



## Laboratoire de neuro-physique cellulaire

### Rapport Hcéres

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

Section des Unités de recherche

Evaluation report

Research unit

Laboratoire de Neuro-Physique Cellulaire

University Paris 5



March 2009



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

Section des Unités de recherche

# Evaluation report

Research unit

Laboratoire de Neuro-Physique Cellulaire

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 : Laboratoire de Neuro-Physique Cellulaire

Requested label : EA

N° in case of renewal : EA 3817

Head of the research unit : M. Benoit FORGET

## University or school :

University Paris 5

## Date of the visit :

9<sup>th</sup> February, 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. Olivier BERTRAND, INSERM, Bron, 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

# Observers

## AERES scientific representative:

M. Pierre-Hervé LUPPI

## University or school representative:

M. Arnaud DUCRUIX, University Paris 5

M. Daniel JORE, University Paris 5



# Evaluation report

## 1 • Short presentation of the research unit

- Total number of lab members: 11 including
  - Researchers with teaching duties : 6
  - PhD student : 1
  - Technicians and administrative staff : 4
- Number of students who have obtained their PhD during the past 4 years : 2
- Number of HDR : 5
- Number of PEDR : 1
- Number of “publishing” lab members : 6 out of 6

## 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.

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

The unit is composed of 2 Full-Professors (the Director and the Director-candidate), 4 Assistant-Professors and a variable number of lecturers on temporary positions without research duties. Over the past four years, one Assistant-Professor (specific expertise in cryobiology) and one Full-Professor (the Director-candidate) joined the team, while 2 Assistant-Professors left. One position of Assistant-Professor is currently open.

The team was created in 2004 following the decision to further strengthen research activity in the field of the Neurosciences at the Centre Universitaire des Saint-Pères (CUSP). It has led the team to reorient its research programs from the study of biological model systems towards the study of living astrocytes and neurons, the focus being put on assessing cellular mechanics by means of atomic force microscopy (AFM) and magnetocytometry and on optical imaging with quantum dots (QD).

It had been anticipated (and very much hoped for) that a team from the Institut Curie would have joined the CUSP during the present four-year term, to merge with the unit. This project having not come to a good end, the laboratory is led to apply for re-creation as an “Equipe d’Accueil” with the resources available.



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

Past activity along the reoriented research themes was centred on assessing dynamics of axonal growth and glial scar, on fluorescence imaging using functionalized quantum dots and on the study of cell adhesion using ultrasonic devices. Also, the effect of glutamate on structural, mechanical and functional properties of astrocytes was tackled using AFM. Due to its principal investigators having left the laboratory, the latter research theme was abandoned.

Among initial, particularly noteworthy, results is the demonstration of the differentiation of PC12 neuronal cells on chemically modified surfaces and in NGF-free medium, the QD-fluorescence imaging results showing co-localization of GABA-A 1 receptors and VLGUT1 glutamate transporters in presynaptic varicosities of the molecular layer in fixed cerebellar slices from young rats (a result that was not observed in adult rats), and the elaboration (in collaboration with LI2C laboratory, Univ Paris 6) of magnetic quantum dots (MQD) and their internalization in primary rat astrocytes using the peptide vector pep-1.

The scientific production over the past four years, while being unrelated to the reoriented research themes, counts near to 40 papers in international peer-reviewed journals of speciality, among which : Cryobiology (3), Biophys J (2), Phys Rev E (2), J Phys Chem B (1), Bioch Biophys Acta (2), Optics Lett (3), Opt Express (2).

Future activity will be developed along three directions.

Along the first ("optical characterization and multiscale imaging"), projects will focus on the development and the applications of new optical imaging techniques, possibly combined with acoustics. Developments will be based mainly on multipixel heterodyne interferometric detection schemes. Privileged fields of application lie in acousto-optics of thick tissue and wide-field assessment of cerebral blood flow changes in mice.

Projects along the second direction ("influence of physical parameters on axonal growth and astrocyte migration") are in line with past activity: Reflective Interference Contrast Microscopy (RICM) and AFM studies are planned on axonal growth and on axonal regeneration and astrocyte migration following lesion as a function of the adhesive and mechanical properties of the substrate. Also the abilities of adhesion and migration of glioblastoma cells will be studied.

The third direction of research ("cryopreservation") has been introduced recently into the team, following arrival in the laboratory of an Assistant-Professor presenting this particular expertise and interest. Projects include using QDs for understanding failures in cryopreservation due to apoptosis or for monitoring cryoprotectant impregnation of biological tissue (as an alternative to the NMR technique), optimizing a cryogenic device dedicated to the study of vitrification of cryoprotective solutions, improving glial cell cryopreservation, setting up a "cryotheque" for long-term preservation of neuropathological tissues.

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

The laboratory has currently 1 PhD and no postdoctoral student. The PhD student is apparently happy with his situation and mentions good relationships with his supervisor. He indicated a high degree of freedom in his research activities. There are apparently also good contacts with all permanent personnel of the laboratory. However, the interactions with other PhD students or permanent researchers of other research groups located at the same floor are limited. Such interactions would, however, be beneficial, in the sense that they could improve the knowledge of the PhD student in the field of Neuroscience.

All permanent members of the laboratory are involved in teaching and have high teaching duties. They represent the major fraction of personnel teaching physics at the level of first and third years of medical studies. The university authorities support the development of research in the field of physics, but clearly indicated that this research must be at the interface of physics and biology, and preferentially at the interface between physics and Neuroscience. The committee suggested to the university authorities that one or two members of the laboratory should be freed from teaching activities for one or two years in order to be able to integrate a Neuroscience laboratory on a full time basis and to acquire a better scientific knowledge in this field. The university representatives seemed to be aware of this point, but could not give a clear favourable answer especially given the high teaching charges and the limited teaching personnel in physics.



## 6 • Recommendations and advice

### Strengths

Strengths of the team lie in the strong physics background of its members (as demonstrated by the publication record over the past four years), and in the strong support from the university.

### Weaknesses

Weaknesses lie in the lack of neurobiological and neurophysiological expertise needed to formulate general directions of research with particular relevance to the neurosciences - under the present conditions, it is understandable that the team has not yet a perfectly clear view onto the general neurobiological direction to be taken. In this context, the overall relevance for the neurosciences of the cryopreservation line of research is not particularly obvious. Further weaknesses lie in the limited number of PhD students (3 PhD students over the 4 year period and currently a single one!), in the lack of any full-time researcher in the team, in the lack of clear assignments of research duties to all members of the team.

### Recommendations

It is recommended that the team identifies more clearly the neurobiological questions to be tackled with the expertise in physics present. Ideally, this might be done in strong interaction with the other neuroscience laboratories of the CUSP so as to ensure optimal site integration. Further recommendations include assigning distinct research responsibilities to all team members and the increase of the number of PhD students.

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



*Le Président*  
Axel KAHN

Paris, le 7 avril 2009

DRED 09/n° 144

**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'équipe d'accueil  
« EA 3817 Laboratoire de neurophysique cellulaire (LNPC) » rattachée à mon établissement.

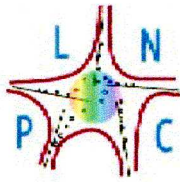
L'Université Paris Descartes a rencontré des difficultés dans le passé pour stabiliser et parfaitement définir un programme de recherche en physique lié aux activités d'enseignement dans la sphère biomédicale et qui interfère de manière optimale avec les équipes du Centre Universitaire des Saints-Pères.

Le recrutement récent (2007) d'un jeune professeur dynamique, la focalisation de ses thématiques, marquent le début d'un succès de l'entreprise. Le recrutement prochain pour cette équipe d'un Maître de conférence permettra de dégager plus de temps pour la recherche, mis à profit, comme demandé, pour accroître les interactions avec les équipes de neurobiologie du site.

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 3<sup>rd</sup>, 2009

**Reply to the report by the AERES on EA3817 : General comments**

We wish to thank the visiting committee for its recommendations and advice.

We are well aware of the somewhat scattered aspect of our research projects, which is for a large part a result of staff movements in the lab over the past few years. Our development will bank on the strengths existing in the lab and aim at a more focussed vision before the end of the next term. Discussions with neurobiology units of the CUSP (especially those of A. Marty and S. Charpak) are as of now underway.

Gérard LOUIS

Benoît C. FORGET