NIA - Neurosciences intégratives et adaptatives

Rapport Hcéres

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

Section des Unités de recherche

AERES report on the research unit

Neurosciences Intégratives et Adaptatives

From the

Université de Provence

CNRS

February 2011

Research Unit

Name of the research unit : Neurosciences Intégratives et Adaptives

Requested label : UMR CNRS

N° in the case of renewal : 6149

Name of the director : M. Christion XERRI

Members of the review committee

Committee chairman:

M. Egbert WELKER, University of Lausanne, Switzerland

Other committee members:

M. Alain BERTHOZ, Collège de France, France

M. Jean-Marc EDELINE, Université Paris-Sud, France

M. Maurice FALEMPIN, Université de Lille, France, CNU Representative

M. Alessandro FARNE, Université Lyon 1, France

Mrs. Stéfania MACCARI, Université de Lille, France

Observers

AERES scientific advisor:

Mrs. Thérèse JAY

University, School and Research Organization representatives:

Mrs. Nathalie LERESCHE, CNRS

M. Jacques MARVALDI, UFR SVTE, representative University Aix Marseille 1

Report

1 • Introduction

- Date and execution of the visit:

The evaluation committee visited the research unit on February 28, 2011. All members were present. The first step was a closed-door meeting of committee members with the AERES representative to agree on the mission and timetable of the visit.

After a general presentation of the past, the present and the future of the unit by the director, two scientific projects were presented by the two team leaders. The Committee subsequently met the doctoral and post-doctoral students, the members of the technical staff and the research staff, respectively. After a short discussion with Christian Xerri, the committee members exchanged their observations of the day and formulated a number of recommendations.

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

The UMR CNRS 6149 forms together with two other laboratories (UMR 6146 and UMR 6155) the Center for Behavior, Brain and Cognition of the University of Provence ("Pôle 3C"). It is situated at the campus of the University in Marseille. Its current structure of 8 research teams was determined in 2008 and underwent a midterm evaluation in 2009/10. The current proposal is based on the formation of two research projects that are headed by a team-leader each. It forms the logical follow up of the process of regroupment that started earlier and was prepared within the context of the fusion of the three local universities (University of Provence, University of the Mediterranean and University Paul Cezanne) as well as with the restructuring of the neuroscience laboratories in Marseille.

- Management team

The unit is directed by Christian XERRI. The management includes regular staff meetings where decisions are made and that follow the UMR-guidelines.

- 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)	24	8
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	13	8
N3: Number of other researchers including postdoctoral fellows (Forms 2.2, 2.4 and 2.7 of the application file)	10	8
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	16.5	12
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 2.8 of the application file)	20	
N7: Number of staff members with a HDR or a similar grade	15	9

2 • Overall appreciation on the research unit

- Summary

The research unit has been under continuous restructuring over the last 5 -6 years. The current configuration of 8 research groups was introduced in 2008 and had a mid-term evaluation about two years ago. The proposal formulated for the next period (2012 - 2015) is based on a further restructuring of the scientific staff into two research groups – both studying important aspects of brain function/dysfunction with very interesting clinical applications that are currently being introduced. The first group studies sensory processing in the auditory and somatosensory cortices. The research is mainly focused on functional plasticity within the cortical representation of these two sensory modalities using morphological, electrophysiological and high-standard imaging techniques. The experimental paradigms selected are in strong relation with pathological situations, thus providing a strong translational dimension to these studies (spinal cord injuries, cerebral palsy or neuronal plasticity following acoustic trauma). The second group defined three lines of research : (1) multisensory contribution to the construction of body and spatial representation in the healthy and brain damaged brain (peripheral and central mechanisms for coding of self-body movements and self-movement perception) (2) episodic memory in relation to visual spatial memory decrease, (Alzheimer disease) including behavioral, biochemical and genetic methodologies in animal models and fMRI studies on autobiographic memory in young and elderly humans. In humans the efficacy of remediation therapies (as studied previously) and the role of attention and proactive inhibition as possible mediators of episodic memory are studied. (3) How attentional and emotional factors may intervene and modulate "lower-level" aspects, such as postural control, somatosensory encoding at the level of the mechanoreceptors, and postural recovery after vestibular loss.

- Strenghts and opportunities

The committee noticed a general enthusiasm for the new project as expressed in our discussions with the researchers, the doctoral and postdoctoral fellows as well as the technical staff. The process by which the new structure was defined was clearly successful and obtained complete support. As an outcome the research projects formulated are not just the continuation of the projects carried out during the previous years but include new aspects that arose during the various discussions they have had internally. At the scientific level this process is still continuing and more ideas will be formulated.

The research staff is composed of CNRS/INSERM members and members fully employed by the university. There is a good collaboration between the two sets allowing the university members to actively participate in the research projects.

Both research projects are based on an interesting combination of basic neuroscience and clinically-oriented research. Besides that this shows the large scope of interest of the researchers involved and their commitment towards society, this approach has led in the past to the obtention of a brevet.

Over the last few years there was a significant increase in the number of publications per researcher as well as the appearance of the papers in better ranked journals

The budget of the unit is well equilibrated with 70-80% of its income for research (besides salaries) coming from external sources (total 2008-2009: 840.5 k€) including 40 percent from the ANR in 2009 (total same period: 531 k€). The evaluation committee considers this as an excellent result taken into account that the unit is composed of a relatively small group of researchers.

The unit has an active policy for recruitment of young independent researchers. Currently there are two candidates running for CNRS/INSERM positions – for each research projects one.

As a member of Pôle-3C the research unit contributes and has access to a very broad set of technical equipments (e.g. including animal MRI and a set-up for voltage-sensitive dye imaging) run by skillful and highly motivated technical staff members. The unit profits of a large working space that has a potential to welcome new groups.

Neuroscience remains one of the priority axes of the newly formed University of Aix-Marseille which forms a guarantee for support of the university allowing further development of the unit.

- Weaknesses and threats

No European grants and few collaboration with other research groups in France;

Not a main role in the Neuroscience doctoral school program in Marseille:

The restructuring includes the movement of some research groups to other units as well as to other places. With these movements there is a risk of loss of competences. In this respect the unit needs strengthening in staff with skills in data-processing and signal analysis.

The research projects formulated can be considered as very ambitious and may not completely be realistic in relation with the actual work power in place.

- Recommendations

The recruitment of new members through the CNRS/INSERM selection procedure is necessary for the accomplishment of the project. The two teams have the potential to attract very good young researchers at the CR2 levels.

Stabilization/promotion: the need for an effective support from the University or CNRS to obtain "décharge d'enseignement" which will facilitate the activities of a number of scientists to make definitive steps in their career.

Priorities should be determined on the research projects. This would allow focusing on a limited set of experiments through which some research lines could be accelerated and obtain a higher impact.

Continuation of the efforts made in the last few years to obtain European Grants and to develop an active search for collaborations with research groups in France.

Contribution to activities of the Neuroscience doctoral programme in Marseille.

To increase the international visibility of the unit a more active role should be developed in the participation of organization of meetings, summer schools etc. The technical platforms present would allow a contribution in European Training Projects.

- Production results

A1: Number of permanent researchers with teaching duties (recorded in N1) who are active in research	16
A2: Number of permanent researchers without teaching duties (recorded in N2) who are active in research	12
A3: Ratio of members who are active in research among staff members [(A1 + A2)/(N1 + N2)]	16/16
A4: Number of HDR granted during the past 4 years (Form 2.10 of the application file)	1 (+4 en cours)
A5: Number of PhD granted during the past 4 years (Form 2.9 of the application file)	16 (+2 récentes)

3 • Specific comments

- Appreciation on the results

The unit defined two projects of research each carried out by a team: one project is entitled "Sensory processing and Neuroplasticity" and the second project, "Body and Cognition". The two research projects concern important aspects of brain function and are carried out according a similar strategy: basic neuroscience research in combination with clinical observations and trials. The evaluation committee was impressed by the quality of both the basic and the clinical parts of the two research projects and the fact that team leaders are actively involved in the two aspects of their projects. Both research projects are original and have yielded in the past important results which can be measured by the number and quality of their publications as well as the introduction of their observations in clinical trials.

During the period 2008 – 2009 members of the research unit published 107 papers. : 66 (62%) of them with an IF larger than 4. During this period the yearly production progressed to 1.8 article per ETP.

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

Taken into account the number of researchers involved, the evaluation committee considered the success of the research unit to obtain competitive funding as "very good". The research unit has undertaken several attempts to obtain European grants without success although their grants were very positively evaluated. New applications are pending.

Members of the research units are regularly invited to present their work at national and international meetings/conferences. In the discussion with the members of the research unit the evaluation committee raised several possibilities to further extent collaboration at the national and international level. The unit has/had a few post-doctoral fellows from abroad.

The arrival and integration of the research group of the project 1 team leader within the research unit has been clearly successful and is a clear sign that the unit is attractive and has an active policy to recruit new members. Currently the research unit identified two young scientists that should reinforce the two research projects respectively. They are both strong candidates for an INSERN/CNRS position.

The research group "Body & Cognition" obtained a brevet for their memory training software. This is a very strong indication that members of the research unit are aware of the potential outcome of their research and that they have the know-how to transfer laboratory achievements into economically interesting tools.

- Appreciation on the management and life of the research unit

The evaluation committee was positively impressed by the enthusiasm expressed by members of the research unit for their own future. They clearly were very much behind the formulation of the new structure and research projects of the unit. The process by which the new project has been formulated yielded not only in a clear structure but was also very creative in terms of scientific ideas. This enthusiasm was expressed by the scientific staff members as well as the doctoral/postdoctoral fellows and members of the technical staff. On their own initiative the doctoral/postdoctoral fellows from both research projects meet at regular basis to discuss scientific topics with the support of invited members of the scientific staff. The communication during these meetings is in English.

The research unit has a transparent policy about authorship on papers which was valued as very positive.

Research staff is involved in teaching Neuroscience at the Master level in psychology. The evaluation committee strongly suggested exploring the possibilities to contribute to the teaching at the doctoral level.

- Appreciation on the scientific strategy and the project

As stated above, the evaluation committee is impressed by the proposed research projects and the structure of the unit. The coherence of the staff is the underlying strength. The unit has created an excellent infra-structure that covers the scientific needs for a large extent. The committee identified the need for research engineer in signal processing. This opening of this position is currently being negotiated with the university who expressed their support.

The committee indicated the need to determine research priorities that would help to focus upon a limited number of experiments in order to increase their impact.

4 • Appreciation team by team

Team 1

Title of the team: Sensory processing and Neuroplasticity

Name of the team leader: M. Arnaud NORENA

- Staff members

The team « Sensory processing and Neuroplasticity » proposed for the incoming term (2012-2015) is mainly composed of members of the team « Neuroplasticité corticale » of the previous 2008-2011 term. It now incorporates a researcher expert in spinal nerve injury, an associate professor specialized in neuronal plasticity in the vestibular system, a member of the former team "theoretical neuroscience" and an expert in auditory physiology. The team is made of 4 fulltime researchers (3 CNRS and 1 INSERM) and of 4 assistant professors (all from Université de Provence) and it also includes a clinician (from Marseille hospital) who has been previously collaborating with the team. In its actual configuration, the team also benefits from 4 post-doc and one PhD student with a governmental fellowship.

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)	3	4
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	3	4
N3: Number of other researchers including postdoctoral fellows (Forms 2.2, 2.4 and 2.7 of the application file)	2	4
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	7	unknown
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 2.8 of the application file)	4	
N7: Number of staff members with a HDR or a similar grade	1	4

- Appreciation on the results

The processing of sensory information in the auditory and somatosensory cortices, and the plasticity of cortical maps in these two sensory modalites are the main focus of this group. Many topics are related with pathological situations, thus providing a strong translational dimension to these studies. For example, this is the case for the researches focusing on spinal cord injuries, on cerebral palsy or on neuronal plasticity following acoustic trauma. As a consequence, the team is engaged in testing rehabilitation strategies ranging from the molecular level (with olfactory ensheathing cell transplantation) to the computational level (with brain computer interfaces) and to the behavioral level (with acoustic stimulations compensating the consequences of acoustic trauma). Thus, it is clear that the research topics of this team are particularly relevant for public health, which is probably the major strength of this team.

In the previous term (2008-2011), the activity of the team "Neuroplasticité corticale » was very good both in terms of number and of quality of the publications: It generated up to 24 papers in leading such as J. Neuroscience, Cerebral Cortex, EJN. This team masters up-to-date techniques such as optical imaging collected via Voltage Sensitive Dyes (VSD) and multisite microelectrode recordings. Very few teams are using these two techniques in France (and in Europe in general) and it is clear that these techniques will be the cornerstones for the different research topics that will be investigated in the future. The multisite electrophysiology set-up seems to be fully operational. During the presentation at the evaluation day, impressive new (unpublished) data was presented showing the application of the VSD optical imaging system within the auditory system.

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

Taking into account the low number of graduate students interested by in vivo electrophysiology, the team has attracted a correct number of PhD students (4) despite its low number of researchers with a habilitation (HDR).

The team has attracted four members (with permanent position), which probably open new avenues of research. Two research directors (one working in auditory system, the other working in spinal nerve injury) and two assistant professors (one working on computational neuroscience and the other in the vestibular system) have joined the team. Their expertise will be a real strength to complement the knowledge of the younger researchers of this team.

In general, the team has been quite successful in obtaining grants either from governmental agencies (ANR) or private foundations (FRM, Tinnitus Research Initiative, France Acouphène). These grants allowed the team to attract PhD students and post-doc including from abroad. This team is not involved in major international research programs but they have strong collaborations with outstanding laboratories in Canada and US. There is a correct number of invitations to conferences and a real effort to participate to cultural local event such as the "fête de la science".

- Appreciation on the scientific strategy and the project

In both the auditory and somatosensory modalities, the proposed projects can be grouped in 4 main lines of researches.

1. The dynamics of sensory processing will be investigated to look for cortical correlates of perception. It will be studied with multisite electrophysiological recordings and VSD optical imaging.

2. The experience-dependant plasticity of cortical representation will also use multisite recordings and VSD to understand how patterns stimulations produce short-term plasticity.

3. Post-injury plasticity: different situations will be study ranging from hearing loss and tinnitus after acoustic trauma to nerve sections, spinal cord injuries and cortical ischemia.

4. To complement the 3rd topic, a large range of rehabilitation strategies will be investigated ranging from submitting the subject to "compensatory auditory environment" and electrical nerve stimulation and brain-computer interfaces to pharmacological/molecular strategies.

All these research topics should allow the team to expand its international recognition and visibility and to become a leader in the French sensory physiology.

- Conclusion :

  - Summary

Clearly, the projects of this new team are very ambitious. They are also very important for public health, which should help the team to obtain grants in national and international agencies. The team is composed of researchers having an excellent expertise in their field and, if they coordinate their research efforts on specific aims, they should be able to aim publications in high impact factor journals.

  - Strengths and opportunities

This team now has a new, young leader who is a bright and well-recognized scientist in the auditory cortex community. His enthusiasm and expertise both in psycho-acoustic and in neuroscience should help promoting new research topics and should help linking basic electrophysiological studies in animals with clinical research. The collaborations with clinicians should be encouraged but they should also generated publishable studies.

With the diversity of the techniques they master and the expertise in different sensory modalities the team should try to set up a multi-sensory project which can be a way to unify the effort toward a common goal.

  - Weaknesses and threats

Considering the limited number of full-time researchers, the evaluation committee found that there are too many scientific projects, and that each individual project has too many facets. The recommendation was formulated that the team should focus on a few projects and attack them with the different technical expertises available in the team.

Although some members of the team have apparently a good background in signal processing there is a need to recruit a research engineer in signal processing or in computational neurosciences to support the team in his future projects.

  - Recommendations

Some researchers should get their habilitation as soon as possible to be officially responsible of graduate students

There is a need for the recruitments of young CR researchers at the CNRS or at INSERM

The team should try to develop strong collaboration with other European laboratories to apply with them to EC grants.

Team 2

Title of the team: Body and Cognition

Name of the team leader: Ms. Béatrice ALESCIO-LAUTIER

- Staff members

N1: Number of researchers with teaching duties (Form 2.1 of the application file)	4
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	4
N3: Number of other researchers including postdoctoral fellows (Forms 2.2, 2.4 and 2.7 of the application file)	4
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	Cf nota
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	
N6: Number of Ph.D. students (Form 2.8 of the application file)	
N7: Number of staff members with a HDR or a similar grade	5

- Appreciation on the results

The past work of the members composing this newly reorganized team is of high international standing. In the previous 4 years these members were distributed over several research teams each very strong in their field. One team did outstanding work on the neurosensory substrates for body and movement perception using microneurography. A second team studied the influence of vestibular activity on the central representation of the body and extrapersonal space and analyzed in this context patients with vestibular lesions. A third team headed by the team leader of the second future research project focused on the study of cognitive dysfunction during aging and neurodegenerative diseases (Alzheimer) and developed a cognitive rehabilitation tool that they brought on the marked.

All of these studies on humans were paralleled with original work using animal models that involved behavioral testing, neurophysiology and molecular analyses. Their work had a good impact and the tracking publications record is very good. Members of the newly formed team cover a wide range of techniques and have a very high potential for translational research. The approaches proposed to address their scientific questions are original. The originality, quality, and quantity of the published work will consolidate this team at high international levels.

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

International reputation is increasing, but should be strengthened, as there are relatively few invited conferences of international level. Several international collaborations are established and will potentially foster international reputation of the team/members. Awards are prestigious, but mostly at national level.

Several new members have been appointed during the past term: the new structure shaped by the Director could further benefit from the insertion of new tenured positions which would assure the growing success of this team.

Overall, a very good amount of external funding has been raised in the past. The newly established team needs to spend some efforts to ensure a comparable level of success in grant applications. The originality and quality of the research project proposed by this team is a very solid basis for the obtainment of new grant funding. European community awarded funding should be targeted.

- Appreciation on the scientific strategy and the project

Three main scientific lines of research are proposed within the body & cognition team. The first line tackles the multisensory contribution to the construction of body and spatial representation in the healthy and brain damaged brain. A very ambitious project is proposed, which includes studying both the peripheral and central mechanisms for the coding of self-body movements, as well as for self-movement perception. The cognitive aspects of this project are enriched by the additional question as to whether some specific brain areas like EBA are involved in the process of distinguishing between self from other, both in terms of ownership of, and agency on, body-parts. The collaboration with highly reputed clinicians in this filed is a strong asset to the project. The same consideration applies to the part of the project addressing the role of vestibular functions in the representation of space, and a very interesting parallel is proposed for the study of neglect patients. The role of the hippocampal changes in spatial memory disorganization following vestibular loss possibly brings some risks, but it is most original and worth doing.

The second line of studies focuses the episodic memory in relation to visual spatial memory decrease, as in Alzheimer disease. This part of the project is well articulated in three steps, taking advantage of behavioral, biochemical and genetic methodologies in animal models. Interconnected projects propose to focus the autobiographic memory in young and elderly humans by using fMRI, and the efficacy of some remediation therapies the team members contributed to establish in their past work, as well as the role of attention and proactive inhibition as possible mediators of episodic memory. The clinical implications of this approach are relevant.

A third research axis will deepen the knowledge about the extent to which attentional and emotional factors may intervene and modulate "lower-level" aspects, such as postural control, somatosensory encoding at the level of the mechanoreceptors, and postural recovery after vestibular loss.

Although ambitious, the project is feasible within the proposed time frame, and the scientific competence and expertise of the members involved are a very solid guarantee for the success of the project, which additionally makes use of several, convergent methodologies and living models.

- Conclusion :

  - Summary

This is a relatively young, but solid team, which has a high potential to increase translational research projects with applications in clinical neurology. Its scientific productivity is good.

  - Strengths and opportunities

The team is well inserted in the neuroscience community and strategically well-articulated within the behavior brain and cognition center. The solid quality of the basic research science that makes the history of the team members constitutes a guarantee for the original projects they wish undertaking. The mastering of the technique of micro- neuromyography, unique feature in France and rare in Europe, is a major asset for some key projects. The new structure shaped by the Director is bound with a very high potential to increase substantially the interaction between the teams and their international reputation.

  - Weaknesses and threats

The potential for collaboration between the teams is present, but the scientific projects still appear quite far apart and it is not obvious how the scientific coherence will be maintained/enhanced in the future.

  - Recommendations

The number of international and national post docs should be increased, as the effort to come to a higher international visibility. Recurrent funding is decreasing everywhere, so this felt threat should be counteracted by further increasing the already high proportion of external funds to the laboratory activity.

Intitulé UR / équipe	C1	C2	C3	C4	Note globale
NIA- NEUROSCIENCES INTÉGRATIVES ET ADAPTATIVES	A	A	A+	A	A
CORPS ET COGNITION [XERRI-ALESCIO-LAUTIER]	A	A	Non noté	A	A
TRAITEMENT SENSORIEL ET NEUROPLASTICITÉ [XERRI-NORENA]	A	A	Non noté	A	A

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**