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## Laboratoire de neurophysique et physiologie

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

Neurophysics and Physiology

University Paris 5



February 2009



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et de l'enseignement supérieur

Section des Unités de recherche

# Evaluation report

Research unit

Neurophysics and Physiology

University Paris 5



Le Président  
de l'AERES

Jean-François Dhainaut

Section des unités  
de recherche

Le Directeur

Pierre Glorieux

February 2009



# Evaluation report )

## The research unit :

Name of the research unit : Laboratory of Neurophysics and Physiology

Requested label : UMR CNRS

N° in case of renewal : 8119

Head of the research unit : M. Claude MEUNIER

## University or school :

University Paris 5

## Other institutions and research organization:

CNRS

## Date of the visit :

18th December 2008



# Members of the visiting committee

## Chairman of the committee :

Ms. Eve MARDER, Brandeis University, Waltham, MA, USA

## Other committee members :

M. Jean-René CAZALETS, University Bordeaux 2, France

M. Alain DESTEXHE, CNRS, Gif-sur-Yvette, France

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

Ms. Catherine SOULA, CNU representative, Toulouse, France

M. Clement LENA, CoNRS representative, Paris, France

# Observers

## AERES scientific representative:

M. Erwan BEZARD

## University or school representative:

M. Bruno VARET, University Paris 5

## Research organization representative :

Ms. Nathalie LERESCHE



# Evaluation report



## 1 • Short presentation of the research unit

Total number of members in the unit : 23

- Number of full - time researchers : 8
- Number of researchers with teaching duties : 2
- Number of post doctoral fellows : 3
- Number of PhD students : 5
- Number of technicians and administrative assistants : 5
- Numbers of HDR : 7, 3 being PhD student advisor
- Numbers of students who have obtained their PhD during the past 4 years : 11
- Average duration of PhD during the past 4 years : 3 years
- Numbers of lab members with a PEDR : 1
- Numbers of "publishing" lab members : 10 out of 10

## 2 • Preparation and execution of the visit

The preparation and execution of the visit was as specified in the AERES guidelines. The visit went smoothly with all aspects of the evaluation covered satisfactorily.

From 8 :30 to 9 :00

Door-closed meeting : Committee members and AERES representative

From 9 :00 to 9 :30

Presentation by the director: past activity and projects

From 9 :30 to 10 :15

Presentation by the leader of team #1: past activity and projects

From 10 :15 to 10 :45

Presentation by the leader of team #2: past activity and projects

10 :45-11 :00 : Coffee break

From 11 :00 to 11 :35

Presentation by the leader of team #3: past activity and projects

From 11 :35 to 12 :30

Presentation by the leader of team #4: past activity and projects

Lunch from 12 :30 to 13 :15 Lunch

From 13 :15 to 13 :45

Two meetings at the same time



- Meeting with PhD students and postdoctoral fellows
- Meeting with engineers, technicians and administrative assistants

From 13 :45 to 14 :15

Door-closed meeting : Committee members, AERES representative, University and Research Organization representatives

From 14 :15 to 15 :45

Door-closed meeting : Committee members, AERES representative

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

The research unit consists of a talented group of investigators who combine electrophysiological and computational investigations to understand the dynamics of single neuron and network function. The proposed laboratory retains and builds upon many areas of strength evident in the progress during the past laboratory term. At the same time, some modifications in personnel and scientific directions are planned. These modifications broaden the scope of the laboratory's research. If successful, they should add to the potential impact of the laboratory's experimental work.

The group in computational neuroscience is internationally recognized, and is arguably one of the strongest groups in Europe in computational neuroscience. There is also a strong experimental effort in motor function.

The graduate students, postdoctoral fellows and technical staff describe their work environment as supportive and collaborative, and feel that there are few barriers between their immediate group and the rest of the neuroscience community at the Université Paris Descartes.

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

#### Team 1. Spinal Physiology and Physiopathology

The team is composed of 1 theorist, 1 in vivo physiologist and 1 in vitro physiologist, with several trainees (PhD students/postdoc) and a technical staff of 3 (animal care, computer, lab technician). This team focuses on a specific issue: the contribution of intrinsic conductances and synaptic inputs from spinal cord interneurons to the firing patterns of motor neurons. This question is addressed with intracellular recordings of spinal cord motor neurons in vitro and in vivo, which are very difficult experiments. The group produced a number of papers of good quality in the past four years, including papers on mathematical models of motor neuronal dynamics. The group now plans to apply its expertise to tackle the study of motor neurons in murine models of degenerative disorders (amyotrophic lateral sclerosis and spinal muscular atrophy).

A tremendously exciting new avenue comes from preliminary results that demonstrate the feasibility of recording from motor neurons in vivo from adult mice. This opens up the possibility for numerous experiments in the context of both normal function and motor neuron degenerative disorders. This group intends to profit from highly suitable collaborations with other groups, which will provide complementary expertise in numerous areas (production of mice models, analysis of transcripts in motoneurons, behavioral analysis, histology). A study of the dual neurotransmission in recurrent inhibition of motor neurons will also be pursued. In summary, this team is appropriately focused, has a good level of scientific production, and is orienting its activity in promising directions. The committee strongly endorses this group in its proposed direction of research.



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. Brain dynamics

The team leader is a high-quality researcher well known in his field. He has made important contributions in a number of subjects, including the modeling of the dynamical properties of networks of neurons in various contexts. His level of publication is very good, with several articles in journals of excellent standing. He is well respected in the computational neuroscience and physics (dynamical systems) communities. The committee notes that he has only limited participation in editorial boards and in the organization of workshops or conferences. Its most visible international activity is that he is one of the leading members of the Franco-Israeli laboratory of Systems Neurophysiology and Neurophysics, which includes a number of influential neurophysiologists and theoreticians. This initiative has not yet produced visible publications or collaborative projects, but is to be encouraged.

Overall, the results of the team are satisfactory. The senior permanent CNRS researcher assisting the team leader is an outstanding theoretical neuroscientist with a world-class reputation. However, his publication level is somewhat disappointing during this last 4-year period, although there appear to be some papers en route, and it is hoped that this will be redressed in the next time period.

A major change in this team is the addition of another permanent researcher who aims at establishing a cerebellar slice project. She works on the plasticity in cerebellar Purkinje cells. She has devoted a large amount of effort to the demonstration of the presence of NMDA-R at the mature climbing fiber/Purkinje cell synapse, a very important finding against the classical view, this induced a much longer delay to publish than more incremental studies. She will pursue this work in collaboration with a team at the University of Chicago and with theorists interested in specific, hitherto underexplored, aspects of plasticity. She will also develop a preparation of immature cerebellum to study, in close collaboration with the theorists of the group, the dynamics of a recurrent network where GABA is depolarizing, and its impact on the establishment of mature connectivity. This addition enlarges the research scope of the team and it is hoped that other fruitful collaborations will also result. The committee understands that the team is enthusiastic about the new dimensions created by the addition of this young researcher, despite the fact that the intellectual ties between her and the rest of the team do not seem obvious for all. Nonetheless, the committee understands the potential benefits of this addition, and will be pleased to see this addition broaden the scope of the work of the team.

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 3. Memory, learning, dynamics

This team is without doubt the most eminent part of the lab. Since moving to the Université Paris Descartes, the principal investigator has come into his own to assume a position as one of the world leaders in computational neuroscience. He is well-respected by both the theoretical physics and computational neuroscience communities. His work stands at the interface between these disciplines and has dealt with a number of different subjects. He has investigated the mechanisms responsible for different types of network activity, from synchronized fast and slow oscillations, to asynchronous irregular states in networks of randomly-connected neurons. He has also investigated models of cerebellar oscillations, based on inhibitory mechanisms in Purkinje neurons. This latter work has led to a Neuron publication with several groups, including experimental laboratories, and constitutes a nice example of well integrated experimental and theoretical work.

The overall publication record is outstanding, and demonstrates his ability to collaborate effectively with both other theorists and experimentalists. Other indications of international standing and reputation include his many invitations to talk at scientific meetings, his role on several editorial boards of internationally respected journals, and his role as organizers of international workshops and courses. Specifically, he is an organizer of the Advanced Course in Computational Neuroscience (Freiburg, Germany), which is one of the most prestigious courses in the field, and is an Action Editor of several journals, including the Journal of Computational Neuroscience, one of the leading journals in this field, and the new Frontiers in Computational Neuroscience.

Plans for future work include a number of important topics in computational neuroscience. These include modeling of synaptic plasticity at synapses. However, we expect that this research will continue to collaborate widely with both other theorists and experimentalists, and that his future work will bring important insights into a number of fundamental and interesting problems in neuroscience. The committee feels strongly that the principal investigator has demonstrated his ability to pick interesting and important research problems and to establish useful collaborations, and is extremely supportive of his projects and team.

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 4. Motor Behaviour, sensory-motor learning and functional recovery

The goals of this group are to carry out translational research projects with direct application in rehabilitation (evaluation of impairments and development of new rehabilitation techniques or prosthetic systems). They study simple movements like pointing to a target or grasping and moving an object with the hand to establish how subjects interact with objects and tools with a focus on "upper limb" movements. They directly interact with clinical neurorehabilitation departments, academic French networks on disability research, and foundations dedicated to handicap remediation. Some of their projects are related to multi-sensory aspects of human-environment coupling in healthy subjects or in patients with sensory or orthopedic pathologies : the study of the integration of the upper-limb in the coordination of the whole body and the role of sensorimotor coupling for the exploration of environment.

It is possible that the diversity of projects proposed is too extensive, given the size of the group. The productivity of the group during the past four years has been good, although these papers have been largely in specialized journals. The group is to be commended for its contributions to the dissemination of their work to the general public.



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

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

The committee felt that there was considerable cooperation and communication across the individual investigators, the students, and the postdoctoral fellows. The intellectual synergies across many of the investigators are strong.

## 6 • Recommendations and advice

### – Strong points :

Overall, the committee is enthusiastic about this laboratory. Collectively, it is one of Europe's strongest groups in computational neuroscience, and has significant strengths in motor control.

### – Weak points :

The committee is slightly concerned about the thematic integration of the new experimentalists in a researcher group, and is not totally convinced that all components of the laboratory are intellectually integrated to the same degree.

### – Recommendations :

Continued support for the activities of the laboratory is strongly endorsed. Because much of the work is theoretical and computational, these components do not require considerable resources, but these investigators are to be encouraged to be proactive to become a major training site for young theorists in Europe.

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 1<sup>er</sup> avril 2009

DRED 09/n° 127

**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 8119 Neurophysique et physiologie** » rattachée à mon établissement.

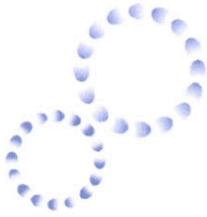
Ce rapport n'appelle pas de commentaire particulier de la part de l'Université.

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

Le Président de l'Université



Axel Kahn



Laboratory  
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Paris March 30, 2009

AERES  
20, rue Vivienne  
75002 Paris

Dear Madam, Dear Sir,

We are extremely pleased with the very positive report on the research activity of our laboratory. The committee well appreciated the interdisciplinarity which is at the heart of our laboratory, composed in equal proportions of experimentalists and theoreticians who all address important issues of physiology and pathophysiology.

We would like to comment on only two points. We regret that the research activity of the two Assistant professors (Maîtres de Conférence) in Teams 2 and 4 has been a bit overlooked. They co-authored, respectively, six and nine publications in international peer-reviewed journals since 2004 and initiated collaborations with other laboratoires (Laboratory of Psychology of Perception, Institut Pasteur).

The second remark concerns the funding of our research. While it is true that theoretical investigations require in general less financial support, our laboratory plans to install two new electrophysiological setups in the coming years, and our new experimental program on murine models of ALS and SMA will prove costly.

Sincerely yours,

Claude Meunier (proposed director)

Daniel Zytnicki (current director)