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# RIDI - Réponse immunitaire et développement chez les insectes

Rapport Hcéres

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

Research Units Department

AERES report on unit:

Immune response and development of insects

(Réponse Immunitaire et Développement chez les  
Insectes, RIDI)

Under the supervision of the following  
institutions and research bodies:

CNRS

January 2012



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

Research Units Department

President of AERES

**Didier Houssin**

Research Units Department

*Department Head*

**Pierre Glaudes**



## Unit

Name of unit:	Immune response and development of insects
Acronym of unit:	RIDI (Réponse Immunitaire et Développement chez les Insectes)
Label requested:	CNRS
Present no.:	UPR 9022
Name of Director (2009-2012):	Mr Jean-Marc REICHHART
Name of project leader (2013-2017):	Mr Jean-Marc REICHHART & Mr Jean-Luc IMLER

## Members of the committee of experts

Chair:	Mr Stéphane NOSELLI, Nice
Experts:	Ms Georgia Barlovatz-MEIMON, Evry (CNU representative)
	Ms Dominique BUZONI-GATEL, Tours
	Ms Michèle CROZATIER, Toulouse
	Ms Marie-Odile FAUVARQUE, Grenoble
	Ms Dominique MAZIER, Paris
	Mr Eric OSWALD, Toulouse
	Mr Joël PESTEL, Lille (CoNRS representative)
	Mr Mika RAMET, Tampere, Finland
	Mr Bernhart RYFFEL, Orléans
	Mr Dirk SCHLÜTER, Magdeburg, Germany
	Mr Gérald SPAETH (INSERM representative)



# | Representatives present during the visit

Scientific Delegate representing AERES:

Mr Joost Van MEERWIJK

Representative(s) of the unit's supervising institutions and bodies:

Mr Stanislas TOMAVO, CNRS

Ms Christine TUFFEREAU, INSERM



# Report

## 1 • Introduction

### Date and conduct of visit:

The on site visit of UPR9022 took place on January 31<sup>st</sup> 2012, from 8H30 am to 7H00 pm. UPR9022 is part of the Institute of Molecular and Cellular Biology (IBMC), located on the University of Strasbourg campus. The visit started with a short closed door meeting of the committee, followed by presentations by the director and by all project leaders. Presentation of the unit and of scientific projects took place in the presence of the whole laboratory. Following scientific presentations, the committee split in three groups to discuss with the unit personnel (staff researchers and teacher-researchers, technicians and engineers, post-docs and students). The committee then discussed with University of Strasbourg, INSERM and CNRS representatives. This was followed by a discussion with the director. The committee ended the visit with a final closed door meeting. Overall, the organization was very good and despite a tight schedule the visit allowed discussions to take place in an excellent way.

### History and geographical location of the unit, and overall description of its field and activities:

The origin of the UPR9022 unit can be traced back to the 'Centre of insect Biology' created in Strasbourg in the late nineteen-fifties. Up until the mid 90s, the centre was mainly dedicated to the study of insect humoral biology and endocrinology, with projects starting to explore insect immunity by 1985. The latter field of research then expanded and a critical decision was made to shift all efforts on the study of *Drosophila* innate immunity, at a time when very few laboratories worldwide were involved. This led to the moving of the teams to the IBMC building in 1994 and the creation of the UPR9022 unit by Mr J. HOFFMANN, who was the head of the unit until 2006. This key new scientific direction was fully supported by the CNRS (UPR9022 is an exclusive CNRS research infrastructure). Since 2006, the unit is headed by Mr J.-M. REICHHART.

UPR9022 teams study host-pathogens interactions using *drosophila* and mosquitoes as model systems. The unit has made outstanding contributions to the field. In the past period, teams have explored novel regulatory mechanisms controlling the IMD and Toll pathways, performed systematic proteomic analysis of the IMD pathway, characterized the role of RNA interference in the antiviral response, developed new models of infection/colonization, characterized a complement-like pathway with anti-parasitic activity in mosquitoes, to cite a few. Work over the last five years led to major achievements and first class publications.

### Management team:

The laboratory is headed by Mr J.-M. REICHHART since 2006, with Mr C. HÉTRU serving as deputy director during this period. For the next term (2013-2017), Mr REICHHART will continue heading the unit together with Mr J.-L. IMLER who will take the deputy director position and replace Mr REICHHART in 2016. The director and Mr J. HOFFMANN are assisted by a dedicated secretary. The financial service is managed by one person working in a financial team shared with other units housed at IBMC.

In terms of scientific organization, UPR9022 teams work in very close contact with frequent meetings of senior scientists, within a specific council ('capitulum'). All scientific, management and strategic decisions are made by this council on a consensual basis, therefore involving all scientific heads into the life and development of the unit. This management model, made possible by both the small size of the unit and its internal history, contributes to the building of a specific unit spirit leading to a unique and strong cohesion that could be felt at all levels. The very intricate/shared scientific management led the unit to propose over the years a single team for evaluation. For the next term, two teams are proposed for evaluation, headed by Mr REICHHART (*drosophila* model) and Ms S. BLANDIN (*mosquito* model).



### Unit workforce:

The UPR9022 unit is a relatively small size unit by today's standards, with a total of 65 members, distributed in 5 groups/projects and common services including a bioinformatics/sequencing and molecular biology platform. Of all UPR9022 members, 23 are on permanent positions (7 researchers including 4 CNRS and 3 INSERM, 5 university teacher-researchers including 3 MCU and 2 PR, 11 technicians/engineers including 3 university BIATOS and 8 CNRS ITAs) and 42 members are on contracts (4 Master students, 15 PhD students, 15 post-docs, 8 technician/engineers).

Workforce	Number on 06/30/2011*	Number on 01/01/2013*	2013-2017 Number of producers**
<b>N1:</b> Professors or assistant professors	5	5	5
<b>N2:</b> EPST or EPIC researchers	6	6	6
<b>N3:</b> Other professors and researchers			
<b>N4:</b> Engineers, technicians and administrative staff *on a permanent position	11	10	
<b>N5:</b> Engineers, technicians and administrative staff * on a non-permanent position			
<b>N6:</b> Postdoctoral students having spent at least 12 months in the unit	16		
<b>N7:</b> Doctoral students	13		
<b>N8:</b> PhD defended	13		
<b>N9:</b> Number of Habilitations to Direct Research (HDR) defended	1		
<b>N10:</b> People habilitated to direct research or similar	7	8	
<b>TOTAL N1 to N7</b>	<b>51</b>	<b>21</b>	<b>11</b>

\* If different, indicate corresponding FTEs in brackets.

\*\* Number of producers in the 2008-2011 period who will be present in 2013-2017.

Definition and downloading of criteria:

<http://www.aeres-evaluation.fr/Evaluation/Evaluation-des-unites-de-recherche/Principes-d-evaluation>.



## 2 • Assessment of the unit

### Overall opinion on the unit:

Since 1994, the unit past and current members have contributed tremendously to the field and UPR9022 is renowned worldwide as evidenced by the numerous high level invitations and awards its members have received in the last five years. Overall, the scientific impact of UPR9022 is outstanding and one of a kind; UPR9022 represents one of the most brilliant and successful CNRS research unit in France. The continuous success and growing impact of its research stems from key visionary decisions, excellent scientific and infrastructure management, high success rate in grant raising, high attractivity leading to the recruitment of international quality collaborators at all levels (group leaders, post-docs, PhD students, technicians).

UPR9022 has pioneered the field of insect and drosophila innate immune response and made major breakthroughs including, i) the characterization of antimicrobial peptides and their regulation, ii) the identification of the role of the Toll and IMD pathways in innate immunity, iii) the characterization of new regulatory mechanisms controlling the Toll and IMD pathway, iv) the characterization of pathogen pattern recognition mechanisms, v) the characterization of some aspects of the gut immune response, iv) the characterization of the role of RNAi in the antiviral response, v) the identification of a complement-like pathway in the anti-parasitic response of mosquitoes, to cite a few. More recently (2002), UPR9022 has recruited a talented group working on malaria, expanding on a major insect model of health and economical interest.

The scientific impact of UPR9022 can be illustrated through objective criteria including i) the quality of publications (since 2007 : Science, Cell, Nature Immunology, Nature Genetics, Molecular Cell, PLoS Biology, PLoS Pathogens, PNAS, Cell Host Microbe), ii) numerous invitations to international meetings (217 in total, which often are keynotes), iii) invitations to write comprehensive reviews in leading journals (Nature Review Immunology, Immunity, Current Opinion in Immunology, Current Opinion in Microbiology, Trends in Parasitology, EMBO Journal) and iv) the best national and international prizes, awards and distinctions (Nobel Prize in Medicine and Physiology 2011, Shaw Prize 2011, CNRS Gold Medal 2011; Prizes from the French Academy of Sciences, ERC grants, EMBO membership and many others).

In terms of resources, UPR9022 proves to be very successful in raising competitive grants from national and international sources. Indeed, UPR9022 holds 2 ERC grants, 5 EU grants, 12 ANR, 2 FRM teams, etc... UPR9022 participates to 3 LABEX and was awarded a specific EQUIPEX to build a new key facility, a P3 level insectarium that will be crucial for future studies using *Anopheles gambiae*/*Plasmodium falciparum*, chikungunya, dengue and West Nile fever viruses.

### Strengths and opportunities:

The unit has a clear vision of the field, has proven to be able to anticipate the important questions and build the resources to address them in a very competitive manner, to develop collaborations and contacts with key laboratories, expand its technological toolkit and facilities, take risk and promote the work worldwide. The personnel at all levels is of the very best quality showing the high attractivity of the groups and the unit as a whole.

The development of a new P3 level insectarium was made possible by the Plan Campus from University of Strasbourg as well as by a successful application to the 'big loan' call through an EQUIPEX project coordinated by Mr J.-L. IMLER. Clearly, the building of this unique facility will provide UPR9022 with a new important tool that will further reinforce its competitiveness in the field of malaria and insect virology. Furthermore, this project will bring new laboratory space that will allow new teams to be recruited on microbiology and virology, therefore increasing the critical mass on these very promising and important projects.

### Weaknesses and risks:

No intrinsic weakness could be identified. One external risk could come from unexpected delays and complications in setting up the new P3 insectarium.

As for any successful research structure, the challenge is to maintain and ideally increase its leadership over the next years. It is clear that the many recent Prizes (Nobel, Shaw, Gold Medal) and awards (ERC, Labex, Equipex, etc..) will contribute to maintain UPR9022 to the top as well as provide new promising directions to explore. The committee is very confident in the ability of the unit to perform at the highest level during the next term.





### Recommendations:

In order to maintain UPR9022 competitiveness and attractivity, it appeared to the committee that the funding institutions still have room for further support, both at the level of human resources (common services and scientific personnel) and infrastructure.

The fact that INSERM is willing to continue supporting team 2 is perceived as a good asset for the unit. The situation should clearly be accompanied by a significant increase of support.

The committee strongly recommends that the unit organizes the recruitment of new external teams, with the new space being generated through the building of the insectarium. Given the new developments and interests of the unit, recruiting new groups working on virology and microbiology is seen as a very positive move.



### 3 • Detailed assessments

#### Assessment of scientific quality and production:

The scientific production and quality of UPR9022 are outstanding. The scientific impact of UPR9022 can be illustrated through objective criteria including the quality of publications (since 2007 : Science, Cell, Nature Immunology, Nature Genetics, Molecular Cell, PLoS Biology, PLoS Pathogens, PNAS, Cell Host Microbe), numerous invitations to international meetings (217 in total, with many keynote lectures), invitations to write comprehensive reviews in leading journals (Nature Review Immunology, Immunity, Current Opinion in Immunology, Current Opinion in Microbiology, Trends in Parasitology, EMBO Journal) and the most prestigious prizes, awards and distinctions (Nobel Prize in Medicine and Physiology 2011, Shaw Prize 2011, CNRS Gold Medal 2011; Prizes from the French Academy of Sciences, ERC grants, EMBO membership and many others).

#### Assessment of the unit's integration into its environment:

In terms of resources, UPR9022 proves to be very successful in raising competitive grants from national and international sources. To cite a few, UPR9022 holds 2 ERC grants, 5 EU grants, one ATIP/AVENIR team, 12 ANR, 2 FRM teams, etc... UPR9022 participates to 3 labex and was awarded a specific Equipex to build a new key facility, a P3 insectarium that will be crucial for future studies using *Anopheles gambiae*/*Plasmodium falciparum*, chikungunya, dengue and West Nile fever viruses.

#### Assessment of the research unit's reputation and drawing power:

The visibility and reputation of the individual groups and unit is of the highest international level. During the past period, the groups have been awarded the most prestigious scientific prizes and distinctions, including the Nobel Prize 2011, the CNRS Gold Medal 2011, the Shaw Prize 2011, the Canada Gairdner International Award 2011, the Keio Medical Science Prize 2010, the Lewis S. Rosenstiel Award 2010, the Balzan Prize 2007 to one of the senior PIs and the Grand Prix Charles Léopold Mayer from The French Academy of Sciences 2011, the Grand Prix Thématique Foulon from The French Academy of Sciences 2011, the Prix Tartois 2008 and the Prix Cino Del Duca from The French Academy of Sciences 2009 to three other key scientists of the unit.

One scientist of the unit served as President of the French Academy of Sciences (2007, 2008) and was elected to the Russian Academy of Sciences (2006), the National Academy of Sciences of the United States (2008) and is a member of the German National Academy of Sciences.

Three other scientists were elected members of the EMBO.

Overall, group leaders have been invited to numerous international events (217 in total) to present their work, demonstrating the very high visibility of the unit as a whole. Many invitations involved keynote lectures.

The quality and reputation of the unit helps attract very high quality students and post-docs, of which most are from abroad. For example, of 14 post-docs present at UPR9022, 4 are French citizens while 10 are from 9 different countries.

As a consequence of its visibility and attractiveness, the unit has developed a number of fruitful collaborations with laboratories all over the world, as illustrated by several collaborative publications and participation to EU grants.

#### Assessment of the unit's governance and life:

The unit governance and life are excellent. Discussions are very frequent and there is a consensual management for important questions regarding the unit strategy and scientific directions. The council of group leaders ('capitulum') is well adapted to the size of the unit and provides all senior scientists with a direct participation to the unit life and management. It also provides the unit with an optimal participation of its members.

Discussion of the committee with the unit personnel showed a very positive and strong commitment of all laboratory members to the life and success of the unit. The committee could feel a very dynamic community animated with a shared and positive spirit.

The unit as a whole has a strong impact on education at the University of Strasbourg (see below) and on the structuring of regional research, through its international reputation and attractiveness leading to the emergence of new projects stimulating scientific activity, grant raising and promotion of new technological developments (for example, the insectarium).



### Assessment of the strategy and 5-year project:

The UPR9022 has built its success and reputation on its ability to define an ambitious scientific project with clear objectives and accompanying development of the necessary infrastructure and collaborations. For the next term, the unit has clearly defined its scientific objectives and organized the work force in consequence. The research is very ambitious and teams take risk in exploring new avenues, developing new technology and raising the necessary funds for performing the research at the highest international level.

The main general questions that the unit wants to address are all well thought and clearly orchestrated.

### Assessment of the unit's involvement in training:

The unit is strongly involved in training at many levels. Two professors and three assistant professors are involved in training and administration and strongly contribute to teaching molecular biology, pathogenesis and cell biology at the L and Master levels. One of the unit scientists is member of IUF and head of the Master program 'Biochemistry and Molecular Biology: developmental biology and pathogenesis models'. Another one, who was also a member of IUF, is deeply involved in several teaching and organizational duties at University of Strasbourg and currently responsible of 6 teaching units.

Apart from these teaching-related duties, members of the laboratory hold other local and national administrative duties (CNU sections, Scientific Council of University, participation to AERES committees, CSS INRA, ARC commission, IRD, Doctoral School, ACMO, etc..).

The unit has trained a large number of PhD students and post-docs and currently hosts 15 PhD students and 14 post-docs from all over the world.



## 4 • Team-by-team analysis

**Team 1:** Immune response and development of insects

**Team leader:** Mr Jean-Marc REICHHART

**Workforce**

Workforce	Number on 06/30/2011*	Number on 01/01/2013*	2013-2017 Number of producers**
<b>N1:</b> Professors or assistant professors	5	5	5
<b>N2:</b> EPST or EPIC researchers	3	3	3
<b>N3:</b> Other professors and researchers			
<b>N4:</b> Engineers, technicians and administrative staff *on a permanent position	7.5	6.5	
<b>N5:</b> Engineers, technicians and administrative staff * on a non-permanent position			
<b>N6:</b> Postdoctoral students having spent at least 12 months in the unit	5		
<b>N7:</b> Doctoral students	5		
<b>N8:</b> PhD defended	7		
<b>N9:</b> Number of Habilitations to Direct Research (HDR) defended	0		
<b>N10:</b> People habilitated to direct research or similar	5	6	
<b>TOTAL N1 to N7</b>	<b>25.5</b>	<b>14.5</b>	<b>8</b>

\* If different, indicate corresponding FTEs in brackets.

\*\* Number of producers in the 2008-2011 period who will be present in 2013-2017.

Definition and downloading of criteria:

<http://www.aeres-evaluation.fr/Evaluation/Evaluation-des-unites-de-recherche/Principes-d-evaluation>.



## • Detailed assessments

Due to a highly integrative work organization and the will to develop projects in a very collaborative manner over the next years, four groups headed by different PIs present this common team project. The main general questions that will be addressed in the future are host-pathogen interactions and insect inflammation.

During the past period, the four groups have studied a range of problems and developed original new models of investigation which all represent a significant advance in the field.

### Assessment of scientific quality and production:

A first group aimed at deciphering the immune mechanisms in *Drosophila* by using genetics and biochemical approaches. The project also includes functional analysis of human homologs in innate immunity. Two major sets of results have been published in two Nature Immunology papers and demonstrates (1) a binary signalling pathways acting upstream of Toll and (2) the role of Akirin in NF- $\kappa$ B dependent gene expression in the nucleus. A third project focuses on the study of a novel protein, Big bang, in intestinal integrity and finally, additional contributions to the field have been performed via external collaborations: they concern various aspects of insect defense, including ubiquitin dependent mechanism of signal regulation, serpins biochemical activity and a recent crystallographic study on grass, a Toll activating upstream protease.

A second group has made seminal contributions to the field of antiviral host defense. The group established i) that RNA interference plays a key role in resistance to a large set of viruses, ii) that dsRNA is part of a molecular process that triggers an inducible response in *Drosophila* and iii) that the induced viral immune response is complex and involves specific mechanisms depending both on the virus and the tissue, iv) that the potassium KATP channels play a key role in the control of viral infections in both flies and mice. This project led in the last five years to 6 original papers published in general and specialized journals with high impact factors (Nature Immunology, 2 PNAS where the PI signed as the last author). In addition, many reviews, comments and book chapters have also been published.

The third group is interested in the detection of microbial infection and host-pathogen interactions. The group studied i) the functional role of PRR of the GGBP family, ii) explored several models of septic or natural infection/colonization using medically important yeast (*C. albicans*, *C. glabrata*), iii) performed a genome-wide RNAi screen to study the role of ISCs in intestinal infection model, iv) showed the role of type 2 secretion and quorum sensing in the pathogenicity of *P. aeruginosa* and v) established a very interesting model of intracellular parasitism using the natural drosophila pathogen *T. Ratisbonensis*, a microsporidium.

This work led to an excellent publication record with articles published in Science, Cell, PLoS Pathogens, EMBO J, PNAS, EMBO Reports as well as several reviews published in Nature Reviews Immunology, Immunity and Cell Host Microbe.

The last group addresses the activation and role of the IMD pathway in either infected or non infected flies, notably in response to 'endogenous danger' signals to be yet discovered. To this goal, the group has carried out an extensive proteomics assay *in vitro* identifying the IMD pathway interactome in various conditions. The activity of several interesting new candidates was analyzed in a cell assay and their functional analysis will be pursued in flies. Unpublished results from the group showed that protein modification provides a novel regulatory mechanism in the IMD pathway. These results will without doubt lead to many fruitful projects in the near future. They were published in several important original papers in the leading peer-reviewed scientific journals including *Nature Immunology*, *PLoS Pathogen*, *PNAS*, *Cell Host and Microbe*, and many others. In addition, the PI has been the main author in many important review articles that have been published in the very best scientific journals including *Nature Immunology*, *Annual reviews in Immunology*, *Nature Reviews in Immunology*. He has also been invited to present the work in an impressive number of international events, often as a keynote speaker.

### Assessment of the research team's integration into its environment:

The integration into the research environment is excellent both at the level of the University through active participation to teaching and administrative duties, and at the level of the Institute and Unit through sharing of lab space, equipment, technologies and regular joint meetings. This is illustrated by a large number of collaboration papers.

The ability of the team to obtain external funding is excellent. The team currently holds grants from ERC, NIH, FRM, ANR, EU, LABEX, EQUIPEX and Plan Campus.



### Assessment of the research team's reputation and drawing power:

During the past period, the group leaders have been awarded the most prestigious scientific prizes and distinctions, including the Nobel Prize 2011, the CNRS Gold Medal 2011, the Shaw Prize 2011, the Canada Gairdner International Award 2011, the Keio Medical Science Prize 2010, the Lewis S. Rosenstiel Award 2010, the Balzan Prize 2007, the Grand Prix Charles Léopold Mayer from The French Academy of Sciences 2011, and the Prix Tartois 2008 and the Prix Cino Del Duca.

### Assessment of the strategy and 5-year project:

The team proposes to develop well thought and ambitious projects.

The project proposed by Mr REICHART and coworkers will decipher (1) the serine protease cascades function in Toll signalling pathway and (2) the molecular mechanisms of IMD target genes regulation, notably at the transcriptional level via the analysis of Akirin partners function. Akirin partners were previously identified via ambitious and extensive proteomics approaches coupled with a systematic siRNA functional analysis of candidates in *Drosophila* S2 culture cells system. In addition, a novel more risky strategy has begun with the search for chemical molecules binding to human Akirin and putatively disturbing its function. These chemicals may be developed as anti-inflammatory drugs in the future or as chemical tools for research purpose; this part of the project has therefore a potential socioeconomic impact. Finally, an ambitious high throughput sequencing project, based on preliminary data, is planned to identify small regulatory RNAs involved in *Drosophila* innate immune response and will be coupled with functional screen of known miRNA using an original strategy (miRNA "sponge"). This project may also benefit from and to the antiviral immunity project.

This antiviral immunity project is very ambitious, but given the successful track record and international reputation of the project leader, the committee can be optimistic that he will continue contributing major advances to the field. This is particularly relevant, since it opens the possibility of extending parallels between *Drosophila* and humans on the antiviral response. In the next five years the group will concentrate their efforts on i) deciphering the molecular and cellular processes involved in the recognition of viral RNAs in infected cells and the cell biology of the antiviral siRNA pathway, ii) defining the role of IMD and Toll pathways in antiviral resistance, iii) identifying the effectors of the viral resistance.

The third project is very promising and there is no doubt based on previous achievements that this work will lead to major contributions to the field. The team will further investigate host-pathogen interaction using *P. aeruginosa* as a model of intestinal infection to address the question of digestive tract crossing by bacteria and the regulation of virulence. In collaboration with Harvard Medical School, the group will use a unique transposon insertion library to identify virulence factors. Furthermore, it will decipher the mechanisms of defense against intracellular microsporidia using a very promising model which they have recently developed. Finally, the group will address the emerging question of endurance of the host following infection using their intestinal infection model.

The last project is very interesting potentially leading to major advances in the field of autoimmunity. More specifically, the team will investigate how DNA is sensed in *Drosophila* and how this leads to activation of the immune response. In addition, the group has carried out an extensive proteomics assays *in vitro* identifying the IMD pathway interactome, providing a wealth of interesting candidates and new potential regulatory pathways. These results will without doubt lead to many fruitful projects in the near future.



### Conclusion:

- *Overall opinion on the team:*

The team is composed of a number of successful scientists working in a very collaborative way. This is a very active and dynamic team with an excellent past scientific activity and very promising projects focusing on host-pathogen interactions using the power of *Drosophila* genetics, proteomics and genomics. The team has provided the scientific community with an excellent set of results and benefits from a large international recognition. The team had an outstanding success in getting grants providing the unit with enough funds and work force to perform the proposed ambitious and large scale projects (proteomics, chemical screening, siRNA screens, RNA seq, etc..). Overall, outcomes of the projects are expected to lead to major contributions to the field.

- *Strengths and opportunities:*

The PIs have demonstrated their capacity to produce high impact data in a very competitive field. They have established key collaborations, raised important funds, recruited high quality collaborators and developed new models and facilities (insectarium) to address ambitious projects.

- *Weaknesses and risks:*

None identified.

- *Recommendations:*

There are no particular recommendations to be made, except to continue the excellent work. The Nobel Laureate of this research unit is a great ambassador of French Science with the highest international recognition who the committee encourages to continue promoting science locally, in France and also globally.



**Team 2:**

Anti-parasite defense in *Anopheles*

Team leader:

Ms Stéphanie BLANDIN

Workforce

Workforce	Number on 06/30/2011*	Number on 01/01/2013*	2013-2017 Number of producers**
<b>N1:</b> Professors or assistant professors	0	0	0
<b>N2:</b> EPST or EPIC researchers	3	3	3
<b>N3:</b> Other professors and researchers			
<b>N4:</b> Engineers, technicians and administrative staff * on a permanent position	3.5	3.5	
<b>N5:</b> Engineers, technicians and administrative staff * on a non-permanent position	2.5		
<b>N6:</b> Postdoctoral students having spent at least 12 months in the unit	6		
<b>N7:</b> Doctoral students	8		
<b>N8:</b> PhD defended	6		
<b>N9:</b> Number of Habilitations to Direct Research (HDR) defended	1		
<b>N10:</b> People habilitated to direct research or similar	2	2	
<b>TOTAL N1 to N7</b>	<b>23</b>	<b>6.5</b>	<b>3</b>

\* If different, indicate corresponding FTEs in brackets.

\*\* Number of producers in the 2008-2011 period who will be present in 2013-2017.

Definition and downloading of criteria:

<http://www.aeres-evaluation.fr/Evaluation/Evaluation-des-unites-de-recherche/Principes-d-evaluation>.





## • Detailed assessments

### Assessment of scientific quality and production:

The research team is focused on the genetic analysis of innate immune pathways in Anopheline mosquitoes and their impact on resistance to Plasmodium infection. Over the past four years, this team has continued and expanded its highly original line of research and made seminal contributions to the understanding of the cellular and molecular mechanisms underlying mosquito vectorial capacity. Utilizing RNAi approaches and other cutting edge tools some of which were developed in the laboratory, high impact results have been obtained, including identification and functional characterization of a complement-like pathway with anti-parasitic activity, the identification of the JNK pathway in mosquito resistance to Plasmodium, and a link between reproduction and immunity among others. The team continues to be a major leader in this field of research both at national and international levels, which is well documented by invited presentations to over 40 meetings, publication of two technical reports, 5 review articles and 3 high impact papers in Cell Host Microbe, Science, and PLoS Biology signed as last and/or first author.

### Assessment of the research team's integration into its environment:

The integration into the research environment is excellent both at the level of the Institute as well as of the CNRS Unit as lab space, equipment, technologies are shared and regular joint meetings are held. The research program of the team is highly complementary to the work of the other teams that are focused on Drosophila immunity. It is somewhat surprising that there are no collaboration papers with the other team despite this complementarity and the very integrative structure of the Unit. The potential for innovation is very good based on the high impact of the scientific questions asked and the development of new genetic approaches for the genetic analysis of their system. The quality of contractual relations is outstanding as documented by the success of the team in obtaining external funding, including various EU grants (as coordinator or participant).

### Assessment of the research team's reputation and drawing power:

The research team continues to be a major player on the international scene and certainly is one of the leading teams worldwide on mosquito genetics. Members of the team were invited to over 40 conferences, and the excellence of their research were recognized by an ERC grant to Ms BLANDIN and a price of the academy of sciences to the former team leader. Numerous international collaborations are sponsored by EU programs (Biomalpar, MalVecBlok, Evimalar, Infravec) and the NIH.

### Assessment of the strategy and 5-year project:

The project continues and expands the established lines of research on the genetic analysis of innate mosquito immunity using Plasmodium infection as a read out. The future focus of the research program on mosquito-parasite interaction using highly relevant P. falciparum infection will further increase the impact of the team. A major driving force for the originality and impact of the proposed project relies in the genetic approaches that are currently under development. Importantly, the basic research work has a high potential for applied research and patent applications, especially with the development of plasmodium resistant strains of mosquitoes that could be spread out over endemic areas.

### Conclusion:

In conclusion, the team continues its outstanding scientific research and major strengths lie (i) in the impact and general interest of the scientific questions addressed; (ii) the international visibility and competitiveness; and (iii) the outstanding scientific environment. The recent move of the former team leader to Germany and the nomination of a new team leader bears only a limited risk as the latter one is already a leader in the field and has recently been awarded an ERC grant, while another researcher in the team has been awarded an ANR grant. The move could provide a very good opportunity to establish a fruitful new link between the CNRS and the Max Planck Society. One major risk that would largely limit the impact and feasibility of the proposed research lies in unexpected complications and delays regarding the availability of the new P3 level insectarium required for P. falciparum infection. Thus the major recommendation is to secure this important construction project and ensure its full funding.



## 5 • Grading

Once the visits for the 2011-2012 evaluation campaign had been completed, the chairpersons of the expert committees, who met per disciplinary group, proceeded to attribute a score to the research units in their group (and, when necessary, for these units' in-house teams).

This score (A+, A, B, C) concerned each of the four criteria defined by the AERES and was given along with an overall assessment.

With respect to this score, the research unit concerned by this report (and, when necessary, its in-house teams) received the overall assessment and the following grades:

Overall assessment of the unit "Immune response and development of insects" (RIDJ : Réponse Immunitaire et Développement chez les Insectes) :

Excellente unité à tous points de vue.

Grading table:

<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>
Scientific quality and production.	Reputation and drawing power, integration into the environment.	Laboratory life and governance.	Strategy and scientific project.
A+	A+	A+	A+

Overall assessment of the team 1 "Immune response and development of insects" (REICHHART-REICHHART):

Excellente équipe à tous points de vue.

Grading table:

<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>
Scientific quality and production.	Reputation and drawing power, integration into the environment.	Laboratory life and governance.	Strategy and scientific project.
A+	A+	-	A+

Overall assessment of the team 2 "Anti-parasite defense in *Anopheles*" (REICHHART-BIANDIN):

Excellente équipe à tous points de vue.

Grading table:

<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>
Scientific quality and production.	Reputation and drawing power, integration into the environment.	Laboratory life and governance.	Strategy and scientific project.
A+	A+	-	A+



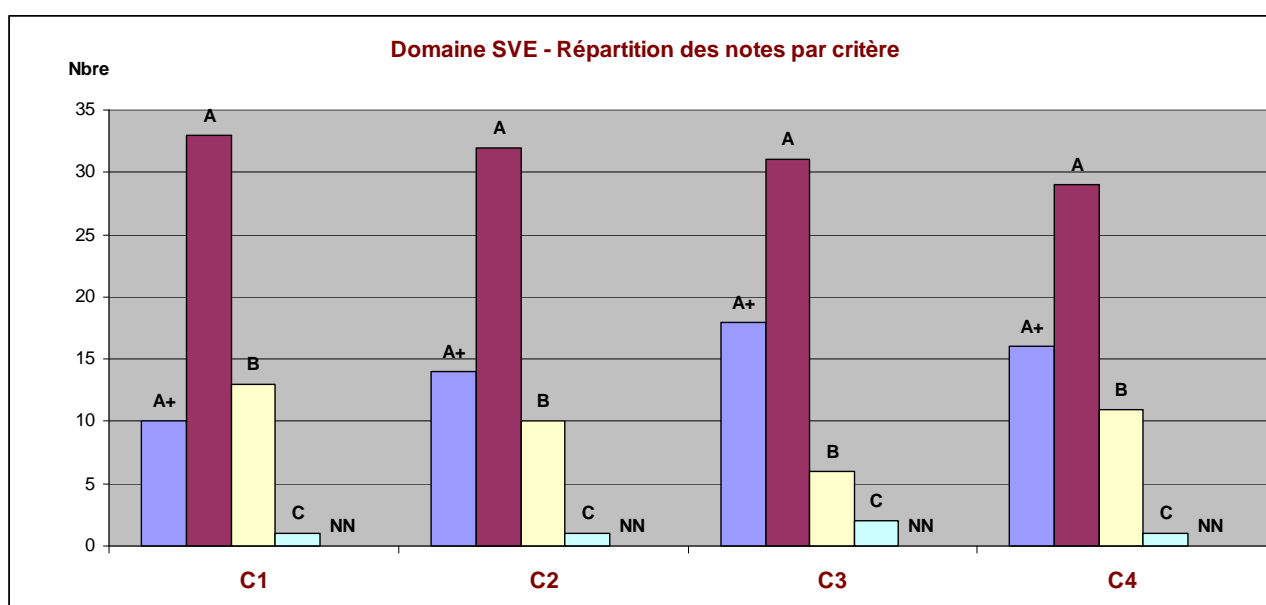
## 6 • Statistics per field

### Notes

Critères	C1	C2	C3	C4
	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Gouvernance et vie du laboratoire	Stratégie et projet scientifique
A+	10	14	18	16
A	33	32	31	29
B	13	10	6	11
C	1	1	2	1
Non noté	-	-	-	-

### Pourcentages

Critères	C1	C2	C3	C4
	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Gouvernance et vie du laboratoire	Stratégie et projet scientifique
A+	18%	25%	32%	28%
A	58%	56%	54%	51%
B	23%	18%	11%	19%
C	2%	2%	4%	2%
Non noté	-	-	-	-





## 7 • Supervising bodies' general comments

Monsieur Pierre GLORIEUX  
Directeur de la Section des Unités de recherche  
Agence d'évaluation de la recherche et de  
l'enseignement supérieur (AERES)  
20 rue Vivienne  
75002 PARIS

**Alain BERETZ**  
Président

Strasbourg, le 29 mars 2012

Objet : Rapport d'évaluation de l'UPR 9022 Réponse immunitaire et développement chez les insectes (réf. S2PUR130004538-RT)  
Réf. : AB/EW/N° 2012-156

Affaire suivie par  
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Cher collègue,

Je vous remercie pour l'évaluation de l'unité propre de recherche CNRS « Réponse immunitaire et développement chez les insectes » (RID1 – UPR 9022) dirigée par Monsieur Jean-Marc Reichhart.

Direction de la recherche

Le directeur de l'unité de recherche et moi-même n'avons pas de remarques particulières à formuler sur le rapport d'évaluation rédigé par le comité d'experts.

Je vous prie d'agréer, Cher Collègue, l'expression de mes sentiments distingués.



Alain BERETZ

**P.J. :**

- Une première partie corrigeant les erreurs factuelles
- Une seconde partie sans observations