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## Neurophysiologie et nouvelles microscopies

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

Section des Unités de recherche

# Evaluation report

Research unit

Laboratory of Neurophysiology and  
New Microscopies

University Paris 5



March 2009



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et de l'enseignement supérieur

Section des Unités de recherche

# Evaluation report

Research unit

Laboratory of Neurophysiology and New Microscopies

University Paris 5



Le Président  
de l'AERES

Jean-François Dhainaut

Section des unités  
de recherche

Le Directeur

Pierre Glorieux

March 2009



# Evaluation report )

## The research unit :

Name of the research unit : Laboratory of Neurophysiology and New Microscopies

Requested label : UMR\_S INSERM, UMR CNRS

N° in case of renewal : U603 - UMR 8154

Head of the research unit : M. Serge CHARPAK

## University or school :

University Paris 5

## Other institutions and research organization:

CNRS

INSERM

## Date of the visit :

February 9, 2009



# Members of the visiting committee

## Chairman of the committee :

M. Arthur KONNERTH, Technical University Munich (TUM) Institute of Neuroscience, Germany

## Other committee members :

M. Christoph SEGEBARTH, Institut des Neurosciences, Grenoble, France

M. Joachim DEITMER, University of Kaiserslautern, Germany

M. Remy SCHLICHTER, Université de Strasbourg, France

M. Michel ROUX, IGBMC, Université de Strasbourg, France

M. Alan HAWKES, Swansea University, UK

## CNU, CoNRS, CSS INSERM, INRA, INRIA, IRD representatives :

M. Joel DE LEIRIS, CNU representative

M. Pierre GILLIOT, CoNRS representative

M. Olivier BERTRAND, CSS INSERM representative

# Observers

## AERES scientific representative:

M. Pierre-Hervé LUPPI

## University or school representative:

M. Arnaud DUCRUIX, University Paris 5

M. Daniel JORE, University Paris 5

## Research organization representatives :

Ms Pascale ROUBIN, CNRS

Ms Christine TUFFEREAU, INSERM



# Evaluation report



## 1 • Short presentation of the research unit

- Total number of lab members : 33 including
  - 1 researchers with teaching duties
  - 9 full time researchers
  - 10 postdoctoral fellows
  - 7 PhD students, all with a fellowship
  - 6 engineers, technicians and administrative assistants
- Number of HDR : 3, all of them being PhD students advisors
- Number of students who have obtained their PhD during the past 4 years : 7
- Number of lab members with a PEDR : 0
- Number of “publishing” lab members : 10 out of 10

## 2 • Preparation and execution of the visit

In general, the visit was well organized. The committee appreciates the effectiveness of the local organization of the visit. All activities (scientific presentations, lab visits, interactions with lab members) went smoothly and according to the schedule. An even better organization may be achieved if the AERES would compile a summary checklist of all the procedures. This may be particularly helpful for the visiting scientists coming from foreign countries.

## 3 • Overall appreciation of the activity of the research unit, of its links with local, national and international partners

The research unit is highly active, with a great national and international reputation. It is one of the top institutions for neurophysiological research in France and it is becoming one of the very important institutions for the development and implementation of research tools of optical imaging. The members represent an excellent mix of mostly young researchers originating from various European countries. The unit has made major progresses in various areas, ranging from high resolution microscopy in vitro to in vivo two-photon imaging. The projects that are planned for the coming years are highly innovative and very promising.



#### 4 • Specific appreciation team by team and/or project by project

##### Team 1, Imagerie et physiologie neurovasculaire du bulbe olfactif :

This team studies processes of odour perception and discrimination on a cellular level in the rodent olfactory bulb, using optical, molecular, electrochemical and electrophysiological methods. In the past 4 years, the team has focussed on neurovascular coupling, and on the control of mitral cell synchronisation. The team is at the technical forefront of imaging using multiphoton microscopy, and has advanced this technology according to their neurophysiological applications. Their scientific output has been excellent, in particular in the last 2-3 years. The team is one of the most visible in the field of olfactory information processing on the cellular level, and it has made major contributions in the field. Their cooperation with other units on site, as well as with other groups on the national and international scale, has provided an efficient network for collaborations. Both management and strategy of the team are outstanding, and the recruitment of postdocs is excellent; there are several promising young scientist in this group, and those who have already developed in this group successfully. The contribution to course programmes for Master students and graduate students could still be improved, however. Nevertheless, the team provides a very stimulating and high-quality scientific environment for young researchers. The presence of this team in the unit is central and the most inseminating, providing stimulants both technologically as well as scientifically to projects of the other teams.

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

##### Team 2, Diversité cellulaire et interactions neurone-glie dans le cortex :

Team 2 has shifted its scientific focus in recent years to glial functions in health and disease and to neuron-glia interactions, using electrophysiological techniques, immunocytochemistry, pharmacology and transgenic mouse models. In particular, the team has studied the release of gliotransmitters and their impact on neuronal activity, the physiology of microglial cell activation during epileptic neuronal activity, and neurotransmitter receptors on NG2 cells, a type of brain cell yet to be classified being either glial or glia-neuron precursor cell. The team has made first very good entries with several publications in these fields, with some potential to improve in the future. There is a new, exciting strategy evolving from this group, which needs to be focussed and energized further in the future. The collaboration on site, nationally and internationally is successful, as well as the recruitment of postdocs and young researchers, one of which is ready to form her own team soon. The contribution to the Masters and graduate programmes could still be improved. The placement of this team in the unit and in relation to the teams of the other neurophysiology unit on the same floor is strategically valuable and bears great potential to further develop collaborations. The team promises to make even more significant contributions in the coming years in the field of glial (patho-) physiology.

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|------------------|------------------------------------|---|--|------------------------|
| A                | A                                  | B   | B  | A                      |



**Team 3, Biophysique cellulaire et moléculaire de la transmission synaptique :**

This team has a strong focus in high resolution microscopy and in synaptic neurophysiology. In recent years they developed and improved new methods of TIRF imaging that markedly enlarge the size of the field that can be imaged at once. This represents an impressive breakthrough in this field. Further, the team engineered FRET-based biosensor for the detection of calcium signals in microdomains near the membrane. These technologies were successfully implemented for the analysis of exocytosis of neurotransmitters from glia cells. An important outcome from the visualization and analysis of single vesicles in astrocytes, is a new model of glial exocytosis showing a calcium-dependent release of lysosomes. Another project of the team was the exploration of the role of serotonin in thalamo-cortical development. In the coming years the team will focus with more emphasis on the astroglial calcium-dependent lysosomal exocytosis, which is a highly original and important line of research. The analysis of thalamo-cortical serotonin actions will not be pursued. Another important focus will be the further improvement of the approaches of superresolution microscopy. The preliminary set-up for two-photon imaging has an excellent design and the initial imaging results are very promising. With the TIRF methodology the team aims at achieving isotropic 100 nm resolution on near-membrane fluorescence imaging. Conceptually, the main efforts will be devoted towards a better understanding of the mechanisms of TRPV4-dependent calcium signalling in mechanotransduction.

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|------------------|------------------------------------|---|--|------------------------|
| A                | A+                                 | A   | A  | A                      |

**Team 4, Microscopie par modulation du front d'ondes :**

This highly innovative team joined the unit in 2005 and has a research program that is focused on the development of optical methods to be used in neurosciences. Three major areas of interest are being pursued, namely (i) neuronal activity control by holographically controlled photoactivation, (ii) superresolution scanningless microscopy, and (iii) microendoscopy. A major and worldwide noted development has been achieved recently in the field of the holographically controlled photoactivation. The approach has many powerful applications, including activation of neurons in a spatio-temporally controlled fashion, for example by using caged compounds or photoexcitable channels, like channel-rhodopsins. One of the major projects for coming years is the building of STED microscope. The team has convincing preliminary work on this topic and the probability of success is very high. Overall, this is an excellent team with a very good scientific productivity. Besides being involved in own projects of a very high quality, a hallmark of the team's activities is their intensive collaboration with the other teams in the unit.

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| A+               | A+                                 | A   | A+   | A+                     |





## 5 • Appreciation of resources and of the life of the research unit

Up to now, the unit has suffered from the fact that its administrative and technical support is numerically insufficient at a time when its scientific output has consistently increased both quantitatively and qualitatively. This worrying situation has several causes : i- too few permanent positions for technicians and engineers as well as for administrative staff; ii- the use of contract staff, who are unfortunately often forced to leave the unit when the opportunity of a permanent position arises to them somewhere else; iii- no temporary replacement of staff on sick leave.

Despite these difficulties, all staff members presently employed within the unit are content with the scientific environment of their work and the trust consistently shown in them by those in charge and the researchers from the various teams of the unit. They are happy that they are asked to contribute to the design of the research projects, included as co-authors on publications and offered various training opportunities. As a general rule, these members of staff strongly believe that the institute to which the unit is linked (University Paris 5) needs to be involved in the future development of the unit; they overwhelmingly support this development. Finally, the staff has concerns about the housing of the animals.

### Meeting with PhD students and post-docs

The laboratory is currently training 5 PhD and 9 postdoctoral students. This population of young researchers represents an important element in the research task force of the laboratory which has 10 researchers with permanent positions (CNRS, INSERM, University). The PhD and postdoctoral students originate from France as well as from foreign countries and have very good professional and social interactions. They underlined an overall excellent organization of the laboratory at the scientific level, but also indicated dysfunctions in some aspects of administrative management and running of animal facilities. The problem concerning the administrative management is linked to the absence (due to prolonged illness (>2 years)) of a person specifically in charge of the administration tasks (ordering of products, payment of invoices, reimbursement of congress expenses, etc...). There are also clear problems with the animal facilities, since, due to the lack of competent personnel, the students and the researchers have often to run this facility on their own (wash cages, dispatch food, etc...). Besides these problems, the students appreciate their training. They are encouraged to attend at least one international meeting a year in order to present their work. They indicate a high degree of freedom and autonomy in the way they run their research projects. They interact freely and frequently with their supervisors and attend weekly progress reports and journal clubs. The publication policy of the laboratory is clear : the student or post-doc signs the papers concerning his main work as the first author.

### Meeting with research council and university representatives

The meeting with the representatives from the research councils (INSERM, CNRS) and the University (University Paris 5) was held at the end of the laboratory examination session. The laboratory has a strong support from all authorities. It is an exemplary laboratory that succeeded in promoting an interdisciplinary and highly competitive research activity resulting from the interaction of excellent neuroscientists and physicists. The scientific work and technical developments within the laboratory are highly competitive on national and international levels. During the meeting with the research council and university representatives, the members of the visiting committee emphasized that there were serious problems with the running and the organization of the animal facilities and that an optimal functioning of such facilities is crucial for a research group carrying out a substantial fraction of its research activity on in vivo preparations. It was also indicated that the laboratory should benefit from an efficient administrative support (presence of a full time administrative person). This point could be solved by INSERM (possibly by CNRS). On the other hand, the university authorities should try to solve the problem concerning the animal facilities, especially those located within the laboratory which are of absolute importance and priority for carrying out in vivo experimentation. They agreed to find a solution.



## 6 • Recommendations and advice

- Strong points :
  - top quality of the research
  - high international visibility
  - excellent performance in training young scientists
  - highly successful acquisition of research funding
  - high degree of innovation
  
- Weak points :
  - the animal housing situation needs to be urgently improved
  - there is a serious need for additional administrative support
  - there is also need for additional technical support
  
- Recommendations :
  - improve the infrastructure (animal housing, administration, technicians)
  - improve the interactions with the other research units at the University

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

*Le Président*  
Axel KAHN

Paris, le 7 avril 2009

DRED 09/n° 147

**Monsieur Pierre GLORIEUX**  
Directeur de la section des unités de l'AERES  
20 rue Vivienne  
75002 PARIS

Monsieur le Directeur,

Je vous remercie pour l'envoi du rapport du comité de visite concernant l'unité « UMR-S 603/UMR 8154 Neurophysiologie et nouvelles microscopies » rattachée à mon établissement.

L'Université est consciente des besoins du Centre Universitaires des Saints-Pères en animalerie, et est déterminée à lui apporter une solution dans l'intérêt de l'IFR des neurosciences des Saints-Pères, dont est membre cette formation (département de neurologie moléculaire et cellulaire).

Je vous prie de croire, Monsieur le Directeur, à l'expression de ma meilleure considération.

Le Président de l'Université

  
Axel Kahn

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April 7<sup>th</sup>, 2009

AERES evaluation [EVAL-0751721N-S2100015233-UR-RPRELIM\\_charpak.doc](#) :

The "Laboratory of neurophysiology and new microscopies" makes no comment on the AERES evaluation.

