



## CERCO - Centre de recherche cerveau et cognition

### Rapport Hcéres

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

Section des Unités de recherche

AERES report on the research unit:

CerCo

From the :

CNRS

University Paul Sabatier – Toulouse 3

May 2010



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# AERES report on the research unit

CerCo

From the

CNRS

University Paul Sabatier – Toulouse 3

Le Président  
de l'AERES

Jean-François Dhainaut

Section des unités  
de recherche

Le Directeur

Pierre Glorieux

May 2010



# Research Unit

Name of the research unit : Centre de Recherche Cerveau et Cognition

Requested label : UMR (CNRS-UPS)

N° in the case of renewal: UMR 5549

Name of the director : Mrs Michèle FABRE-THORPE, M. Simon THORPE (Deputy-director)

# Members of the review committee

## Committee chairman:

M. Philippe SCHYNS, University of Glasgow

## Other committee members :

M. Moshe ABELES, Bar Ilan university

M. David BURR, Istituto di Neurofisiologia del CNR, Pisa

Mrs Stephanie CLARKE, Universite de lausanne

Mrs Patrizia FATTORI, University of bologna

M. Alan JOHNSTON, University college of london

Mrs Anna Christina NOBRE, University of oxford

## Committee members suggested by CNU, CoNRS, CSS INSERM, CSS INRA, INRIA, IRD

M. Pascal MAMASSIAN (Représentant CoNRS)

M. Jacques MICHEAU (Représentant CNU)

M. Henri COULAUD (Représentant ITA CoNRS)

# Observers

## AERES scientific advisor :

M. Christophe BERNARD

## University, School and Research Organization representatives

M. Jean-Loup BASCANDS (représentant CS-UPS)

M. Driss BOUSSAOUUD (représentant INSB CNRS)



# Report

## 1 • Introduction

- Date and execution of the visit

The visit of CerCo was carried out over two days, December 1st and 2nd. The visit comprised a tour of the new research facility at Purpan Hospital, and overview of the CerCo activities and project by its Director, Michele Fabre-Thorpe followed presentations of each of the four research units. The Panel also engaged in discussions with the students, post-docs, ITA and representatives of the University.

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

CerCo is a research unit belonging both to CNRS and Université Paul Sabatier (Toulouse). Created in 1993 by Michel Imbert, then developed with Jean Bullier and since 2003 under the directorship of Michele Fabre-Thorpe, it now comprises 20 permanent research scientists and a total of 28 post-doctoral fellows and doctoral students. It is associated with CNRS section 27 « Behavior, Cognition and Brain » and section 25 « Molecular and Integrative Physiology. » Cerco is currently divided between 5 main sites but a significant investment of 9 million euros from two CPERs and one CIADT has led to the development of a new state-of-the-art research site at Purpan Hospital (with fMRI, animal and human laboratories, including EEG and TMS), where all CERCO members will be moved by September 2010.

Though the main research theme is the visual system and cognition, CerCo is divided into three groups : DyTIC (Leading PIs : Barone & Fonta, Processing Dynamics and Cortical Interactions), ECO-3D (Leading PI : Trotter, Perception of Space) and PROS (Leading PI : Thorpe, Perception of Objects and Scenes). The 2011-2014 project identifies a fourth group (CREMe, Leading PI : VanRullen, Shaping of Mental States and Representations), which is a branch of the original PROS 3 and Dytic 1).

- Management team

Under the Directorship of Michele Fabre-Thorpe, a Laboratory Board comprises the following representatives: 5 elected and 5 nominated members cover the different sectors of activities of CERCO. Specifically, 2 members represent DyTIC, 1 member represents ECO-3D and 3 members represent PROS. This is a fair representation that accounts for the differences in group sizes and the membership of the research staff—i.e. CNRS versus University. 1 elected and 2 nominated members represent ITA. 1 elected student represents the students and post-doctoral fellows.

The Laboratory Board meets on a monthly basis. Minutes are taken and then publicly disseminated to all staff members.

Cerco meets at least once a year (in a « general assembly »), but the precise number of meetings is a function of events and can be flexibly adjusted to needs. All decisions that directly impact on Cerco are discussed over the « laboratory board ». In addition, there is a common journal club meeting twice per month. Some of the research teams add their own journal clubs to this dynamics.

It is the view of the panel that Cerco has a rational and efficient organisation that at the same time promotes collegial decision while minimizing potential tensions. It is notable that Cerco has been operating in a friendly and collegial atmosphere, without conflicts, over a long period of time.



- 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)	4	4
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	16	16
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	9	1
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	8,6	10,8
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	1	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	13	19
N7: Number of staff members with a HDR or a similar grade	10	11

## 2 • Overall appreciation on the research unit

- Summary

The main research theme of CerCo is the visual system and cognition. The research unit is coherently divided into four (from 2011) complementary research themes which form the vertical dimensions tapping into a common horizontal research platform (to be located at Purpan from September 2010). The horizontal platform comprises behavioral methods from visual and auditory psychophysics and modeling, with the recent addition of cognition, together with the analysis of brain signal analysis recorded from multiple sources, in humans, patients and non-human primates (i.e. EEG, ECoG ; TMS, cooling ; fMRI, PET, implanted electrodes and anatomy).

The excellent research environment has consistently produced scientists of an international stature. Starting with the trajectory of PhD students, several of them have moved to other internationally ranked research outfits (Toronto ; Caltech ; UCSD) and two returned to CerCo as CNRS researchers to start a new research theme, forging the new fourth theme starting in 2011. One notable feature is the capacity of the unit to attract significant research income from external sources (like EURYL).

- Strengths and opportunities

The evaluation committee identified the following main strengths and opportunities :

CERCO has created an interdisciplinary environment mixing EEG, behavioral studies, modeling, eye movements, implanted electrode recording, fMRI (soon to be operational in the Pavillon Baudot in Purpan), neuroprosthesis (cochlear implant) with fundamental and practical applications, in human and non-human primates and in patients. These are clear strengths in the domain of visual perception and cognition. The research platform ranks amongst the 4-5 worldwide environments with such diversity of methods around a common research theme—on a par with MIT or the Max-Planck Institute in Tuebingen.

CERCO is also an environment producing considerable scientific and technological innovations. Specifically, one spin-off companies emerged from the agenda in fundamental research (SpikeNet and Cochlear implants) and there are strong interactions with another company “Cochlear”.



PROS and CREMe are two research themes of international excellence. These researchers have created a research environment which has consistently generated innovative, ground-breaking ideas, prominent researchers, with 50% of publications in AERES-rated excellent journals and considerable grant awards. This international visibility has allowed PROS and CREMe to recruit high caliber researchers (4 CNRS + 1 MCU since 2005).

The panel noted the quantity and quality of publications and the genuine international composition of the research unit.

- **Weaknesses and threats**

A challenge for CerCo is its embedding in University of Toulouse. An embedding in a more supportive environment would certainly benefit this excellent unit and would therefore represent a worthwhile investment to improve the international reputation of University of Toulouse. The lack of support is apparent in a number of dimensions, including the absence of University investments in the Purpan site, the small number of academic and technical posts assigned to CerCo and in the arcane financial management that the University imposes on the Unit. Overall, this has led to significant delays in the scientific agenda (most notably in monkey research) and unnecessary frustrations on the part of the researchers. However, there is evidence, with a change of Presidency of the University, of a more robust research strategy where CerCo is identified as a clear priority. Furthermore, the Purpan site is reaching completion and the physical proximity of researchers around a common research platform is likely to quickly increase research collaborations.

Another challenge for CerCo was its own success in the tiny premises of the laboratory in which they had to operate until now. However, now that state-of-the-art accommodation is available at Purpan, the unit will be able to grow even further (cf. the recent development of CREMe for one example).

The panel identified that ECO-3D did have a comparatively low publication rate and overall impact. Mitigating factors were the low number of research staff in the team (two full-time researchers between 2005-2010 ; 2 half-time MCU ; 2 post-doctoral fellows, + 2 associate scientists, 2 PhD students) and the comparatively slower publication rate in primate neurophysiology. However, the panel felt that the research was excellent. The problem appears to be a translation of excellent research into impactful papers and conference presentations. We hope that this group will be able to recruit new researchers to invigorate the research agenda.

- **Recommendations to the head of the research unit**

Overall, the unit has had a remarkable scientific success, in the context of national and international competition. The national competitive success applies to CNRS posts and funded ANR projects ; the international competitive success applies to the recruitment of researchers of an international calibre and to the award of European grants. The panel was positively impressed by the conjunction of a considerable success that preserved a research atmosphere where individuals can develop independent research careers. CerCo is clearly a research unit that operates with the balance between leading edge competition and an excellent human touch. The overall recommendation is therefore to keep the ingredients that have fostered this success in the new 2011-2015 project. The panel is aware that such combination of the key ingredients to success is rare, must be noted, and the management team of CerCo be congratulated.

At the same time, the panel believes that it is important to distill the ingredients that have fostered success in PROS, CREMe and DyTIC and to apply them throughout ECO-3D to invigorate research.

Given that the number of ITA has recently increased, it would be constructive to create a committee for the ITA so that discussions with the Head of Research Unit can take place on a more transparent and formal basis.



- Production results

(cf. [http://www.aeres-evaluation.fr/IMG/pdf/Criteres\\_Identification\\_Ensgts-Chercheurs.pdf](http://www.aeres-evaluation.fr/IMG/pdf/Criteres_Identification_Ensgts-Chercheurs.pdf))

A1: Number of permanent researchers with or without teaching duties (recorded in N1 and N2) who are active in research	18-19
A2: Number of other researchers (recorded in N3, N4 and N5) who are active in research	8
A3: Ratio of members who are active in research among permanent researchers $[(A1)/(N1 + N2)]$	0,9 0,95
A4: Number of HDR granted during the past 4 years	4
A5: Number of PhD granted during the past 4 years	9+2

### 3 • Specific comments on the research unit

- Appreciation on the results
  - Relevance and originality of the research, quality and impact of the results :

The panel noted the overall excellence of the research, with potential for groundbreaking discoveries in each one of the four groups.

- Number and quality of the publications, scientific communications, thesis and other outputs

CerCo scientists have published a total of 142 scientific papers in the period. Of these, ~50% appear in excellent journals ; 25% in very good journals (according to AERES classification of journals).

- Quality and stability of partnerships (optional)
- Appreciation on the impact, the attractiveness of the research unit and of the quality of its links with international, national and local partners

Overall, CerCo is one of the most attractive research units in French Neuroscience. Over the period, they were able to attract new CNRS members and grew very fast (particularly PROS). Growth is not only quantitative, as a new team of research has recently been created (CREMe).

- Number and reputation of the awards obtained by staff members, including invitations to international conferences and symposia

In DyTIC, Prix “La Recherche 2008” for work on vasculature of tumours.

In ECO-3D, in 2007: Prize of the “international Academy of astronautics for his book: “Artificial gravity”.

In PROS, “Young Scientist Award” delivered by Advanced Neuro Technology (ANT). European Young Investigator Award and the Bronze Medal of the Life Sciences Department of CNRS. Michel Monpetit prize.





- Ability to recruit high levels scientists, post-docs and students, and more particularly from abroad

CerCo is internationally visible and has therefore been able to recruit scientists from abroad. Specifically, since 2005 they recruited four new CNRS researchers, a university lecturer Post-Docs and PhD students. It is worthwhile noting that the scientists who came back to CerCo all spent a significant number of years abroad before rejoining.

- Ability to raise funds, to successfully apply for competitive funding, and to participate to scientific and industrial clusters

CerCo has attracted significant funding from the European Commission and from the French Research Council (ANR). It is worthwhile noting the impressive increase in external research funding over the period (from 200k euros in 2005 to 650k euros in 2009). This undoubtedly demonstrates the quality of the research projects and the ability of CerCo scientists to seek and attract funding in a competitive context.

- Participation to international or national scientific networks, existence of stable collaborations with foreign partners

CerCo is exceptionally well connected in local, national and international research networks. Specifically, CerCo collaborates with 9 Toulouse-based research units, 20 national institutions and 37 international academic institutions.

- Concrete results of the research activity and socio-economic partnerships (optional)

Notable to CerCo is the range of industrial partners. SpikeNet Technology is a start-up created by three lab members. SpikeNet commercializes bio-inspired vision systems for object recognition. The company employs 8 people. DyTIC has developed a project on hearing recovery using cochlear implants in a collaboration with ENT and Cochlear, a spin-off company involved in the development of cochlear implants.

- Appreciation on the strategy, management and life of the research unit
  - Relevance of the research unit organization, quality of the management and of the communication policy

Excellent. The unit is efficiently organized, the managerial procedures effectively implemented and decisions are communicated in a collegial atmosphere. The Director should be commended for enabling and promoting internationally competitive research in a friendly and collegial atmosphere. This is a rare combination that is reflected and favourably commented upon by CerCo members when they point out that « it feels good to work at CerCo. »

- Relevance of the initiatives aiming at the scientific animation and at the emergence of cutting edge projects

Excellent. As explained elsewhere in this document, the new site at Purpan is in full alignment with the strategic developments at CerCo. CerCo has created a rare interdisciplinary environment mixing EEG, behavioral studies, modeling, eye movements, implanted electrode recording, fMRI (soon to be operational in the Pavillon Baudot in Purpan), neuroprosthesis (cochlear implant) with fundamental and practical applications, in human and non-human primates and in patients. These are clear strengths in the domain of visual perception and cognition.

- Contribution of the research unit staff members to teaching and to the structuration of the research at the local level

Members of CerCo participate to teaching in the University but they are also involved in specialized, research-based teaching both at Masters' level in specialized workshops.



- Appreciation on the project
  - Existence, relevance and feasibility of a long term (4 years) scientific project

Across the four groupings of the research project (DyTIC, ECO-3D, PROS and CREMe), all panel members commented very favorably on the relevance and feasibility of a long term scientific project. The research described is primarily of an interdisciplinary, integrative nature and so long term investments are very much required to carry out the individual research programmes. In all groupings, panel members noted potential for original, genuine scientific breakthrough, justifying the requested funds. The research programme of CerCo receives the unanimous approval of the panel of experts for its originality, coherence, integrative nature and potential for scientific breakthrough.

- Existence and relevance of a policy for the allocation of resources

Most of the funds are allocated by the researchers from their individual grants according to the requirements of the research. The general funds are allocated by a committee. Management and allocation of funds were unanimously praised by the researchers.

- Originality and existence of cutting edge projects

CerCo projects are original and cutting edge. The panel noted:

For DyTIC, that the insertion of the research topics on the overall thematic of cortical interactions and the approach of combining anatomy and physiology were timely and original.

For ECO-3D, the search for cortical homologies using fMRI in humans and monkeys to then guide single units recordings in behaving monkey was noted for its excellence and the potential to develop strong links between basic and applied clinical neuroscientific research.

For PROS, the potential of the couplings between intracranial recordings, fMRI and EEG together with sophisticated psychophysical techniques bode well for the relevance of the studies for basic science and patient diagnosis.

For CREMe, the risky, innovative and potentially groundbreaking research of this new group.

Overall, the panel felt that the project of CerCo has high potential for keeping delivering research of the highest international standards.



#### 4 • Appreciation team by team and/or project by project (to be pasted as many as needed)

Team 1 : DyTIC - PROCESSING DYNAMICS AND CORTICAL INTERACTIONS

Team leader: M. Pascal BARONE and Mrs Caroline FONTA

- 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)	0,5	1
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	5	4
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	2	0
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	0,5	0,8
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	0	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	4	4
N7: Number of staff members with a HDR or a similar grade	2,5	4

- Appreciation on the results
  - Relevance and originality of the research, quality and impact of the results

Research spanning from astute anatomical studies using advanced techniques to single unit recording exploring the coding properties of neurons in the visual cortex of non-human primates. Additional topics are sensory deprivation (animal model) and cochlear implants (patients). Furthermore multisensory interactions are investigated in non-human primates

All three fields are highly topical, the combination of anatomical and functional studies original, the quality excellent. This research has been highly successful as judged from the publication list.

The group is strong and attracts doctoral students (7) and postdocs (6).

- Number and quality of the publications, scientific communications, thesis and other outputs - since 2005

43 original papers, almost all in international journals, mostly in very good and excellent journals (Cerebral Cortex, PNAS, PLOS One)



3 book chapters

8 vulgarisation publications

3 thesis defended (and 5 others in progress)

- Quality and stability of partnerships (optional)

Long standing collaboration, with successful publications

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

Overall excellent performance, both in output and networking

- Number and reputation of the awards obtained by staff members, including invitations to international conferences and symposia

Prix “La Recherche 2008”, for work on vasculature in tumours

11 international meetings organised or co-organised

Invited speakers on 33 international or national meetings.

- Ability to recruit high levels scientists, post-docs and students, and more particularly from abroad

The group is highly visible, and recruited doctoral students and postdocs from abroad.

- Ability to raise funds, to successfully apply for competitive funding, and to participate to scientific and industrial clusters

Group members obtained during the report period numerous grants:

11 grants of < 10'000.- euros

4 grants of 10'000.- to 20'000

4 grants of > 20'000.- euros

- Participation to international or national scientific networks, existence of stable collaborations with foreign partners

Collaboration with 11 European or US universities of high repute in the field. On national level, collaboration with 8 outstanding units working in this field.

- Concrete results of the research activity and socio-economic partnerships

High visibility within the field, excellent research, high level publications, excellent postgraduate education.

- Appreciation on the strategy, management and life of the team

Overall excellent.



- Relevance of the team organization, quality of the management and of the communication policy (optional)

Excellent, as far as it is possible to evaluate from the written report. The site visit confirmed this fully and showed clearly a collegial organization which favours interaction, creativity and critical analysis.

- Relevance of the initiatives aiming at the scientific animation and at the emergence of cutting edge projects (optional)

The group, as well as the lab, organised twice monthly meetings. Furthermore the group participates in the lab retreat every other year. The team members participate regularly at national and international meetings, often with oral communications or posters.

- Contribution of the team members to teaching and to the structuration of the research at the local level

The team members contribute to the teaching at master and doctoral level; this teaching, although excellent, is limited by the local structure.

- Appreciation on the project

Logical and well planned continuation of the current work, building upon the strength and developing further aspects. Specifically, DyTIC specializes in studying the correlations between cortical structures and cortical functions. Their research plans are to study in normal and pathological situations the structural organization (both vascularization and connectivity) of visual cortical areas and the dynamic properties of their neurons. They are also planning to study the plasticity of auditory cortex and its role in social communication using animal models of vocalization and the functional reorganization that occurs for speech processing in deaf patients.

- Existence, relevance and feasibility of a long term (4 years) scientific project

The project is eminently feasible (anatomical work, monkey sensory physiology, plasticity in hearing)

- Existence and relevance of a policy for the allocation of resources

The lab has a common policy of allocation of resources which is implemented by its Director. The site visit showed clearly a great satisfaction of the team members with this procedure, but also a frustration about the limitations of the means. In particular the financing of doctoral students is limited, partially because the lab is attached to the doctoral school of Social sciences (and not Life Sciences). The team counts on obtaining further external funding in the future.

- Originality and existence of cutting edge projects

The proposed projects are cutting edge and well inserted in the general thematics of cortical interactions. The approaches, combining anatomy and physiology are original.

- Conclusion

- Summary

This is an excellent group, with an outstanding record and a deeply feasible plan for 2011-2014.



### – Strengths and opportunities

Well adapted team with a variety of approaches, which are complementary.

Good dynamics in publication and presentation of results.

Methodological expertise.

The new project is highly original and topical and well within the expertise of the applicants.

This team contributed to high standard of Cognitive Neuroscience in Toulouse and, together with the rest of the lab, could be the founding stone of a Doctoral School in Cognitive Neuroscience.

### – Weaknesses and threats

The applicants will need to have the same or even better infrastructure.

As the whole lab, the team suffers from the fact that there is no doctoral school in Neuroscience or even in Cognitive Neuroscience to attract outstanding students from other French or from foreign Universities. Such a doctoral programme should be attached to Life Sciences or Life Sciences cum Social Sciences.

### – Recommendations

To fund the project 2011-2014 as requested (CNRS)

To create a Doctoral School in Neuroscience or in Cognitive Neuroscience in Toulouse (University)

To increase the allocation of doctoral positions to the whole lab, including this team

**Team 2 :** ECO 3-D – Perception of space

**Team leader:** M. Yves TROTTER

- 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)	1,5	1
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	3	3-4
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	1	0
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	0	0
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	0	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	1	2
N7: Number of staff members with a HDR or a similar grade	2,5	2



- **Appreciation on the results**

- **Relevance and originality of the research, quality and impact of the results**

The panel finds the concept of “egocentric fovea” (reference frame for coding visual information that takes eye-position signals into account) exciting and innovative, building on results obtained in the recent past by the Team, to be explored during the next four-year period.

The demonstration of multisensory (audio+ visual) integration in the primary visual cortex is equally innovative, confuting standard hierarchical models of sensory-motor integration.

The studies on internal models of gravity and the tests in conditions of altered gravitational conditions are interesting and of practical relevance. Other interesting research included the interdisciplinary studies devoted to defining operating rules for navigation in space, both for knowledge-driven interest and for application in artificial systems able to move autonomously and interpret sensory inputs from different sensory modalities.

The variety of techniques, ranging from single cell studies in awake behaving monkey, to electroencephalography, to behaviour in the human and non-human primate as well as in patients and astronauts, brain imaging in the human being (that they plan to extend also to the monkey).

- **Number and quality of the publications, scientific communications, thesis and other outputs**

While the quality of the research is unquestionably excellent, the panel noted that the quantity of publications, particularly in the electrophysiological area, is a little disappointing. However, it should also be noted that single cell research is extremely time-consuming, and the group is small, only one full time researcher and two part-time researchers (maternity leave). The group also have heavy teaching and organizational duties in University and other committees (Conseil d'Administration, IFR-deputy directorship, teaching in International universities; Presidency in European Spatial commissions). And it is well known that it is difficult to recruit graduate students for this line of research, notorious for its low production level.

Overall, the group has produced during the period 33 international publications, 11 in the good-excellent category ‘Cerebral Cortex, Neuroimage, Exp Brain res). When the low productivity was commented on, the team leader showed he was aware of the problem, and pointed out the difficulties (mentioned above), and alerted the panel to many publications in press or under review, as well as abstracts of conference proceedings.

All in all, the publication quality is excellent and quantity satisfactory.

- **Quality and stability of partnerships (optional)**

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

- **Number and reputation of the awards obtained by staff members, including invitations to international conferences and symposia**

Prize of the “international Academy of astronautics for the book: “Artificial gravity” in 2007.

The team members received numerous (13) invitations to international symposia.

- **Ability to recruit high levels scientists, post-docs and students, and more particularly from abroad**

The team recruited 2 PostDocs, 1 PhD student and 2M2R students, 3 Master of Space students: all these positions were hired with grants obtained by the team.

One PostDoc from Harvard University has joined the team. However, it is difficult for the single-cell group to recruit given that primate research is a sensitive topic.



- Ability to raise funds, to successfully apply for competitive funding, and to participate to scientific and industrial clusters

The Team obtained a 3 year grant for neuro-robotic research, an outstanding field in the european scientific community, where Y. Trotter is the PI for Toulouse (ROMA « Représentation Oculocentrée et Mouvement d'Atteinte » :Modélisation des mécanismes d'intégration visuo-motrice pour le mouvement d'atteinte chez le primate : apport du formalisme de l'asservissement visuel en robotique).

The group have also raised funds for research in a cutting-edge field, the Neuroprosthetics, including also a PhD salary and an interdisciplinary grant.

In addition, there are numerous National grants for research and salaries.

- Participation to international or national scientific networks, existence of stable collaborations with foreign partners

There are transverse collaborations with research groups involved in other disciplines, from basic to applied (and those, cover different research fields).

Collaboration to national research networks (groups on vision, robotics, physiology) documented by joint publications.

International: Collaborations with first order research centres and Universities (Harvard University, Katholique University in Leuven, Belgium, Wright State University, University of Texas, University of Toronto), with International space research centers (NASA, Euopean Spatial agency, Aerospacial center in Moscow).

- Concrete results of the research activity and socio-economic partnerships

See later

- Appreciation on the strategy, management and life of the team
  - Relevance of the team organization, quality of the management and of the communication policy (optional)

See later

- Relevance of the initiatives aiming at the scientific animation and at the emergence of cutting edge projects (optional)

Despite the limited number of researchers, the Team has devoted much energy to the regular participation in national and international meetings; their researchers have been invited to give seminars, and participated in the scientific organization of symposia and conferences. They also participated actively in the "Brain awareness week" and other public dissemination projects.

- Contribution of the team members to teaching and to the structuration of the research at the local level

All members participate in teaching in the university. The team leader is also Deputy Director of the IFR96, a highly structured organization that organizes locally the research of 6 labs involved in Neuroscience (with many technical facilities such as the fMRI scanner, TMS, EEG, electrophysiology set-up).

Some members of the Team have scientific and administrative responsibilities and in Academic affairs (Participation in Conseil d'Administration, in the scientific conseil in the faculty, membership in Juries, participation in Ethical committees). All these are time- and energy-demanding initiatives.





At the local level, the team appears to be highly active (Trotter is part of IFR direction), organizing each year 2 full days of symposia linking all IFR members to update the Neuroscience community in Toulouse with the last results obtained and to facilitate collaborations and joint projects.

- **Appreciation on the project**

The innovative and well-planned project will investigate the mechanisms involved in the integration of retinal and contextual extra-retinal cues, such as eye and head position. It will also investigate the importance of reference frames. Multi-sensory contextual information including peripheral vision and non-retinal information such as hearing, vestibular, and muscle proprioception, will also be used to help understand the general mechanisms involved in reference frame construction. The contribution of gravity to the mental representation of 3-D space will be explored. The effects of passive and active oculomotor exploration of visual scenes will be compared to investigate the efficiency and speed of the visual processing of natural and artificial images. In addition, they will also address the degree to which the content of a 3-D scene can modulate visual 3-D perception and affect object recognition.

- **Existence, relevance and feasibility of a long term (4 years) scientific project**

Relevant, feasible and highly promising are:

- the 3 clinical projects involving all the members of the Team
- the 2 bridge projects (one on human patients and monkey and one on translational clinical research)
- the 2 interdisciplinary projects (neurorobotics and neuroprosthetics)

- **Existence and relevance of a policy for the allocation of resources**

Resources for research are obtained primarily through external grants.

As far as the panel understands, there is a common policy to allocate about 5-10% of resources to the research centre for activities of common interest.

- **Originality and existence of cutting edge projects**

The fMRI projects in both human and monkeys to search for cortical homologies and guide future single units recordings in behaving monkeys are excellent. The ensemble of planned techniques, some partially in use, are top rate and essential for filling the gap between monkey neurophysiology and human imaging studies. If achieved this should lead to a strong link between basic research in Neuroscience and applied clinical research.

- **Conclusion**

- **Summary**

The evaluation on the research conducted by the Team directed by Y. Trotter is positive.

- **Strengths and opportunities**

The major strength is the stability of the research group working towards a common goal. The results have to date been of excellent quality, and should be built on in future using a wide range of techniques.

Moving the lab in the Pavillon Baudot is a very positive opportunity, which will improve the exchange of expertise between researchers in different fields and also the formation of links between fundamental and clinical neuroscience.

The monkey facility is excellent, really facilitating primate research.

All this will certainly improve the visibility of this active Team.



## – Weaknesses and threats

As already noted, the weakest point is the quantity of publications in behaving monkeys, and the time taken to follow up important research, such as the identification of eye-position modulation in V1. Also, the number of researchers devoted to the single cell recording in the awake monkey is very limited.

## – Recommendations

To be aware that the quantity of publications can be increased. Also to publicize better their research to increase their visibility in the field. And if possible, to recruit more post-docs and grad students for “hands-on” work.

**Team 3 : PROS -**

**Team leader:** M. Simon THORPE

- 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)	2	2
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	8	4
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	6	1
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	0	0
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	0	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	9	8
N7: Number of staff members with a HDR or a similar grade	5	3

- Appreciation on the results
  - Relevance and originality of the research, quality and impact of the results

Most of the research sub-topics were related to the ultra-rapid discrimination among categories of visual stimuli. The team leaders were the source of these findings and they continue to be the leaders in the field. The phenomenon is not only a new discovery, but also have very profound implications regarding the neuronal mechanisms involved in rapid discrimination. During the reported project they introduced saccades as means for reducing time to response, with very promising results. They extended the questions of discrimination mechanism to the interactions of the process with attention. They also started to build models regarding how can the very first spike in each visual area be sufficient for discrimination.

- Number and quality of the publications, scientific communications, thesis and other outputs

They list 83 papers in journals. Of those 75 are quoted in the report, i.e. those perhaps relevant to the groups main research fields. This is a very satisfactory rate. They presented their results in 194 occasions, both national and international which is very impressive. In their web site they quote 60 peer reviewed article, 38 of which are in AERES excellent or very-good category (Neuroimage, J Neurosci, TINS, PNAS, Curr Biol).



- Quality and stability of partnerships (optional)

This is a reasonable cross talk between the projects.

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

They were able to attract new CNRS members and grew very fast till they felt that they should split. Several of their members joined the new team (#4). They had 8 post-docs in the present period, and 15 PhD students. For the coming 4 years there is only 1 postdoc and 6 PhDs. That has to improve. But considering the fact that 4 of the 7 members are new it will certainly do.

Number and reputation of the awards obtained by staff members, including invitations to international conferences and symposia

4 awards of national and international sources.

Ability to recruit high levels scientists, post-docs and students, and more particularly from abroad

Many of the post-Docs came from other institutions, or from abroad. Several of the new recruits came from Europe and 1 from US. Those that came from Toulouse spent several years as postDocs abroad before coming back.

Ability to raise funds, to successfully apply for competitive funding, and to participate to scientific and industrial clusters

Excellent. All together they raise over 1,035,000 Euro + 1,139,000 as a prize for one team member. In addition they had multiple collaborative grants with other institutions.

Participation to international or national scientific networks, existence of stable collaborations with foreign partners

Extremely visible in these.

Concrete results of the research activity and socio-economic partnerships

The team leader founded a new hi-tech company which after 10 years collects ~ 500,000 euro in revenues. The Alzheimer initiative in which they take part is very promising.

- Appreciation on the strategy, management and life of the team
  - Relevance of the team organization, quality of the management and of the communication policy (optional)

Discussions with the team members revealed very good atmosphere, good but liberal management. However the need for running all payments through the University is highly inefficient and should be altered!

- Relevance of the initiatives aiming at the scientific animation and at the emergence of cutting edge projects (optional)
- Contribution of the team members to teaching and to the structuration of the research at the local level

They have one University lecturer that has an impossible load for a researcher and as a result she is unable to run her own project. The other team members are contributing to the masters teaching program. They expressed interest in participating in undergraduate teaching.



- Appreciation on the project
  - Existence, relevance and feasibility of a long term (4 years) scientific project

The group is expected to shrink in the next period due to formation of a new group. The research plans are a step forward in the studies of the previous period, putting much more weight on doing electrophysiology to try and examine the validity of the conclusions derived from the past period. Namely, that the very first spike in each visual region contains enough information for discrimination. The studies will also extend into the auditory domain which is very important. The attempt to include also studies of intracranial LFP and single-unit recordings in patients is very relevant, novel, and should be supported. There is a good mutual interactions among sub-projects.

- Existence and relevance of a policy for the allocation of ressources

Most of the funds are allocated by the researchers from their individual grants according to the need of the research. The general funds are allocated by a committee. There were only praises regarding how it is managed and allocated.

- Originality and existence of cutting edge projects

Most projects are at the cutting edge of technology (intracranial recordings, fMRI and EEG coupled with very original psychophysical experiments and assessment of attention and pre-attention involvement in discrimination). The results will be relevant for both basic science and patient diagnosis.

- Conclusion :

- Summary

Excellent science. Original findings with high relevance for understanding processing in the sensory systems. The past 4 years yielded clear psychophysical basis for the next period in which the neuronal mechanisms will be investigated.

- Strengths and opportunities

The group is strong. Well balanced and holds promise for new insights into brain mechanisms of perception

- Weaknesses and threats

Two of their former PhD students became post-docs in the same group. This is not a recommended procedure. The 2 postdocs that stayed in the group had their PhD training elsewhere and then became research members. This is a reasonable procedure

- Recommendations

Continue with full support



#### Team 4 : CREMe-

**Team leader:** M. Rufin VANRULLEN (this is a new team so some of the comments will refer to prior work in existing teams)

- 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)	0	0
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	0	4
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	0	0
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	0	0
N5: Number of other engineers, technicians and administrative staff (Form 2.6 of the application file)	0	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	0	5
N7: Number of staff members with a HDR or a similar grade	0	2

- Appreciation on the results
  - Relevance and originality of the research, quality and impact of the results

The work of the team is highly original and potentially ground breaking. The emphasis is on levels of representation, perceptual awareness and temporal dynamics - three topics with extremely high potential impact. Past work from the researchers has been not only very well published but also very well cited (359 citations for the papers published between 2005 and 2009). One researcher exploits multistable perception which has become in recent years an effective tool to study the relationship between neural processing and visual experience. The team leader is often credited for some of the most controlled empirical evidence for periodic perceptual episodes taken at a rate of about 13 Hz. An innovative project studies the cyclic nature of visual experience showing perception alters as a function of the phase of the alpha rhythm and that attention may have a similar cyclic quality. This area could have significant impact on visual neuroscience. One team member studies the neural basis of intention and the experience of agency which has implications for understanding symptom of clinical populations. Another highlight is the work on the temporal basis of the perception of causality and agency. Another team member's work on conscious states has some relevance to human-computer interfaces although the mind wandering project appears more speculative.

- Number and quality of the publications, scientific communications, thesis and other outputs

The quality of the outputs from this team group is high. They have a considerable number publications in of ranking journals. Over the last 4 years the group has published 39 papers in peer reviewed international journals including 17 in journals rated as excellent by the AERES. In particular there are a few highlights including one paper in PNAS (2005), two in Current Biology (2006, 2009) and one in Journal of Neuroscience (2009). There are currently 4 PhD students which is appropriate for a group of young scientists.



- Quality and stability of partnerships (optional)
- Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners
- Number and reputation of the awards obtained by staff members, including invitations to international conferences and symposia

The team have all established international collaborations and although a young team have a high level of activity in terms of conference presentations and invitations to speak. Most notably, the team leader obtained the prestigious European Young Investigator Award (EURYI) in 2007. He also obtained a Bronze medal from the CNRS in 2007. In addition, one team member received a Young Scientist Award from Advanced Neuro Technology.

- Ability to recruit high levels scientists, post-docs and students, and more particularly from abroad

This group has attracted two excellent scientists in the last assessment period and recruitment in general appears good. There seems to be a healthy number of PhD students in this group. However, the group does seem to have the capacity to train more PhD students than it currently does. All the postdocs come from outside France (EU, India).

- Ability to raise funds, to successfully apply for competitive funding, and to participate to scientific and industrial clusters

The group has been successful in attracting funding, from the European Commission and from the French Research Council (ANR), which is promising for the future given the number of young scientists.

- Participation to international or national scientific networks, existence of stable collaborations with foreign partners

Because most team members have spent several years abroad, especially in the US, they have maintained a fertile network of collaborations.

- Concrete results of the research activity and socio-economic partnerships

Two members are two of the initiators of SpikeNet a CNRS supported start-up company which has been in existence for around a decade.

- Appreciation on the strategy, management and life of the team
- Relevance of the team organization, quality of the management and of the communication policy (optional)

This is a new team, but the leader presentation demonstrated an understanding of the various components of the project and how the team would work together, and communicated the objectives of the team enthusiastically and effectively.

- Relevance of the initiatives aiming at the scientific animation and at the emergence of cutting edge projects (optional)

One team member has initiated a national call for synesthetes to raise public awareness of this aspect of cross-modal perception.



- Contribution of the team members to teaching and to the structuration of the research at the local level

There is evidence of some contribution to research-based teaching: Schizophrenia, Neuroscience in Learning, INRP), Internal Training on EEGLab, Internal Training in MATLAB. Team members helped organise the CerCo winter school (14-17 Jan 2009).

- Appreciation on the project

The innovative and ambitious project aims to understand the dynamic construction of percepts across time (in particular using bistable or multistable perception), and the attentional mechanisms involved; to characterize the different levels of mental representations (including specific representations such as synesthesia and eidetic imagery) and their interactions (e.g. integration of motor and semantic knowledge into the representation of intentions); to compare different modes or states of consciousness (unconscious vs. conscious perception, meta-consciousness, meditative states, etc.), and to determine their neuronal correlates. The research uses a combination of experimental tools in human subjects such as psychophysics, EEG, fMRI and TMS, as well as computational modeling.

- Existence, relevance and feasibility of a long term (4 years) scientific project

The proposed research of this group is potentially ground breaking and innovative and the ideas behind the programme have received support from external funders. There is a clear direction for the research program over the next 4 years. Parts of the research program follow on from previous projects (e.g. the project on tri-stability), and these studies have already proved to be a feasible line of study. Other parts of the program are more risky (e.g. mind wandering) however it is valuable to have some element of risk in the program.

- Existence and relevance of a policy for the allocation of resources

On the new site (Purpan hospital) most resources will be shared, in particular the brain imaging equipment (fMRI and EEG) and some psychophysics infrastructure in collaboration with team 3.

- Originality and existence of cutting edge projects

There are a number of cutting edge projects within this groups proposals

- Conclusion

- Summary

This is a strong group of young researchers who have an innovative set of research projects which have the potential to deliver ground-breaking research. Their research project is original and they have accumulated funding to generate some high impact results. Overall, this is a very exciting enterprise.

- Strengths and opportunities

The primary strength of the team is the young age of the members. The work on perceptual and attentional dynamics and agency appears particularly strong. The interdisciplinarity of the team and the willingness to draw on multiple experimental techniques including modelling is a great strength of this group. They are also prepared to address fundamental issues in relation to perceptual experience and agency with effective experimental paradigms.



– Weaknesses and threats

It is clearly important the transition to the new building is accomplished successfully and that progress towards the research objectives of the group continues through the period of transition. It is also important that the group attracts PhD students to this area as it may well be an area that develops quickly internationally and new scientist will need to be trained.

– Recommendations

CREMe should be supported and helped to make the transition to the new accommodation.

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

Nom de l'équipe : PROCESSING DYNAMICS AND CORTICAL INTERACTIONS

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+





Nom de l'équipe : PERCEPTION OF SPACE

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

Nom de l'équipe : PROS

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

Nom de l'équipe : CREME

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+

Direction de la Recherche

Toulouse, le 24 mars 2010

Affaire suivie par  
Ghislaine MACONE-FOURIO  
téléphone  
05 61 55 66 05  
télécopie  
05 61 55 69 53  
courriel  
seccs@adm.ups-tlse.fr  
GF/GMF/FW

Le Président

au

Président du comité d'experts de l'AERES

**Objet : Observations de portée générale** sur le rapport d'évaluation  
de l'unité « **Centre de Recherche Cerveau et Cognition** » - CERCO – UMR 5549  
portée par **Michèle FABRE-THORPE**

Monsieur le Président,

Je vous remercie pour l'évaluation du Centre de Recherche Cerveau et Cognition » -  
CERCO – UMR 5549, dirigé par Michèle FABRE-THORPE et rattaché à mon établissement.

Je me réjouis que le Comité d'Experts de l'AERES ait reconnu la très grande qualité des  
recherches menées au CERCO. Les points à améliorer seront discutés avec la Directrice de  
l'Unité dans un esprit constructif pour l'avenir de la recherche à l'Université.

Vous trouverez ci-dessous un message de la Directrice de l'Unité apportant quelques observations  
sur le Rapport d'Evaluation de l'AERES.

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



Gilles FOURTANIER

## **Centre de Recherche Cerveau et Cognition » - CERCO – UMR 5549**

### **Observations de portée générale sur le rapport d'évaluation**

I would like to start by thanking the AERES visiting committee for the time they devoted to their thorough evaluation.

Indeed the CerCo was very impressed and honored by the fact that, in addition to CNRS and CNU representatives, seven foreign scientists of the highest international scientific standard agreed to take the time to conduct such an in-depth examination of the center.

The report is highly positive and we are very pleased that such a distinguished panel of experts described the CerCo as "one of the most attractive research units in French Neuroscience", pointing out the "overall excellence of its research", and giving its research program "the unanimous approval of the panel of experts for its originality, coherence, integrative nature" and for the "potential for groundbreaking discovery in each of the four groups".

We were pleased to note that the committee strongly encouraged the University of Toulouse to give the lab more support in terms of both financial investment and in the provision of academic and technical positions. The CerCo is about to move to new premises that do not belong to the University of Toulouse and we sincerely hope that the University will provide financial support for all expenses associated with the new housing of the CerCo.

The lab director of the Cerco would like to say that I was especially touched by the fact that the committee, in various places in its report, praises the CerCo's management that "promotes internationally competitive research in a friendly and collegial atmosphere". This is especially important for me as I strongly believe in the benefit of collaboration over competition especially at the level of a "research "unit".

The report calls for very few remarks on my side, and I will certainly follow the committee's suggestion of setting up an ITA committee (because of the recent increase in the number of ITAs) for more formal discussions. In a sense this recommendation gives me the opportunity to express one of my few real regrets: I would have liked the committee to make a formal appreciation concerning the remarkable support that CerCo scientists get from their ITA team. Indeed the same is also true concerning the students and post-docs whose dynamism is also a key factor in the success of the laboratory.

One other concern is that, with the exception of team PIs, I thought that no specific names were supposed to appear in an AERES report. The committee might consider anonymizing the very few remarks where names and/or initials appear in the report.

Team 1 DyTIC thanks the committee for their excellent evaluation. They just wanted to mention that Cochlear is not (unfortunately) a spin-off company, but a world leading cochlear implant company with which DyTIC has established a strong collaboration for its project on functional recovery of deaf patients after cochlear implant.

Team 2 ECO-3D thanks the committee for the positive evaluation on their research and project. They are aware that their productivity should increase and have no doubt that the excellent facilities offered for monkey research by the new technical platform will help. They also want to mention that their finding on the "egocentric fovea", that the committee found exciting and innovative, has just been accepted for publication in "Neuron".

Team 3 PROS thanks the committee for commenting on the international excellence of research and international visibility of Teams 3 PROS and 4 CREMe. The team would like to comment on two special points of the report. The apparent discrepancies indicated in the paragraph concerning publications are easily explained. The PROS team published 83



papers (90 by the time the committee came for the visit). The fact that we only explicitly mentioned 75 of them in the report is simply because of the page limit imposed by the AERES. The 60 peer reviewed articles listed on the CerCo's web site (that were made available for all committee members with all pdfs) correspond to the future PROS team and thus does not include the publications of the 3 PROS members that will constitute the CREMe team in the next "plan quadriennal". However, it does include the publications of the new team member that will join the lab in 2011.

I would also like to stress that all CerCo doctoral students, without exception, leave the lab after their thesis. The two PhD students that later became post-docs in the PROS group had both spent 2-3 years abroad. One of them was temporarily employed as a postdoc before being recruited as a software engineer by SpikeNet Technology, the startup company founded by Cerco scientists, and which develops artificial vision systems based on the labs research.

Team 4 CREMe thanks the committee for its excellent evaluation of this new group of 4 young scientists with an "innovative and ambitious" project. They would like to add that the element of risk (considered as "valuable" by the committee) in the mind wandering program, is minimized by the high expertise in new sophisticated EEG analysis methods (such as the development of EEGLab for example) of the team member in charge of the project.

I am grateful for such a positive evaluation that will only reinforce the dynamism and enthusiasm of all CerCo members to carry out their challenging research projects in the next four years.

Michèle Fabre-Thorpe  
Directrice du CERCO