pays du Maghreb, Cameroun, Russie), à travers divers programmes européens (Healthgrain, Dream…) et internationaux (OTAN, EGIDE). Par contre, elle regrette la faible attractivité de l'Unité pour des chercheurs étrangers de haut niveau.*
Nous avons recruté un chargé de recherche étranger (NANO), et avons tenté de recruter de tels chercheurs en soumettant des projets de « package scientifique » à l'INRA (2) et à la Région (2) ; une seule candidature a été acceptée, compte tenu du taux de pression sur ces candidatures. Cette politique sera poursuivie et nous accroîtrons notre effort en ce sens. Le leadership des programmes européens DREAM et WallTrac (ITN) constitue un atout pour renforcer notre attractivité au plan européen.

En terme d'accueil de doctorants:
La Commission souligne à juste titre que la capacité d'encadrement de 25 HDR permettrait d'accroître le nombre de doctorants accueillis (8-10 par an).
Le faible potentiel de l'Université de Nantes dans le domaine des sciences de l'aliment constitue un handicap. En outre, l'ED Venam (Univ. Angers, Nantes, Le Mans) ne dispose que d'un nombre très limité de bourses (4 par an) pour l'ensemble des activités de recherche dans les domaines de la mer, de la santé , du végétal et de l'agroalimentaire. BIA bénéficie au mieux d'une bourse tous les deux ans. Dans ce contexte difficile, des efforts sont accomplis pour améliorer cette situation, en nous impliquant fortement dans les masters SANH et Biovigpa (classés A par l'AERES), en diversifiant les sources de financement institutionnel (3-4 bourses/an : INRA, co-financement INRA-Région, INRA-CNRS), contractuel (3-4 bourses/an : ANR, Cifre) et dans le cadre des programmes européens et internationaux (2-3 bourses/an) Nous intensifierons ces actions et nous retenons l'incitation de la Commission à conforter les liens avec l'Université et ONIRIS, en nous appuyant en particulier sur la création de la structure fédérative de recherche ISBM.

▪ Commentaires des équipes

o *E2-ELIPS: Edifices lipoprotéiques et Protéo-Saccharidiques*

Nous sommes conscients de la visibilité internationale insuffisante de l'équipe; elle est liée au profond **remaniement thématique** initié au cours du dernier quadriennal. Toutefois, **les compétences acquises** sur les systèmes endomembranaires et plus récemment sur l'organisation des systèmes lipidiques (cuticule) **commencent à porter leurs fruits** (brevet, publications récentes acceptées dans des journaux à fort impact). Concernant *le caractère ambitieux de notre projet d'équipe*, nous avons perçu cet avis du comité de manière positive mais nous sommes conscients, en accord avec le comité, que ce projet est conditionné par un renforcement de l'équipe en moyens humains.

o *E4-PVPP: Paroi végétale et Polysaccharides Pariétaux*

Les conclusions de la commission sur l'activité de l'équipe sont globalement positives et les recommandations vont dans le sens de nos orientations vers la biologie et la génétique. Toutefois **l'activité sur les fruits** a été mal comprise; il ne s'agit pas d'étudier la maturation des fruits mais de **comprendre les déterminants de la texture,** ce qui implique une compréhension des propriétés mécaniques des réseaux pariétaux associée à une **modélisation multi-échelle** du fruit. D'autre part, l'aspect finalisé "qualité" fait ici appel à des approches fondamentales et des développements de pointe sur la mécanique des parois qui dépasse le cadre de la texture des fruits.

- *E5-NANO: Assemblages Nanostructurés*

Une recommandation importante du rapport porte sur l'identification de « scientific drivers ». Si cette recommandation porte sur l'identification de chercheurs responsables des thématiques, ce travail est en cours, mais nécessite **une période d'appropriation et de maturation** notamment des **jeunes chercheurs** ou des chercheurs en réorientation thématique. Dans le cas ou le terme « drivers » indique des objectifs scientifiques, ils visent pour les trois thématiques de l'équipe la construction **d'objets fonctionnels** issus des agroressources, **aux dimensions nano et micrométriques**, par une étude approfondie des interactions entre biopolymères, des mécanismes d'assemblage et des relations structures-fonctions. Ces approches s'inscrivent à la fois dans les domaines de la physico-chimie de la matière molle et les nanosciences. *Quant au fait que le laboratoire ne dispose pas de tous les outils nécessaires à notre activité nous en sommes conscients.* Nous sommes convaincus que cette difficulté peut être surmontée par les **collaborations** que nous développons avec des **laboratoires reconnus en nanosciences**, physique ou en physico-chimie de la matière molle (IMN, LLB, ESPCI, IEMN,…).

Le rapport souligne le nombre limité de publications de l'équipe. L'équipe a été créée au 1er Janvier 2008 avec 3 chercheurs, dont deux en réorientations thématiques. Les autres chercheurs et techniciens de l'équipe ont rejoint l'équipe en 2009 et en 2010. Nous soulignons que dans cette phase de construction, au plan thématique, humain et des équipements, nous avons produit depuis 2008, outre les 13 publications académiques, 2 brevets. Ce bilan publicatoire est en progrès.

- *E6-ISD: Interfaces, Systèmes Dispersés*

La commission recommande de privilégier les recherches sur les structures de l'aliment ; or **les questions scientifiques** concernant l'évolution des structures multi-échelles sous contraintes sont similaires**,** que l'utilisation des produits transformés soit alimentaire ou non. En particulier les compétences que nous développons sur les structures et propriétés des assemblages de biomolécules sont **indépendantes des domaines d'application**. Seules les approches de modélisation de la dynamique des systèmes (transferts/réactivité chimique/déconstruction au cours de la digestion) seront plus spécifiquement développées dans le cas de l'aliment en collaboration avec l'UMR GMPA, spécialisée dans le développement de modèles mathématiques des systèmes alimentaires.

- *E7-MC2: Matériaux, création et comportement*

Les recommandations du comité sur les liens avec la communauté « matière molle » ont été anticipées dans les collaborations déjà nouées, notamment *sur le sujet « masticateur virtuel »* ; celles-ci permettront à l'équipe de se focaliser sur les matériaux amylacés, où l'équipe a une renommé internationale, et ainsi d'éviter toute dispersion.

- *E8-FIP: Fonctions et Interactions des Protéines*

Nous observons quelques inexactitudes dans l'évaluation de l'activité de l'équipe. L'absence de nos collaborations avec d'autres équipes de BIA d'une part (ACLE8-10,40), avec les industries d'autre part (partenaires français ANR Funginib, et étrangers du projet OTAN) est moins absolue que le mentionne la commission.

Nous avons déploré dans notre bilan le manque de soutien durant ces 6 dernières années et la crainte de voir les compétences des membres de l'équipe disparaître du fait du non recrutement de jeunes chercheurs. Si notre activité a pu être considérée en dehors du périmètre BIA entre 2006 et 2010, nous étions arrivés à un accord avec le Directeur d'Unité pour que **nos compétences** soient **mises à profit dans le projet 2012-2015** à travers des collaborations avec les équipes ISD et ALL, notamment, dans le cadre du devenir des protéines au cours de la digestion. L'avis de la Commission est ambiguë quand elle ne juge pas pertinent que FIP s'engage dans cette voie tout en déplorant le risque de perte de compétences.

- *E9-ALL: Allergie aux protéines alimentaires*

La Commission recommande à l'équipe de recentrer son projet sur les protéines de blé et de renforcer ses collaborations internationales.

L'équipe reconnaît la nécessité de se focaliser sur les protéines de blé, compte tenu de son expertise, mais considère **qu'en raison de leur particularité de structure**, il est pertinent **d'inclure pour des études mécanistiques d'autres allergènes**, comme certaines protéines de l'œuf ou du lait. Ces travaux sont menés en collaboration étroite avec des équipes reconnues pour leur expertise sur ces protéines.

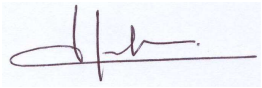
Pour accroître notre reconnaissance internationale, des efforts sont d'ores et déjà engagés pour être **partenaire d'un futur programme européen** sur la gestion du risque d'allergie alimentaire, en apportant notre expertise spécifique sur les allergènes du blé.

- *E10-BIBS : - Plateforme Biopolymères, Interactions et Biologie structurale*

En accord avec la commission, l'équipe a pleinement conscience que sa dynamique dépendra de sa capacité à maintenir ses équipements et son expertise au meilleur niveau et à accroître son potentiel humain.

- *E11-BIOINF: Bioinformatique et de gestion de données*

L'équipe Bioinformatique est en accord avec les conclusions de l'AERES la concernant. Dans le futur, elle devra mieux se positionner compte tenu de ses ressources. Nous sommes également conscients que BIA a besoin d'intégrer plus efficacement la gestion des données et leur exploitation informatique dans sa stratégie scientifique.



Le 22 avril 2011

J. Guéguen
Directeur de l'Unité BIA