Research evaluation

EVALUATION REPORT OF THE UNIT

LNC - Laboratoire de Neurosciences Cognitives

UNDER THE SUPERVISION OF THE FOLLOWING ESTABLISHMENTS AND ORGANISMS:

Aix-Marseille université

CNRS

EVALUATION CAMPAIGN 2022-2023

GROUP C

Rapport publié le 20/10/2023

In the name of the expert committee[1] :

Simon Thorpe, Chairman of the committee

For the Hcéres[2] :

Stéphane Le Bouler, president par intérim

Under the decree n° 2021-1536 of 29th November 2021:
[1] The evaluation reports "are signed by the chairperson of the expert committee". (Article 11, paragraph 2);
[2] The president of the Hcéres "countersigns the evaluation reports established by the expert committee and signed by their chairperson." (Article 8, paragraph 5).

This report is the result of the unit's evaluation by the expert committee, the composition of which is specified below. The appreciations it contains are the expression of the independent and collegial deliberation of this committee. The numbers in this report are the certified exact data extracted from the deposited files by the supervising body on behalf of the unit.

MEMBERS OF THE EXPERT COMMITTEE

Chairperson:	Mr Simon Thorpe, Université Toulouse 3 - Paul Sabatier
Experts:	Mr Benoit Cottereau, CNRS, Toulouse Mrs Véronique Deroche-Gamonet, INSERM, Bordeaux Mrs Christelle Lemoine-Lardennois, CNRS, Boulogne Billancourt (supporting personnel) Mr Joseph McIntyre, Mr Thomas Michelet, Université de Bordeaux Mrs Agnes Nadjar, Université de Bordeaux, (representative of CNU) Mr Simon Thorpe, Université Toulouse 3 - Paul Sabatier - UPS

HCÉRES REPRESENTATIVE

Mrs. Céline Souchay

CHARACTERISATION OF THE UNIT

- Name: Laboratoire de Neurosciences Cognitives
- Acronym: LNC
- Label and number: UMR 7291
- Number of teams: 12
- Composition of the executive team: Mr. Thierry Hasbroucq

SCIENTIFIC PANELS OF THE UNIT

SVE Sciences du vivant et environnement

SVE5 Neurosciences et troubles du système nerveux

THEMES OF THE UNIT

The LNC (Laboratoire de Neurosciences Cognitives) was originally created in 2002. In 2017, it hosted five research teams working on the neural substrates of cognition in pre-clinical models and humans, using a range of methodologies that included cognitive psychology and basic neuroscience. The specific areas of research included the mechanisms of attention, timing, memory, navigation and motivation, as well as the executive and cognitive functions underlying adaptive motor behaviour. Two other teams from the St Jerome campus in the north of Marseille were added to the list to extend the areas of research to include somatosensory processing and the control of feeding behaviour.

There was a second lab also located on the St. Charles campus that had overlapping interests. Originally called the Laboratory of Adaptivce and Integrative Neuroscience (LNIA), it had been renamed the LNSC (Laboratoire de Neurosciences Sensoriels et Cognitive). It included four teams that also worked on neural mechanisms in both pre-clinical models and humans, with a particular interest for sensory systems and the mental representation of extra personal space. The LNSC was particularly involved in studying pathological conditions and rehabilitation.

The two labs were fused at the start of 2021, and for the last two years, there have been a total of twelve teams with an overall objective of understanding the neural underpinnings of cognitive and sensory processing using a combination of behavioural methods and the analysis of neural activity in both normal and pathological conditions.

The twelve research teams evaluated by the HCERES panel are as follows

1. Cognition and pathophysiology of basal ganglia (BASALGANG)
2. Attention, Cerebral Dynamics and Chronometry (ACDC)
3. Neural bases of spatial cognition (SPACE)
4. Neural bases of sensorimotor behaviour (SENSORIMOT)
5. Music, Language and Writing (MULAW)
6. Neurodevelopmental of motor and social cognition (NEURODEV)
7. Neural bases of somatosensation (SOMATOSENS)
8. Brain, Obesity and diet imbalance (BODI)
9. Pathology and therapy of vestibular disorders
10. Neuronal and Dynamic Audition
11. Sensory and Cognitive Rehabilitation
12. Multisense and Body

HISTORIC AND GEOGRAPHICAL LOCATION OF THE UNIT

The LNC and the LNSC were two members of the 3C Federation (Pole 3C – Cognition, Cerveau, Comportement) that also included a third laboratory, the Laboratory of Cognitive Psychology (LPC). All three members of the 3C Federation were located on the Saint Charles campus of Aix-Marseille University.

Starting in 2017, the CNRS and University have progressively been trying to merge all the three components of the 3C Federation, as well as to move teams from the Saint Jérôme and Nord campuses as part of a larger effort to structure Neuroscience research in Marseille that has been continuing for two decades. The final objective is to have three main sites in the Marseille Neuroscience Network characterised by interfaces with three distinct areas.

Labs located on the Luminy site have a strong link with Biology, and include areas such as Integrative and Cellular Neurosciences, as well as Molecular and Developmental Neuroscience.
Labs on the Timone Hospital site favour the interface with Medicine, and include specialities such as Integrative and Clinical Neuroscience as well as Cellular and Molecular Neuroscience.

Finally, the Saint Charles campus site includes labs that have strong links with Psychology, and cover domains that include Cognitive and Social Neuroscience as well as Behavioural and Sensory Neuroscience.

Currently, the LNC occupies around 4,000 m2 located in buildings eight and nine in the Saint Charles campus.

It is important to realise that this restructuring of the Marseille Neuroscience community is still work in progress. Indeed, the current configuration of the LNC is only temporary. Although the HCERES panel was not given access to the detailed proposal, we did learn that the aim is to create a new structure that includes all the original labs on the Saint Charles site from the 1st of January 2024. We have however learned that the name of the future lab will be 'Centre for Research in Psychology and Neuroscience' — CRPN.

RESEARCH ENVIRONMENT OF THE UNIT

The LNC is one of several labs in Marseille that have overlapping interests in Neuroscience. The others include the CNRS and or INSERM labs such as the Laboratoire de Psychologie Cognitive (LPC) that is also located on the Saint Charles campus, the Institut des Neurosciences de la Timone (INT), the Institut de Neurosciences des Systems (INS) located at the Timone site, the Institut de Neurobiologie de la Mediterranée located on the Luminy site, as well as an AMU laboratory in Aix – Centre de Recherche en Psychologie de la Connaissance, du Langage et de l'Emotion (PsyCLE).

The lab is also part of several other structures in Marseille. As part of Aix-Marseille University's AMIDEX funding, the LNC participates in a thematic institute called 'NeuroMarseille' aimed at developing links between training and research. NeuroMarseille includes the 'NeuroSchool' EUR program that has an LNC member as its head.

Together with the Aix-based Laboratoire Paroles et Langage and the LPC, the LNC was closely associated with the creation of the LABEX 'Brain and Language Research Institute', which has since become a Convergence Institute called the Institute for Language, Communication and the Brain.

LNC was closely involved in the development of AMPIRIC (Aix-Marseille — Pôle d'Innovation, de Recherche, d'Enseignement pour l'Éducation ») and is also involved to a lesser extent in two other AMU financed thematic institutes – the Institute for Creativity and Innovation of Aix-Marseille (INCIAM) and Laennec: Numerical sciences and artificial intelligence for health.

The LNC is involved in national level research structures, including CNRS funded GDRs (Group de Recherche) in Memory and Vertigo, and an RTP (Reseau Thematique Pluridisciplinaire) related to education.

UNIT WORKFORCE: in physical persons at 31/12/2021

Permanent personnel in active employment	
Professors and associate professors	6
Lecturer and associate lecturer	22
Senior scientist (Directeur de recherche, DR) and associate	12
Scientist (Chargé de recherche, CR) and associate	13
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	29
Subtotal permanent personnel in active employment	**82**
Non-permanent teacher researchers, researchers and associates	4
Non-permanent research supporting personnel (PAR)	10
Post-docs	3
PhD Students	38
Subtotal non-permanent personnel	55
Total	**137**

DISTRIBUTION OF THE UNIT'S PERMANENTS BY EMPLOYER: NON-TUTORSHIP EMPLOYERS ARE GROUPED UNDER THE HEADING 'OTHERS'.

Employer	**EC**	**C**	**PAR**
Aix-Marseille Université	27	0	12
CNRS	0	24	15
CHU Marseille	0	0	2
Inserm	1	0	0
Université Claude Bernard Lyon	1	0	0
Total	**28**	**25**	**29**

UNIT BUDGET

Recurrent budget excluding wage bill allocated by parent institutions (total over 6 years)	**2,497**
Own resources obtained from regional calls for projects (total over 6 years of sums obtained from AAP idex, i-site, CPER, territorial authorities, etc.)	1,071
Own resources obtained from national calls for projects (total over 6 years of sums obtained on AAP ONR, PIA, ANR, FRM, INCa, etc.)	5,107
Own resources obtained from international call for projects (total over 6 years of sums obtained)	5,146
Own resources issued from the valorisation, transfer and industrial collaboration (total over 6 years of sums obtained through contracts, patents, service activities, services, etc.)	98
Total in euros	**13,119**

GLOBAL ASSESSMENT

The HCERES panel's global assessment is that the LNC is an excellent laboratory. One of the lab's twelve teams was not evaluated at all because the Neural Bases of Somatosensation team (one of the two teams that was supposed to move to the St. Charles site from the north campus of AMU), failed to provide any autoevaluation at all. Of the remaining eleven teams, three were considered excellent to outstanding, two were clearly excellent, and five others between excellent and very good. Only one team was considered to be very good, but this is a team that will not be maintained in the future proposal. While none of the teams was considered to be truly outstanding on all aspects of the evaluation, many scored very highly on the four main areas that were taken into account by the panel – namely Resources, Attractiveness, Scientific Production and Contributions to Society.

The period under evaluation has clearly been a challenge for the lab members and for its direction. The decision by the CNRS and the University to fuse two of the original labs on the St. Charles campus and to transfer two additional teams from the St Jerome site has generated a number of problems. And the process of regrouping the research labs on the site is still incomplete, given that the next stage will be to integrate the third lab from the original Pole 3C federation in the new project that will be evaluated in the near future.

However, the committee considers that the lab's direction has done a remarkable job in steering the fusion process, and they have successfully handled many of the challenges. There is a clear vision which means that the lab can look forward to the future with enthusiasm. There is every reason to believe that the stage has been set for a bright future where the new configuration will be able to play a key role in the development of Cognitive Neuroscience in Marseille.

DETAILED EVALUATION OF THE UNIT

A – CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

The recommendations made by the previous HCERES panel are in many cases no longer applicable because of the major changes in the structure of the lab, and in particular the fusion of three different structures (LNC, LNCS and the FR-3C) that took place on at the start of 2021.
However, the autoevaluation report contains detailed responses made at the level of the twelve individual teams. In the great majority of cases, these responses are quite appropriate and demonstrate that the lab members have taken the recommendations seriously.
For example, there were several cases where the panel recommended that team members obtain their HDR to allow them to participate in the direction of theses, and this seems to have been successful since 49 lab members have an HDR.
Recommendations to increase the number of applications for national and European level funding also appear to have been taken into account, with two ongoing ERC grants, a FET Open project, twenty ANR projects (of which 8 are led by lab members) and 32 other projects funded by other sources.
Only one team (team 7 'Neural basis of somatosensation') failed to respond.

B – EVALUATION AREAS

EVALUATION AREA 1: PROFILE, RESOURCES AND ORGANISATION OF THE UNIT

Assessment on the unit's resources

With 61 researchers and 33 support staff, the LNC has a remarkably well-balanced profile, with a near-perfect balance between permanent staff financed by the CNRS and the University, both for research staff and support personnel. Gender balance is also excellent. As with all labs, there are clearly particular areas where the level of technical support is suboptimal, or where the imminent departure of a member of the team could be problematic. However, in general, the unit has been successful in obtaining support from both the university and CNRS.

Assessment on the scientific objectives of the unit

Despite the fact that the current version of the LNC is the result of fusing two large laboratories and a federation on the Saint Charles site, with a third lab (LPC) that should be joining in the relatively near future, there is nevertheless a lot of overlap in the sorts of scientific objectives of the different teams. There is as almost as much variation between the teams originating from either of the labs, as there is between the teams from the two labs. As a consequence, the scientific objectives are generally coherent.

Assessment on the functioning of the unit

Overall, the lab functions well, despite the difficulties imposed by the fusion, and the problems caused by the Covid crisis. The self-evaluation report demonstrates that the direction of the lab has been doing a good job at respecting the requirements of a large structure of this sort. In addition, a lot of effort has been devoted to planning for the future reorganisation of the site with intensive discussions about how to restructure the different research teams.

1/ The unit has resources that are suited to its activity profile and research environment.

Strengths and possibilities linked to the context

With 61 researchers and 33 support staff, the LNC has a relatively well-balanced profile. As with all labs, there are clearly particular areas where the level of technical support is suboptimal, or where the imminent departure of a member of the team could be problematic. However, in general, the unit has been quite successful in obtaining support from the university and CNRS.

Nearly all the technical support staff have been mutualised and assigned to seven technical support teams: Financial Management, Computer and Information technologies, immuno-Histology and Molecular Biology, Human Experimentation, Photonic Imaging, Electronics and Mechanics, Zootechnics. This is a sensible strategy given the size of the lab and the large number of research teams. The allocation appears to have already taken into account the likely integration of the LPC.

The creation of several representative bodies allows all members of the lab to be associated with collective decision-making. The frequency of meetings appears sensible.

The lab received just over €2.5 million in recurrent funding (45% AMU, 55% CNRS), a split that is close to the split in salary costs.
They also obtained roughly €10 million in external funding. Roughly 49% comes from national sources such as the ANR, with around 50% coming from Europe, and 1% from the valorisation.

Weaknesses and risks linked to the context

The main problems that the lab faces are directly related to the major restructuring that has been taking place, with the elimination of the Pole 3C that used to be responsible for nearly all the support platforms. This process is continuing, with the planned fusion of the LNC with the Laboratoire de Psychologie Cognitive that is planned for 2024. The situation is thus in a state of flux which has not been easy to handle for the directors of the lab, or for the support staff. Hopefully, this period of uncertainty will end in the relatively near future.
The panel considers that having all the research and support teams in the same structure should be very beneficial.

2/ The unit has set itself scientific objectives, including the forward-looking aspect of its policy.

Strengths and possibilities linked to the context

The LNC has clearly been playing a key role in the structuration of the local research environment. They have set up internal committees that meet regularly to discuss strategy. This has obviously been complicated given the decision to fuse together three different labs, and the plan to integrate a fourth one in the near future.

The lab has a number of teams working in areas that have a significant impact for society, including work on ageing and other more specific health problems that include Parkinson's, Huntington's and Alzheimer's diseases, but also vestibular, cochlear disorders, Autism, Learning difficulties and Obesity. There area also teams involved in education-related research.

The lab has allocated some of its recurrent funding to set up a €30K investment fund in 2019 that has been used to finance shared equipment costs. They have also recently set up a solidarity fund.

Weaknesses and risks linked to the context

The geographical dispersion of the LNC's different teams has been a problem. At the beginning of 2018, they were spread over three different sites. But with support from the university, it has been possible to bring many of the teams together and provide some additional space on the Saint Charles campus.

One problem has been the lack of a dedicated meeting room. They can currently use the 'Salle des Voûtes' located in the basement of one of the buildings, but access is not currently guaranteed.

3/ The functioning of the unit complies with the regulations on human resources management, safety, the environment and the protection of scientific assets.

Strengths and possibilities linked to the context

The self-evaluation document describes in detail the various measures taken by the lab concerning respect for gender parity internal mobility and career development for its staff. The lab is clearly concerned with environmental issues, and has decided to implement protocols based on the recommendations of the Labo 1. 5 and EcoInfo initiatives.
It has well-defined procedures for handling emergency conditions, including the recent pandemic.

The lab has been able to take good advantage of the university's policy of providing promotions to Professor level that specifically target local candidates. This has been a very useful strategy that has allowed the promotion of candidates who have played important roles, both in the leadership of research teams, and in the development of the teaching programs.

Weaknesses and risks linked to the context

According to the excel sheet, the lab currently has seven professors, three of whom are PUPH, and 29 Maître de Conferences (3 of whom are MCUPH). This makes the ratio of 26/7 which is relatively favourable.

The difficulty of promoting support staff, particularly those at the bottom end of the scale (category C) is a problem. However, this is clearly not just a problem here.

EVALUATION AREA 2: ATTRACTIVENESS

Assessment on the attractiveness of the unit

The attractiveness of the LNC is clearly excellent. Lab members have been able to obtain an impressive amount of funding both at the national and European level, with twenty ANR funded projects and two ERC grants. They also have access to several high-quality research platforms, which makes the lab attractive to other researchers. The lab's strong links to other Neuroscience labs in the Marseille region, and the Brain and Language Convergence Institute, are also major advantages.

1/ The unit has an attractive scientific reputation and contributes to the construction of the European research area.

Strengths and possibilities linked to the context

Members of the LNC are regularly invited to present their work at international meetings, and the lab has organised international events including four European Workshops, three European and several national symposia.

Several lab members have editorial responsibilities in leading journals that include various Frontiers journals, but also Cell, Neuron, PNAS and Neuropsychologia. They have provided expertise for various funding agencies including the Medical Research Council (UK) and Science Foundations in Israel, Switzerland, Denmark and Canada. They have also played key roles in the European Brain and Behaviour Society (Presidence and Council members), as well as for several organisations at the national level (Association France Parkinson, GDR Vertigo, etc.).

Impressively, lab members obtained three CNRS bronze medals in 2016, 2017 and 2020.

Weaknesses and risks linked to the context

The panel noted no particular weakness related to the attractiveness of the laboratory, and its role in the construction of the European Research Area. Of course, the lab's members are strongly encouraged to continue to play a leading role.

2/ The unit is attractive for the quality of its staff hosting policy.

Strengths and possibilities linked to the context

The attractiveness of the lab is well demonstrated by the fact that from 2016 to 2020 the unit hosted Frederic Ambroggi, who obtained support from the ATIP/Avenir program.
The lab also recruited three CNRS researchers – Ambroggi in 2021 (section 25), Rochelle Ackerley in 2017 (section 26), and Pierre-Yves Jacob in 2019 (section 25). They also recruited Aline Frey in 2019 with a MCU position.

The lab has also hosted three guest researchers, two Canadians, and one from the USA, for a total of six months.

The attractiveness of the lab is also demonstrated by the fact that it has hosted eighteen postdocs, eight of whom were from abroad. Ten of the 75 PhD students were from outside France.

The lab takes scientific integrity very seriously, and has implemented a coherent policy for determining the authorship of papers.

Weaknesses and risks linked to the context

The self-evaluation report notes that one weakness may be the relative lack of cutting-edge equipment, but this is mitigated by the fact that Marseille is in general well positioned, and there are ample opportunities based on the existence of Convergence Institutes that should be able to promote collaborations.

3/ The unit is attractive because of the recognition gained through its success in competitive calls for projects.

Strengths and possibilities linked to the context

The reputation of the lab is also demonstrated by the fact that it currently hosts two ERC grants (one starting and one consolidator) with two others that have been submitted. It also hosts a FET-OPEN grant, with a follow-up proposal that is in preparation. The lab has obtained twenty ANR grants, with eight where the main proposer was a lab member, and 32 other grants.

Weaknesses and risks linked to the context

The ability of lab members to obtain funding from competitive calls is generally excellent, especially given the limited funds available. However, there are clearly teams that are clearly less successful and could be given extra support in preparing viable projects.

4/ The unit is attractive for the quality of its major equipment and technological skills.

Strengths and possibilities linked to the context

The lab has several research platforms that are shared between teams. They include a Human Behaviour and Neurophysiology, an Immuno-Histology and Molecular Biology facility, and a Kids Baby Lab.
It also has access to several external facilities that include an MRI scanner (located on the La Timone campus), a Photonic Microscopy platform, and high performance computing facilities provided by the University.

Weaknesses and risks linked to the context

The restructuring of the St. Charles research campus and the fact that the research platforms were originally attached to the Federation de Recherche – Pole 3C – has been a challenge for the direction. There have clearly been concerns among members of the support staff about the transition. Nevertheless, globally, it is clear that the lab equipment and technological skills are clear assets, and add to the lab's attractiveness.

EVALUATION AREA 3: SCIENTIFIC PRODUCTION

Assessment on the scientific production of the unit

The scientific production of the lab is globally excellent, with at least three teams where the output that is not far from being outstanding. Some of the teams have been less productive, but even the weakest teams have a level of scientific output that is at least very good. Overall, the level of output is perfectly satisfactory given the number of permanent staff and the level of funding support. It is clear that problems related to the Covid pandemic and the major restructuring of the site will not have helped, but these difficulties will hopefully be temporary.

1/ The scientific production of the team meets quality criteria.

Strengths and possibilities linked to the context

The list of publications provided by the Lab includes a total of 436 publications for the period 2016–2021. This number is nearly identical to the list of 438 publications obtained using Scopus and searching for either 'Laboratoire de Neurosciences Cognitives' (Affiliation ID = 60,107,158) or 'Laboratoire de Neurosciences Sensorielles et Cognitives' (Affiliation ID = 60,107,111), which have been cited well over 5,100 times, indicating 11.8 citations per article on average.

When divided by the number of permanent research staff, and giving the weighting of 0.5 for staff with teaching responsibilities, this is equivalent to 1.8 publications per researcher per year.

Forty of the publications are Reviews, with six book chapters, five conference papers, four editorials and six Letters. The list includes 249 articles. Around 105 publications are not in open access journals.

Thirty-nine percent of the publications are in the top 25% of papers in terms of citation rate, which is above average.

The list of publications includes papers in some high-profile generalist journals including Nature Communications (4) and Scientific Reports (14) as well as more specialist journals such as Cerebral Cortex (6) and NeuroImage (10).

In terms of training, a total of 40 students obtained a PhD, with two students abandoning the thesis before finishing.

Weaknesses and risks linked to the context

The global level of scientific output is certainly excellent. That said, the overall influence of the research in terms of the level of citations is somewhat disappointing. For example, although 39% of the lab's output is in the top 25% of publications for citation rates (which is clearly above average for the field), when stricter citation rate thresholds are used, the picture is less impressive. 10.5% are in the top 10% in terms of citation rate, 4.3% in the top 5% and just two papers (around 0.5%) are in the top 1%. This suggests that the output of the lab may not be getting the recognition it deserves.

It is also notable that there are still quite a few publications that are not in open access journals. The CNRS now insists that all publications should be available via the HAL repository, but while this is certainly important and useful, using open access journals can be even more effective in making a lab's output easy to access.

Another potential weakness could be related to a number of presentations at international conferences, which are a good way to promote the lab's research activity. Obviously, this sort of activity will have been made more difficult by the Covid pandemic, which has seriously limited travel. Again, this will hopefully change in the near future.

2/ Scientific production is proportionate to the research potential of the unit and shared out between its personnel.

Strengths and possibilities linked to the context

Most of the analysis of the lab's scientific production is done on a team-by-team bases. There is an initial section in the self-evaluation document that compares the production of the different teams and notes that there are large variations in the number of papers produced relative to the number of research staff, with 'Team 2 being the most productive and Team 8 the least'. They attempt to see if there are any simple explanations of these differences, but there is clearly a mixture of factors. Team 8 is the only one that has been forced to move during the period, and this almost certainly led to a drop in output. The factors also include the proportion of full-time CNRS staff. But another factor is probably the use of preclinical models because four of the least productive teams use them.

Using Scopus as a source, it would appear that globally, the LNC has produced a reasonable number of publications for a lab of its size. The number visible in Scopus (438) is close to the number that the lab lists in the Excel sheet.

Using the Scopus based data, it can be seen that the lab's publications between 2016 and 2021 have been cited over 5,160 times, which gives an average number of citations per publication of around 11.8.

Sixteen papers are in the top 5% in terms of the number of citations (3.8%) and 42 papers are in the top 10% for citations. Such numbers are close to what would be expected.

Another criterion of the quality of the lab's output is provided by the fact that around 60% of the lab's publications appeared in the most relevant journals of their disciplines.

Weaknesses and risks linked to the context

While the average citation rate of 11.8 per article and the percentage of articles highly visible through their citation rate are fine, the figures are not particularly exceptional. Likewise, while the percentage of articles appearing recognised disciplinary journals is good, the percentage of publications in prestigious journals is not high with essentially any publications in the most prestigious multidisciplinary journals.

3/ The scientific production of the unit complies with the principles of research integrity, ethics and open science.

Strengths and possibilities linked to the context

The LNC appears to have appropriate mechanisms in place to ensure that the scientific production of the lab complies with the principles of research integrity, ethics and open science. Most of the teams have clearly defined rules for authorship, and there do not appear to have been any major problems during the evaluation period. Indeed, it is notable that one of the teams that was supposed to join the lab has not been integrated, and that it seems that this may be related to an ongoing investigation related to the scientific integrity of some of the members of the team. This level of integrity is to be commended.
The lab also seems to have clear policies concerning the ethical use of both humans and preclinical models in research. Furthermore, there is little evidence that lab members have been tempted by so-called 'predatory' conferences and journals. Nor is there any reason to question the lab's policies concerning the traceability, storage and accessibility of research data.

Weaknesses and risks linked to the context

The panel did not identify any particular weaknesses in this area.

EVALUATION AREA 4: CONTRIBUTION OF RESEARCH ACTIVITIES TO SOCIETY

Assessment on the inclusion of the unit's research in society

Overall, the LNC's links with society were considered to be excellent. Some of the teams were even rated as outstanding in terms of societal impact. There are numerous examples of teams with active partnerships with industry. For example, the Vestibular pathology team has collaborations with pharmaceutical companies involved in the development of antivertigo medications and has filed two patents. Another example is the Multisense and Body team's collaborations with companies that include l'Oreal and Clarins. Many of the lab's researchers are involved in promoting scientific research for the general public. The lab also plays a vital role in the development and administration of several teaching programs.

1/ The unit stands out by the quality of its non-academic interactions.

Strengths and possibilities linked to the context

The LNC has actively pursued a policy of developing partnerships with actors in the non-academic world, including the social and community sectors, industry and culture. Several teams have a particularly strong presence in the area. For example, the MULAW team is actively involved in developing collaborations with local schools to evaluate the impact of choral music on the academic and cognitive performance of elementary school pupils. It is also working with the Police to develop a handwriting database that could have applications in criminology. A further example is provided by the Sensory and Cognitive Rehabilitation team's efforts to develop an e-education web platform for patients with head trauma.

Weaknesses and risks linked to the context

While many of the teams are actively involved in promoting nonacademic interactions, there are a few exceptions. But, generally, this was only visible in the case of relatively small teams.

2/ The unit develops products for the socio-economic world.

Strengths and possibilities linked to the context

Several teams have ongoing collaborations with industrial partners, and there are a number of projects that have real commercial potential. This is particularly true for the Vestibular and Body Sense teams that have active collaborations. Other teams, including the Audition team, have developed diagnostic tests for auditory problems including hyperacusis and misophonia that have considerable potential for applications. The laboratory has also been involved in the creation of start-up companies such as ASPertise, set up in 2016 to help people with ASD (Autism Spectrum Disorders).

Weaknesses and risks linked to the context

In some cases, there are teams that would be keen to increase their interactions with industrial partners but where it has not yet been possible to find the right collaborators.

3/ The unit shares its knowledge with the general public and takes part in debates in society.

Strengths and possibilities linked to the context

Many of the lab's members have been actively involved in promoting science to the general public via the organisation of debates and presence in the media (radio, press, etc.).

Weaknesses and risks linked to the context

While many lab members have been playing an active role in sharing knowledge with the general public, this is by no means universal, and there is definitely room for improvement.

C – RECOMMENDATIONS TO THE UNIT

Recommendations regarding the Evaluation Area 1: Profile, Resources and Organisation of the Unit

The committee's ability to make clear recommendations concerning the profile, resources and organisation of the unit are clearly limited by the fact that it was not given access to the document concerning the future project that was submitted a few days after the visit. Nevertheless, the general idea of fusing the LNC with the Laboratoire de Psychologie Cognitive seems very sensible, and makes a lot of sense. We understand that the proposed name for the new laboratory will be the CRPN – Centre for Research in Psychology and Neuroscience, and that the lab will have Boris Burle as director, with two deputy directors – one from the original LNCS laboratory (that had fused with the LNC at the start of 2021) and another from the LPC.
If this is the case, the committee recommends that the members of the LNC seize the opportunity to further promote the laboratory as one of Marseille's key players in Cognitive Neuroscience and at the interface between Neuroscience and Psychology.
There are several existing teams within the LNC that are working in areas that overlap with the interests of teams working at the Laboratoire de Psychologie Cognitive, and it would make very good sense to try and reduce the total number of teams by bringing together researchers working in areas such as Vision, Audition and Language.
The committee also considers that the future laboratory should continue the strategy of mutualising technical support by concentrating resources in platforms that are available to all members of the lab. This is already effectively the case because there are very few permanent support staff that are not entirely affiliated to a technical platform.
The committee considers that the lab's policy of reserving funds for developing particular research programs is to be actively encouraged, and will be very important for allowing new research initiatives to be started, particularly in the period before large-scale national or European funding is available.
Lab members should also continue to play an active role in promoting activities related to structures such as the Brain and Language Research Institute. The Aix-Marseille site has been particularly successful in obtaining this sort of funding, and the future lab ought to be at the centre of such developments.
Given that the lab will have both a relatively large number of research teams and several research support platforms, it will be particularly critical to maintain communication between the two sectors. Regular meetings should be held with the direction and all the actors to ensure that decision-making is as transparent as possible. It may be that increasing the number of meetings of the full-lab council, with elected representatives of all the different groups (students, postdocs, support staff, teaching staff and researchers) could help ensure that information circulates fluidly. Such communication is particularly vital during a phase of major restructuring.

Recommendations regarding the Evaluation Area 2: Attractiveness

The committee recommends that the lab continues with its policies for promoting the attractiveness of the site. In particular, the lab could further augment the number of international and European congresses that it organises, and encourage lab members to participate in the scientific committees involved in planning such meetings as well as steering committees at the international, European and national levels.
The lab should also actively encourage its members to take on editorial responsibilities in internationally recognised journals.

Given the reduction in social activities that resulted from the pandemic, it will be particularly important to re-establish such measures rapidly, to avoid students feeling isolated. There have already been retreats associated with the planned fusion of the LNC with the LPC, and such meetings should be continued at regular intervals – ideally once a year.

The lab should also continue to welcome both junior and senior visiting researchers, which are key to generating the pool of potential candidates for both CNRS and University positions.

The lab should actively help prospective applicants for ANR and European funding by providing feedback to potential PIs during the development phase.

The lab should promote the existence of the various research platforms both within the lab, and in the local environment that are such a key part of the attractiveness of the lab. Opening the facilities to outside researchers (possibly by charging for the use of resources) would be another way of increasing the visibility of the site.

Recommendations Regarding Evaluation Area 3: Scientific Production

The committee encourages lab members in their ambition of ensuring that 100% of the lab's production is freely accessible in the next two years. Of course, it is now highly recommended for all publications to be made available in HAL, but global accessibility is particularly favoured by publishing in Open Access journals. While there is a cost associated with the use of such journals, the lab is well funded, and should make sure that publication costs are covered for all lab members.

Globally, the lab should be encouraging its members to concentrate on the quality of the research, rather than the number of publications. While the committee discourages the use of using pure Impact Factor measures as the criterion for choosing where to publish, there are a number of open access sites that allow the best journals for publication in a particular scientific area in a field weighted way and which can rapidly determine whether newly established journals are good places to publish.

It is important and worthwhile that all lab members give the lab as their affiliation, rather than simply their affiliation with the CNRS and University. It is also useful that individual researchers monitor the literature to see whether their work gains influence in their disciplinary communities through citations and comments.
When publishing particularly significant work, the lab should actively encourage the CNRS and the University to promote the research via communiqués.
The committee also strongly encourages the lab to promote open science with sharing of complete data sets and methods.

Recommendations regarding Evaluation Area 4: Contribution of Research Activities to Society

The lab has been quite successful in promoting links with society, and this sort of activity should be actively encouraged.

TEAM-BY-TEAM ASSESSMENT

Team 1 Cognition and pathophysiology of basal ganglia (BASALGANG)

Name of the supervisor: Mr. Abdel-Mouttalib OUAGAZZAL

THEMES OF THE TEAM

The work of team 1 focuses on the pathophysiology of the Basal Ganglia (BG) in the context of Parkinson Disease (PD). The team is interested in how meso-striatal dopaminergic and cortico-striatal networks interact to support motor and cognitive behaviours. Using pre-clinical models, they address questions from behaviour to neurochemical systems through molecular signalling pathways. Techniques applied to 6-OHDA-induced models of PD range from biochemistry, pharmacology to cell-type targeted optogenetics. Team 1 has been a partner of a H2020 European project aimed at refining in vivo real time recording and manipulation of brain activity through the development of wireless micro-scale devices for electrophysiology, optogenetics and ultra-localised drug delivery.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

All team members should be involved in knowledge transfer.
A researcher produced a MOOC and up to ten outreach activities were produced over the reporting period, although most involved just one researcher.

Regarding research strategy, the team should
1. Focus research on a smaller number of well-identified projects
The research projects were more focused on the role of cortico- and meso-striatal inputs in the modulation of motor and cognitive functions in normal and PD conditions.
2. Strengthen the scientific link with the Atip/Avenir team
The scientific link is not attested by common publications yet, but by a co-partnership in a H2020 project.
3. Increase the scientific visibility of the new team leader by improving its network in basal ganglia research
The team was a partner of a H2020 project, which indicates research visibility of the team. However, there are no apparent responsibilities of the team leader in PD-related research networks (e.g. GDR) or foundations.
4. Seek more technical support
The team hired an engineer for two years, but the team needs support to secure technical support on a long-term.
5. Make every effort to integrate all team members into the projects.
Based on publications, the integration of the teacher researcher in the team projects appears still limited.

WORKFORCE OF THE TEAM

Permanent personnel in active employment	
Professors and associate professors	0
Lecturer and associate lecturer	1
Senior scientist (Directeur de recherche, DR) and associate	1
Scientist (Chargé de recherche, CR) and associate	2
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	0
Subtotal permanent personnel in active employment	**4**
Non-permanent teacher researchers, researchers and associates	0
Non-permanent research supporting personnel (PAR)	0
Post-docs	0
PhD Students	1
Subtotal non-permanent personnel	1
Total	**3**

EVALUATION

Overall assessment of the team

Team 1 had a very good to excellent activity considering its low number of full-time researchers. Attractiveness is very good to excellent with the recruitment of a CR in 2021 and the supervision of four PhD students. Funding is very good to excellent with a H2020 grant as partner (StarDust, 534 k€). Production is very good with seven original articles in journals with very good to excellent visibility (e.g. J Neurosci, Neurobiol Disease). Links with society are very good to excellent with public conferences, partnership with industry and implication in international events (NeuroFrance 2019).

Strengths and Possibilities linked to the context

The team has shown that it can be attractive. By the end of 2021 the leader of team 13 (Atip) has been recruited as CNRS researcher and two senior scientists with complementary expertise in electrophysiology and molecular biology will join the team in the next quinquennial plan. The team supervised four PhD students.

The team is visible. Members gave nine invited oral presentations between 2017 and 2021 including in six international congresses (e.g. EBPS 2017 Greece, EBPS 2019 Portugal, 9th international meeting on mGlu receptors 2017, Italy). The team contributed to international congresses through sixteen posters from 2016 to 2021 (e.g. IBAGS 2019 France; NeuroFrance 2019; FENS 2018, Germany; FENS 2016 Denmark; EBPS 2017, 2019). One senior researcher contributed to the redaction of the document '*Consensus Statement on European Brain Research: the need to expand brain research in Europe*' (EJN March 2016). The team has ongoing collaborations with local (Goaillard JM, INT, Marseille), national (Paoletti P, IBENS, Paris) and international researchers (Nicoletti F, La Sapienza, Italy; G. Paolone, Univ Ferrara, Italy).

The mean PhD duration is four years and the three students who defended had been published as the first author.

Scientifically, the team provided the first empirical evidence that zinc, an atypical neuronal messenger that is co-released with glutamate by a subpopulation of cortico-striatal neurons is a key actor in the pathophysiology of PD (Sikora et al., Neurobiology of Disease, 2020). The team has implemented new tools and technologies (e.g. production of genetically modified mouse lines and behavioural procedures). As a partner in an international consortium (FET OPEN H2020, STARDUST project, 2017–2022), the team is involved in the development of a microscale implantable device to monitor and modulate the activity of basal ganglia circuitry for Parkinson's disease states. These technological and methodological advancements should favour cutting-edge research and help increase publications in high-profile journals.

Considering the actual number of researchers over the reporting period, i.e. 2.5 researchers full-time equivalent, the production is very good with eleven publications including seven original articles (6 as PI), one book chapter and three reviews as PI, in journals with very good to excellent visibility (J Neurosci, Neurobiology of Disease, Inter J Mol Sciences).

In terms of contribution to society, the established partnership with industry through the European StarDust project is expected to lead to technological breakthroughs in many areas (e.g. photonics, drug delivery, neuronal activity monitoring). Also, the team helped organise the NeuroFrance 2019 congress (president of the welcome committee) and produced a MOOC on preclinical models of PD. Regarding outreach activities, from 2016 to 2021, the team has been involved in ten activities, including three conferences toward the lay public and sessions for the education of Marseille school pupils.

Weaknesses and risks linked to the context

The limited number of permanent full-time researchers (2.5) over most of the reporting period has limited the production capacity. It may also have affected fund-raising, as the team was not the principal investigator on competitive grants over the reporting period. The limited number of permanent researchers was unfortunately not compensated by postdoctoral researchers, which potentially reflects a lack of resources, without forgetting, however, that the Covid pandemic impacted non-permanent recruitment.

The lack of permanent technicians is a risk for the sustainability of techniques within the team.

The newly recruited CNRS researcher (ex-team 13 leader) will not remain in the team for the new contract. While his expertise, the originality of his questionings, his production in high-profile journals (J Neurosci 2020, Curr Biol 2019, Neuron 2016…) would have been clear benefits to the team, his scientific interests were not easily connectable to the team without a major reorientation from his side or the team's side.

Based on the publications, it seems that there is no collaboration with other teams of the LNC. Considering the limited human resources of team 1, it may have been beneficial to collaborate locally.

The scientific production of the teacher researcher (2 articles) is limited in number. Authorship also (one paper as co-last in 2016) questions the time the teacher researcher is able to dedicate to carry out their own projects.

The implication of the team in evaluation activities appears limited, at least based on the available data.

RECOMMENDATIONS TO THE TEAM

Specific provision of time to apply for larger grants as principal investigator would be beneficial, and if successful, would address the lack of postdoctoral staff.

The committee recommends that the team works on preparing for the future during the coming contract and encourages the team to recruit and bring young researchers to the forefront.

If scientifically relevant, seeking local collaborations might be beneficial, notably for partially compensating for the lack of technical support.

At terms, securing permanent technical support would be decisive considering the recent implication of the team in technological developments, which the committee encourages pursuing.

Attendance of larger international conferences by the PI might help further developing international visibility.

The committee encourages the team to pursue efforts in increasing contribution of research to society, through educational actions but primarily by contributing to evaluation activities and evaluation bodies.

Team 2 Attention, cerebral dynamics and chronometry (ACDC)

Name of the supervisor: Mr. Boris BURLE

THEMES OF THE TEAM

The central theme of the team 'Attention, cerebral dynamics and chronometry' is the neural bases of cognitive control and time estimation studied thanks to a combination of behavioural, electrophysiological, neuroimaging, stimulation tools as well as a modelling approach. The team is interested both in normal and pathological populations, in both adult and infant subjects. Hence the team as the capability to tackle the same questions along a neurodevelopmental axis and a normal to pathological continuum. This makes the team's project original with a clear and straightforward direction toward a better understanding of the contribution of a few but very-well-defined brain regions in very well circumscribed cognitive processes.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

***1**. It seems important to devote effort toward grant applications.*
This only recommendation based on the previous evaluation stressed the importance devote effort toward grant applications. The team demonstrated a real fund-raising capacity in the past and has secured two ANR grants during the evaluated period with a clear wish to appropriately scale its funding to its actual research capacities. Considering the level of publication of the team, this strategy appeared to be effective and fair enough!

WORKFORCE OF THE TEAM

Permanent personnel in active employment	
Professors and associate professors	3
Lecturer and associate lecturer	0
Senior scientist (Directeur de recherche, DR) and associate	2
Scientist (Chargé de recherche, CR) and associate	1
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	0.5
Subtotal permanent personnel in active employment	**6.5**
Non-permanent teacher researchers, researchers and associates	0
Non-permanent research supporting personnel (PAR)	0
Post-docs	6
PhD Students	6
Subtotal non-permanent personnel	12
Total	**18.5**

EVALUATION

Overall assessment of the team

Overall, the Attention, cerebral dynamics and chronometry team is an excellent to outstanding team. Its international visibility is sustained by an excellent track record of publication over the evaluated period despite the heavy involvement of two team members in time-consuming unit administration functions. The organisation of the team is well balanced with a good proportion of professors (full or assistant) full-time researchers and clinicians and a part-time IR.
The team demonstrates a constant interest in studying the same brain regions involved in the same cognitive processes, which turns out to be a very efficient strategy. A specific effort will be necessary to compensate for the probable retirement of two very contributive team members.

Strengths and possibilities linked to the context

One of the strengths of the team is its constant and in-depth study of the same neuronal brain regions investigated in the same cognitive functions. This tenacity is certainly one of the keys to the international reputation of the team since the study of the neural bases of executive functions and time estimation is grounded on a recognised experience regarding the behavioural bases on which the study of the neural substrate should always be based. In this respect, the permanent questioning of the team of apparently well-known cognitive processes (e.g. time estimation, action monitoring, conflict, error…) does an important and salubrious service by challenging the pertinence of these processes and thereby their neural bases.

Once the behavioural approach is well grounded, the team uses a combination of a wide range of approaches (electrophysiology, fMRI, stimulation, and modelling) which allows for a strong input to the understanding of the neural bases of adaptive behaviour. Such a strategy has proven to be very effective given that the team published no less than 135 articles in the best journals of experimental psychology (e.g. JEP: General, J Cognitive Neuroscience, Trends in Cognitive Science).

Beside scientific production, the team secured two ANR grants but also a few other grants (e.g. PHC, ICR NeuroMarseille) which allows for a smooth implementation of the research projects. Also notably, the team has organised four international meetings and its members have been repeatedly invited to international meetings. Finally, the team is part of the editorial board of various journals (J. Psychophysiol. Neuropsychologia, Timing and Time perception).

In a near future, a kid's lab will be created and team 2 should benefit from this new platform, making possible a real 'ontogenetical' approach to cognitive control thanks to the transfer in children of the tools already mastered in adult subjects' experiments. This provides a great opportunity to make significant progress in the understanding of cognitive functions and dysfunction in the next few years.

Weaknesses and risks linked to the context

The main (but anticipated) weakness of the team is the upcoming retirement of a significant proportion of the researchers.
Regarding the number of HDR and the potential of training through research, it seems that the number of recruited students during the period was a bit low. However, this could be related to the heavy administrative burdens on some of the team's members and to a deliberate policy of only recruiting students when an appropriate and continuous mentoring is possible.
The contribution of an engineer (IR1 CNRS, ½ of her time) to the projects of the team does not appear very clearly, which may result in a lack of efficiency to ask for an increase in research support probably needed in the future, especially in the context of the creation of a kid's lab.

RECOMMENDATIONS TO THE TEAM

The team has a well-established national and international collaborative network, but there would certainly be mutual benefit from developing collaboration with other teams of the lab.
The committee recommends that the team remains attentive to the risk of the (already anticipated) departure of key members, which may cause a loss of competitiveness in the future.
Increasing the attractiveness toward PhD students could be important to maintain the development of the current and upcoming projects, as well as to ground the future of the different projects in the next period. A greater implication of training through research would also be very beneficial for the students!

Team 3 Neural bases of spatial cognition (SPACE)

Name of the supervisor: Ms Francesca SARGOLINI

THEMES OF THE TEAM

The main research topic of the Space team is spatial cognition. For this purpose, this team has developed a multidisciplinary approach based on the combination of fine behavioural procedures with electrophysiological recordings, selective brain lesions and reversible inactivation. Emphasis is put on the role of the hippocampus and several neocortical areas (entorhinal, prefrontal, parietal, …) thought to be involved in distinct functions associated with spatial processing and spatial navigation.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The previous committee encouraged all the team members who did not hold their HDR to defend it. The process is in progress as two members are currently writing their HDR thesis and should be ready to apply and defend soon. The committee also suggested that the team implements optogenetics or DREADD tools to complement the current lesion and pharmacological approaches, and these two techniques are now under development in the lab. Finally, the previous committee remarked that technological developments in the team could strongly benefit from the support of a dedicated engineer. Unfortunately, the number of engineers in the unit has decreased even more over the last years and so this issue remains unsolved.

WORKFORCE OF THE TEAM

Permanent personnel in active employment	
Professors and associate professors	1
Lecturer and associate lecturer	1
Senior scientist (Directeur de recherche, DR) and associate	2
Scientist (Chargé de recherche, CR) and associate	1
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	1
Subtotal permanent personnel in active employment	**6**
Non-permanent teacher researchers, researchers and associates	1
Non-permanent research supporting personnel (PAR)	0
Post-docs	0
PhD Students	1
Subtotal non-permanent personnel	2
Total	**8**

EVALUATION

Overall assessment of the team

Overall, the SPACE team is an excellent to outstanding team. Attractiveness, funding and production are excellent, with a researcher recruited, about 1 M€ collected through national grants, and five articles published per full-time researcher, including some in excellent supports (J. Neurosci, Nature Comm). Contribution to society is excellent to outstanding with a leading role in the local structuration of research and training (NeuroMarseille Institute), responsibilities in four research societies and in collective tasks (ethical committee, teaching).

Strengths and possibilities linked to the context

The Space team is the only team in France studying the functional properties of all the main classes of neural populations coding for spatial cognition (place cells, grid cells and head direction cells). It was at the origin of the first study published on grid cells in France. Its members developed a unique expertise in behavioural investigations, coupled with innovative techniques to record (single unit) neuronal activity in real time, and are now involved in implementing techniques to interfere with neural activity (optogenetics and chemogenetics). This expertise was notably acknowledged through the CNRS bronze medal awarded to one of their members in 2017, who had also been a member of the Institut Universitaire de France from 2012 to 2017. Over the evaluated period (2016–2021), the team published twenty articles in peer-reviewed journals, some of which are in the best supports of the discipline (see e.g. Cholvin et al., J. Neuroscience 2019; Duvelle et al., J. Neuroscience 2019; Jacob et al., Nature Comm 2019). These studies included collaborations at both the national and international level (more than 40% of the publications were realised in collaboration with foreign partners).

The team is clearly very attractive and hired three postdoctoral researchers over the reporting period. One of them, recruited in 2020 as a CNRS researcher in the team, has a high-profile publication record (Nature Neurosci 2017; Nature Comm, 2020, both as first author) and is a strong addition to the team.

The team has a clearly defined strategy, with each member responsible for at least one project and strong interactions between members (as can be observed in their numerous co-publications). During the evaluated period, the team supervised or co-supervised six PhD students (n=5 and 1, respectively) who all, as the three postdoctoral researchers, contributed to the team's scientific production.

During the evaluated period, the members of the Space team were involved in five ANR projects, including two for which they were coordinators (ANR THALAM, 368 k€ and ANR JCJC ConnecSpace 110k€). The team also coordinated two major projects funded by AMU-AMIDEX and FRM grants (200 k€ each) and three grants from the Féderation 3C. In total, the team members obtained more than 1 million euros of funding over the last five years.

The team members are heavily involved in collective tasks, notably through their participation in the committees of learned societies. Beside their teaching duties, three team members also have responsibilities in teaching organisation (e.g. co-direction of a Neuroscience Master Program). The team plays an important role in the local scientific and training integration of the LNC; a team member co-supervised the application and defended the NeuroMarseille Institute project, which brings together nine research institutes (3,000 people) and the graduate school in neuroscience NeuroSchool (EUR).

Weaknesses and risks linked to the context

Although the sanitary crisis surely complicated this point during the evaluated period, the average duration of PhD theses in the team could be lower.

While fund-raising has been very successful, it concerns national grants exclusively. Team members are not involved in internationally funded grants.

While the number of engineers has decreased in the unit over the last years, the team would need more technical support to pursue its research in the best conditions.

RECOMMENDATIONS TO THE TEAM

The committee recommends that the SPACE team continues its very high quality and interdisciplinary research work. It acknowledges the effort made by the team to allow the more junior researchers to obtain their HDR qualification. Indeed, it encourages these young researchers to take more responsibilities in the upcoming years in terms of student supervision. The committee also encourages team members to apply more for European or international collaborative grants.

The committee encourages the team to try to avoid exceeding three years for the duration of the PhD theses.

Finally, the committee recommends the recruitment of new technicians and/or engineers in order to maintain the excellent scientific level of the team.

Team 4 Neural bases of sensorimotor behaviour (SENSORIMOT)

Name of the supervisor: Dr. Jean BLOUIN

THEMES OF THE TEAM

The team studies the neural bases of the control of voluntary movements and posture in humans. A recurrent theme is that of the weighting of sensory information used to guide voluntary motions and posture, with the hypothesis that sensory modalities are combined with weighting factors that reflect the reliability of the sensory signals in each channel, reminiscent of the principles underlying a Kalman filter. Typically studied using psychophysical techniques such as observing reactions to sensory conflict between visual, vestibular and kinaesthetic sensory cues during targeted motions, these techniques are extended to include tactile sensation in the control of body posture and uses EEG to tie together the observed motor behaviours and the neurophysiological substrates in the CNS.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

Three recommendations were presented during the preceding HCERES review:

- 1. For the coming period, the focus could be increased by identifying key common questions to be tackled from the different angles provided by the various tasks and experimentations planned.
- 2. The team should try to attract more visiting researchers.
- 3. The cohesion of the team around the central theme of sensorimotor transformation could be improved by identifying key common questions and increasing collaborative work to tackle them.

The team has addressed at least some of these issues. For example, in the auto-evaluation, the authors argue that the question of weighting of sensory inputs has been the common focus of the team. This is a valid, unifying focus, but it is not clear that this represents an action taken in response to the previous review. In any case, the current level of focus in the team appears appropriate. The team has had modest success in attracting visiting researchers, but the interactions appear to be fruitful. Recent collaborative works represent a significant step toward understanding the neural mechanisms underlying the implementation of sensorimotor transformations, in line with the recommendations from the previous review.

WORKFORCE OF THE TEAM

Permanent personnel in active employment	
Professors and associate professors	1
Lecturer and associate lecturer	1
Senior scientist (Directeur de recherche, DR) and associate	0
Scientist (Chargé de recherche, CR) and associate	1
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	0
Subtotal permanent personnel in active employment	**3**
Non-permanent teacher researchers, researchers and associates	0
Non-permanent research supporting personnel (PAR)	0
Post-docs	0
PhD Students	3
Subtotal non-permanent personnel	3
Total	**6**

EVALUATION

Overall assessment of the team

The committee considers that, overall, the SENSORIMOT team is very good to excellent. It is, by choice, a small but productive team producing high quality research with a hypothesis driven, computational approach. The team extends work using psychophysics and motion analysis with novel EEG and other neural imaging techniques to better understand sensorimotor behaviour. The research provides a valuable contribution to the understanding of the neural control of movement, resulting in an assessment of excellent for scientific production, and very good to excellent in terms of obtaining resources, attractiveness for students and collaborators and impact for society.

Strengths and possibilities linked to the context

The team takes a rigorous, hypothesis-driven approach toward questions of multisensory integration, making use of quantitative models that lead to testable hypotheses. This principled approach has led to a laudable collection of 21 publications on the neural mechanisms underlying this important aspect of human sensorimotor behaviour. The team should be commended for extending their studies in recent years beyond the psychophysics of human motor control to included brain imaging studies (notably the novel use of EEG) to elucidate the neural basis underlying the observed motor outcomes. The team members should also be commended for 'stepping out of their comfort zone' (their words) to extend their studies and interests to the sense of touch. This has led to interesting and fundamental insights into the control of posture and at the same time to technological developments that show promise not only as laboratory tools for investigations but also in terms of novel technologies for virtual rendering of touch. The theoretical basis for the hypotheses that they employ, i.e. the weighting of sensory information based on the relative reliability of the different sources of information, has broad applications, beyond the scope of the specific sensorimotor tasks addressed in their experiments. This opens the possibility for a further impact, either through direct collaborations between the team and other research groups or through the dissemination of the ideas and models through the broader community studying multisensory integration in humans.

Weaknesses and risks linked to the context

The most obvious 'weakness' of the team is its size, with only two active senior researchers, this naturally has limited some of the outputs of the team compared to others in the unit. It must be noted, however, that the indicator of fundamental importance, i.e. that of rigorous scientific output in quality journals has been met by these two researchers. It is also noted that this pair of investigators plans to reorganise in the coming years into a team of significantly greater size (6 chercheurs/MCUs statutaires), so this potential risk appears to be mitigated in the plans for the future.

There appears to be a geographical focus in terms of international collaboration. Given the fundamental nature of the research topics, one might expect there to be other opportunities to share expertise and perspectives within the Neuroscience research community at large.

RECOMMENDATIONS TO THE TEAM

One challenge faced by this team, and any other team, is that of receiving proper recognition for the fundamental advances in knowledge that the team has achieved. While the results are genuinely solid and the publication record is more than satisfactory, there does not seem to be a 'banner' publication that properly highlights the unique contributions that this team has made to the scientific community. The need for rapid publication (doctoral candidates need two accepted publications; imposed by the 'école doctorale' on which this team depends.) Perhaps makes this task more difficult compared to other teams, but the Sensorimotor team is encouraged to set a goal for a high-profile publication (J. Neurosci. Nat. Neurosci.) To achieve the 'name recognition' that their work deserves, which might then lead to new collaborative activities.

On the more scientific side, the team has taken the step toward identifying the neural basis for sensorimotor integration using brain imaging techniques (primarily EEG). The team might also be encouraged to pursue, through collaborative projects, mathematical analyses or otherwise, studies of the underlying mechanisms at the level of individual neurons or populations of neurons. e.g. How are the weights acquired? Are they hard-coded or based on experience? How is the weighting implemented at the synaptic or population level?

Team 5 Music, language and writing (MULAW)

Name of the supervisor: Mrs. Marieke LONGCAMP

THEMES OF THE TEAM

The MULAW teams study the brain mechanisms underlying music and writing and their role in language learning using behavioural methods such as auditory psychophysics and movement kinematics, together with measurements of brain activity using EEG and fMRI. They study both normal adults and patients, and both normal children and ones with learning problems.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The team has taken into account nearly all the comments made during the previous evaluation, despite the challenges posed by the Covid lockdown period. They have increased intra-team cooperation with regular monthly methodological and theoretical discussions. Younger scientists have increased their implication at the local and national levels, although they could do more at the international level. They have increased collaborations with clinical researchers. Two team members obtained their HDRs during the period, and a third has obtained a CNRS delegation that should allow her to obtain her HDR soon.

WORKFORCE OF THE TEAM: 1 PROF, 1 DR1, 1 CR, 1 MCU

Permanent personnel in active employment	
Professors and associate professors	1
Lecturer and associate lecturer	3
Senior scientist (Directeur de recherche, DR) and associate	1
Scientist (Chargé de recherche, CR) and associate	1
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	0
Subtotal permanent personnel in active employment	**6**
Non-permanent teacher researchers, researchers and associates	1
Non-permanent research supporting personnel (PAR)	0
Post-docs	0
PhD Students	5
Subtotal non-permanent personnel	6
Total	**12**

EVALUATION

Overall assessment of the team

The committee considers that the MULAW is a truly excellent or even outstanding team. The team's use of resources and its attractiveness are both excellent to outstanding. Scientific output has also been excellent and links to society are outstanding. Globally, it is an active and dynamic team that has developed a novel set of research questions. The team leader has demonstrated real leadership and has played a key role in developing research and teaching programs, both within the lab, and across the university.

Strengths and possibilities linked to the context

The team has developed a number of novel research paradigms that are quite original and interdisciplinary in nature, at the interface between educational studies, semiotics, engineering, science and clinical work. The methodologies appear to be solid and built on sound foundations, with some (but not all) of the protocols being preregistered. As with most publications from the lab, the team systematically enters them into HAL and makes the text available online.

In particular, they have developed novel training paradigms that are already being used in schools. Some of these projects have used EEG recordings techniques combined with behavioural methods to study music learning in children, which is a very novel approach.

The study of writing is a particularly novel feature of the team's work and could have very significant societal implications.

The team has published an impressive number of publications. They mention 45 original articles, eleven reviews and several chapters.
These numbers are confirmed by examining their output in Scopus that returns 63 publications for the period 2016–2021 (47 papers, 1 chapter, 1 conference proceeding, 1 review, 2 editorials and 3 letters). Nineteen of the papers benefit from a number of citations which is above average. They include papers in journals including NeuroImage, J Cognitive Neuroscience, Development Science.
Over twenty of the publications involve co-authors in a range of countries including Switzerland, Canada, Germany, Netherlands, Spain, USA, the UK, Italy, Cuba, demonstrating that the team is well connected with the international research community.
Furthermore, several publications involve other teams from the LNC.

The team has included ten doctoral students during the period from 2016 to 2021, five of whom have already successfully defended their PhD.

Weaknesses and risks linked to the context

Although the team's publications are available from HAL, around one third of the publications are not in Open Access journals, which reduces the ease with which the output can be found outside of France.

RECOMMENDATIONS TO THE TEAM

The committee encourages the team to continue with its highly original research program and to consolidate the existing strong links with society via the applications in education.
The committee also believes that the MULAW team should continue to play a very important role in the Brain and Language Convergence Institute where it has already demonstrated its importance.
The panel also hopes that the team will be able to take full advantage of the planned fusion between the LNC and the Laboratoire de Psychologie Cognitive. The proposed 'Centre for Research in Psychology and Neuroscience' is a structure where the team can be expected to be critically important.
Finally, the creation of the kid's lab is another area where the team should be able to take a lot of benefit and play a major role.

Team 6 Neurodevelopmental of motor and social cognition (NEURODEV)

Name of the supervisor: Dr. Christine ASSAIANTE

THEMES OF THE TEAM

The team studies social interactions, both through studying and observing social behaviours coupled with neuroimaging and by investigating correlations between social behaviour and human sensorimotor function over the course of development from childhood, through adolescence and into adulthood. Through these studies the team investigates how motor behaviour reflects, or underlies, social behaviour, and vice versa. Commonality between these processes within the mapping of neuronal activity in the CNS may shed insight into the origins and possible remedies for developmental disorders such as Autism.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The team has responded well to the recommendations from the previous review. Involvement of team members in national and international events, as well as the implication of PhD students in translational activities provide added support of the team's efforts in this socially important line of research, thus augmenting the team's scientific impact and visibility. One permanent member defended her HDR, as recommended.

One might nevertheless notice that further progress could still be pursued in some of the aspects noted by the previous reviewers. The implication in national and international events is somewhat unbalanced between the three PIs. There was a recommendation to encourage interactions between non-permanent researchers that, according to the response, was encouraged, but there is little indication that this has fostered greater interactions in terms of common publications between the three parallel lines of research. And whereas researchers seem to have heeded the advice to increase links with preclinical models of autism through participation in discussion groups (again, an apparently unbalanced effort across PIs), there is little evidence that these models have been concretely integrated into the research activities and scientific outputs of the team.

WORKFORCE OF THE TEAM

Permanent personnel in active employment	
Professors and associate professors	1
Lecturer and associate lecturer	5
Senior scientist (Directeur de recherche, DR) and associate	0
Scientist (Chargé de recherche, CR) and associate	0
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	0
Subtotal permanent personnel in active employment	**6**
Non-permanent teacher researchers, researchers and associates	0
Non-permanent research supporting personnel (PAR)	0
Post-docs	0
PhD Students	2
Subtotal non-permanent personnel	2
Total	**8**

EVALUATION

Overall assessment of the team

The NeurDéveloppement team performs high quality research using behavioural techniques coupled with sophisticated methodologies in brain imaging to identify the neuronal networks underlying the development of social and affective behaviour. The team has had very good to excellent results in terms of scientific production while also achieving very good to excellent results in terms of obtaining sufficient resources to carry out their studies. The social importance of the subject matter affords to the team an excellent level of attractiveness and an excellent level of impact on society.

Strengths and possibilities linked to the context

The most prominent strength of the team is the ability to tie together two seemingly disparate lines of study, that of social and cognitive behaviour with experimental studies of human sensorimotor behaviour. The linking of these two disciplines is a promising avenue for understanding the loci of atypical social behaviour in the CNS, sensorimotor factors that might be the source of, or that might exacerbate the manifestations of atypical behaviours and potential avenues to better integrate individuals displaying these atypical behavioural characteristics into society. The creation of a start-up to promote exactly such integration and the contribution of the team to multidisciplinary efforts to address these issues constitute positive characteristics of the team's work with respect to attractiveness and inclusion with respect to society. The contribution of the team's director as a member of the CoNRS Section 26, all the while continuing a rich research activity, further exemplifies the strength of the team and its contribution to the scientific community as a whole.
In terms of production, the team has published at least 33 publications, with a further nine chapters. Two theses were defended between 2016 and 2021 with another defended in 2022 and two others that are currently in progress. The team obtained eleven research contracts, including two financed by the ANR.

Weaknesses and risks linked to the context

There would appear to be a disconnect, as addressed in the auto-evaluation, between the principal investigators in the team, with few if any common publications. This is not a weakness per se, provided that the individual labs invest efforts into the mutualisation of resources and scientific interactions.

In terms of science, the techniques involved, where the mechanisms for perception and action are inferred from observations about the brain areas involved in different behaviours, begs the question of what kind of neuronal processing is carried out by each of these areas. This comment is a global challenge in terms of understanding the complex system that represents the brain, not a weakness specific to this team, but the challenge remains to corroborate the inferences drawn from these imaging studies with concrete evidence for different forms of neuronal processing.

RECOMMENDATIONS TO THE TEAM

The team should continue to strive to meet the recommendations from the previous review. For instance, evidence of a common journal club or some other means to ensure scientific exchanges between team members would be reassuring, given that the actual research lines of the PIs do not appear to intersect in terms of common publications.

The team should also take to heart the recommendation of integrating their studies with non-human models. Or they might look toward computational models to better understand how sensorimotor information from the different areas identified through brain imaging might indeed be processed and combined in each of these areas to better understand the behavioural outcomes and the time course of development for the sensorimotor behaviours that they observe.

Team 7 Neural bases of somatosensation (SOMATOSENS)

Name of the supervisor: Mr. Patrick DELMAS

THEMES OF THE TEAM

- The Neural Bases of Somatosensation (SOMATOSENS) Team, headed by Patrick Delmas, and which was supposed to join the LNC during the period of evaluation, failed to provide any report for the self-evaluation document.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The integration of the team within the LNC has clearly not been successful, and it is unclear what strategy the University and CNRS should adopt for the future of the team members.

WORKFORCE OF THE TEAM

Permanent personnel in active employment	
Professors and associate professors	0
Lecturer and associate lecturer	1
Senior scientist (Directeur de recherche, DR) and associate	1
Scientist (Chargé de recherche, CR) and associate	0
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	0
Subtotal permanent personnel in active employment	**2**
Non-permanent teacher researchers, researchers and associates	0
Non-permanent research supporting personnel (PAR)	0
Post-docs	0
PhD Students	3
Subtotal non-permanent personnel	3
Total	**5**

EVALUATION

Overall assessment of the team

The panel was unable to assess the activity of the team. However, it is clear that the attempt to integrate the team into the LNC has been a failure.

Strengths and possibilities linked to the context

With no documentation provided by the team, it is impossible to evaluate whether the strengths or weaknesses of the Somatosens team.

Weaknesses and risks linked to the context

Again, the committee cannot comment on the potential weaknesses of the team, although it is clear that the team's status is very fragile.

RECOMMENDATIONS TO THE TEAM

It is clear that the future of the team members will be a major concern for both the CNRS and the University.

Team 8 Brain, obesity and diet imbalance

Name of the supervisor: Mr. Jean-Denis TROADEC

THEMES OF THE TEAM

The team aims at characterising the neural and glial mechanisms, within the hypothalamus and the dorsal vagal complex, that regulate energy balance. Using integrated *in vivo* approaches (dietary manipulations, neuropharmacology, transgenic mouse models), they demonstrated some of the body-to-brain communication mechanisms at stake in the control of food intake and energy expenditure, with an emphasis on the role of astrocytes. In the future, and to adapt their research to the LNC's prerogatives, the team will study the impact of the metabolic syndrome on the planning and execution of goal-directed behaviours, with a special focus on alterations of the neuro-gliovascular interface and its impact on leptin signalling.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

As previously recommended by the HCERES committee, significant consideration was given to the dissemination of the team's findings to increase their international visibility, but also to validate their novel expertise in the field of neuron-glia interactions in the control of energy homoeostasis. All staff members (non-permanent and permanent, junior and senior) participated in national and international meetings. The team also published original papers and reviews in their new field of research and participated in specialised conferences. The team maintained its relationships with the economic environment by offering services and consultancy, yet balancing better between their activity for the CRO and academic research. Of note, their close connection to two companies (Biomeostasis, Azur Isoptopes) has brought significant funding, including one CIFRE contract and two service contracts. They did not, however, follow the third recommendations of the former HCERES committee, namely that young assistant professor should defend their HDR, supervise PhD students and sign articles as senior author.

WORKFORCE OF THE TEAM:

Permanent personnel in active employment	
Professors and associate professors	2
Lecturer and associate lecturer	0
Senior scientist (Directeur de recherche, DR) and associate	1
Scientist (Chargé de recherche, CR) and associate	0
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	0
Subtotal permanent personnel in active employment	**3**
Non-permanent teacher researchers, researchers and associates	0
Non-permanent research supporting personnel (PAR)	1
Post-docs	0
PhD Students	2
Subtotal non-permanent personnel	3
Total	**6**

EVALUATION

Overall assessment of the team

The panel considers that Team 8 is globally very good, especially considering that it is entirely composed of researchers with teaching commitments, the fact that the team was forced to relocate during the evaluation period, and the departure of technicians. Overall attractiveness is good to very good (3 PhD students and 2 postdocs). Likewise, the team's use of Resources is good to very good with an ANR grant as partner and six smaller contracts (4.3-22k€). Scientific production is very good to excellent, with 1.8 articles per researcher in journals that include some with high visibility (Glia). Finally, links with society are also very good to excellent, with public conferences (Semaine du cerveau) and partnerships with industry (Caylab, Azur isotopes, Nestlé).

Strengths and possibilities linked to the context

This team underwent profound reorganisation in recent years, both thematically and geographically. This comes with many difficulties that the team has been able to face, by validating its thematic conversion around the role of neuron-glia interactions in the control of energy homoeostasis.

The team has shown that it can be attractive by supervising three PhD students (including 1 CIFRE contract, and one thesis still in progress) and recruiting two postdocs.
Team members have reviewed manuscripts for nineteen journals, in the field of Metabolism, Neurosciences, Nutrition, etc. The team has also developed national collaborations with influential people in the field (e.g. V. Prévôt, Inserm U1172, Lille; N. Rouach, Collège de France, Paris).
Three members of the team got promoted (2 from MCU CN to MCU HC, 1 from PR2 to PR1).

Considering the composition of the team (5 MCU and 1 PR), the production corresponds to 1.8 papers per researcher over the six years from 2016 to 2021. The scientific production includes eight original publications, including six as principal investigator (PI), and three reviews, including two as PI, in good quality journals (e.g. Molecular Neurobiology, Cells) to very good quality reviews (e.g. Glia).

They have successively developed their research economically through service contracts (29 k€) and a CIFRE contract with local companies (Caylab, Azur Isotopes). Team members are also involved in the dissemination of research to the general public (Brain's week, Fête des Sciences, Université du temps libre) and in teaching activities (inherent to their professional status). Some members of the team are/were in charge of Licence or Master courses. Since 2010, they have created and animated 'The Marseille Association for the teaching of Physiology' (AMEPHY).

Weaknesses and risks linked to the context

Despite all their efforts to maintain a quality research activity in a complex context, the composition of the team limits their research capacity. In particular, the low number of HDRs (2 out of 6 researchers) is a major obstacle in the training of young researchers.
This also affected fund-raising capacity, as the team was not the principal investigator on competitive grants over the reporting period.

The visibility of the team at national and international is limited, with no invitations to meetings/conferences as speakers.

The implication of the team in evaluation activities seems limited, based on the information provided.

The lack of technical staff and non-permanent young researchers (i.e. postdocs) also impairs the development capacity of the team (only 2 postdocs, including one ATER, over the reporting period).

Moreover, the number of secured contracts is low, which reduces the scientific ambitions of the team. They secured one ANR funding in 2016 as partner (240 k€) as well as some service contracts. The limited number of postdoctoral staff (1 full-time person) and technical staff (0) over the reporting period potentially reflects this lack of resources.

Over the reporting period, three of the five assistant professors rarely published as a principal investigator of original works and if so, always as co-last author. This questions their level of involvement in the research projects of the team and whether their teaching duty compromises their research activity.

The organisation of the teaching in Marseille (multisite, multi-city) is another highly time-consuming constraint that also diminishes the research capacity of the team.

RECOMMENDATIONS TO THE TEAM

As explained by the team leader during the HCERES visit, this team will not be renewed for the next contract. Thus, the HCERES committee will not make any specific recommendations.

However, irrespective of where the original members of team 8 work in the new laboratory, the committee recommends that they increase the number of publications with leadership positions in high-profile journals. This would improve their international visibility, and improve their chances of being invited to give talks at conferences.

As already recommended by the previous committee, the committee also strongly encourages all teachers researchers to obtain an HDR and supervise master and PhD students.

All teachers researchers should increase the amount of funding applications, which could help address the lack of postdoctoral and technical staff.

Team 9 Pathophysiology and therapy of vestibular disorders

Name of the supervisor: Mr. Christian CHABBERT

THEMES OF THE TEAM

Team 9 aims to understand the mechanisms of vestibular disorders, for which there is no effective and specific therapy, although the prevalence is very high. To meet this challenge, the team was formed in a multidisciplinary spirit, including scientists, assistant professors, engineers and clinicians. The stated goal is to develop therapies in the field of otoneurology, based on a bench-to-bedside approach. During the last contract, this allowed them to decipher some of the fundamental mechanisms underlying vestibular disorders and functional restoration, but also to invest in technology (patent) and clinical transfer, in education and in the promotion of the visibility of research in neuro-otology.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The team has taken the recommendations of the past commission into account, in a very serious way, which has enabled them to further improve their scientific production and increase their visibility and attractiveness. As recommended, they increased intra-team scientific collaborations, especially with clinicians, which has led to the publication of numerous articles, including some in excellent journals such as Progress in Neurobiology and Sleep Medicine Reviews. They also increased their visibility, which translates into more international collaborations, the direction of the GDR vertigo, the organisation of an international conference in 2021, and the recruitment of more professionals from the neuro-otology field. They also reinforced their interactions with the industry, by filing two patents, obtaining maturation funding from the SATT, taking part in the launching of a start-up, and supervising PhD students under CIFRE contract.

WORKFORCE OF THE TEAM

Permanent personnel in active employment	
Professors and associate professors	0
Lecturer and associate lecturer	2
Senior scientist (Directeur de recherche, DR) and associate	1
Scientist (Chargé de recherche, CR) and associate	1
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	1
Subtotal permanent personnel in active employment	**5**
Non-permanent teacher researchers, researchers and associates	0
Non-permanent research supporting personnel (PAR)	0
Post-docs	0
PhD Students	5
Subtotal non-permanent personnel	5
Total	**10**

EVALUATION

Overall assessment of the team

Globally, the committee considered that Team 9 is excellent. It has maintained a high level of scientific production, despite the rarity of their discipline, and their thematic and technical isolation within the laboratory. Attractiveness and Resources are very good to excellent with 1) the recruitment of eight PhD students, one postdoc and one IE; 2) four contracts (eg. AMIDEX, SATT). Scientific production is excellent with 32 publications, i.e. 2.6 per researcher. Links with society are outstanding with seminars and articles for lay audience, thematic schools, patents, etc.

Strengths and possibilities linked to the context

The strengths of Team 9 lie in its ability to produce excellent quality science, which is reflected in the publication of excellent papers (32 publications over the last contract; 2.6 articles per researcher), despite the rarity of their discipline at national level.
This level of productivity is really impressive considering the relatively modest level of funding of the team (4 contracts over the reference period, essentially from local funding sources and contracts with industry).

The team was able to attract eight PhD students (4 defended, 4 still in progress, 3 CIFRE contracts) and recruiting one postdoc and one IE.

The team members have complementary expertise and have developed close interactions, which allows them to further increase their performance and visibility.
Their visibility is attested by their central role in launching the GDR Vertige and by their recognition as 'reference center' among three in France (+ Paris and Caen), for their discipline. They were invited to talk at international conferences twelve times during the reporting period.

The team has obtained the highly selective 'Rare discipline' label from the MESRI that only selected a few laureates out of 4,000+ applications. This will hopefully offer them more funding opportunities with the ANR and allow the opening of positions at the University. This will also participate in increasing their international visibility in near-future, with dedicated funding opportunities at the EU level.

This team has very strong links with the industrial sector, which is reflected in the filing of two patents related to the treatment of vestibular pathologies, the obtaining of several CIFRE contracts, all this to ensure the technological transfer of their research to patients. They are also in close contact with clinicians and patients directly, via conferences, schools, sensitization actions, development of new diagnostic tools, etc.

In terms of dissemination to the lay audience, team 9 is outstanding, with training of clinicians and young students, by organizing and participating to conferences for the general public (Semaine du cerveau, Cité des sciences), by participating to joint meetings with patients (Hopital Européen, 2020, semaine de l'équilibre et du vertige), by publishing in Science et Avenir or in the CNRS magazine.etc.

Weaknesses and risks linked to the context

The main weakness of Team 9 is the scarcity of their public funding (2 funded projects: one contract from the AMIDEX foundation, from 2015 to 2017, 280k€; one contract in 2019 of 15k€ from PHC XU GUANGQI France-Chine). This is likely to be due to their status as rare discipline. This problem should be solved now that they obtained the official label, which opens new funding opportunities. Interactions with the private sector seem to be their main source of funding for their research projects.

The second point is related to human resources, with the departure of one of the team members in 2021 and the team's apparent difficulty recruiting young researchers. It may also have affected fundraising capacity. The limited number of permanent researchers was unfortunately not compensated by postdoctoral researchers (1 contract over the reporting period), which might be correlated to the lack of resources and/or to the lack of visibility of their discipline.

This cellular neurobiology team is part of a laboratory with a strong psychological and behavioural orientation. This can be difficult, especially for the technical aspects and the development of new technological tools.

RECOMMENDATIONS TO THE TEAM

The technology transfer capacity is one of the team's great assets and must absolutely be maintained.

Their capacity to disseminate to the general public and to clinicians and patients is also something that should be continued and developed.

The team could increase its interactions with the rest of the laboratory, and more specifically with team 12, whose scientific prerogatives (vestibular system) seem close to their own.

The committee strongly encourages the team to increase their number of funding applications. The 'Rare discipline' label seems to represent a great opportunity in that respect. This would allow the recruitment of more young researchers, which would increase their visibility at the local and national level.

Team 10 Neuronal dynamics and audition

Name of the supervisor: Mr. Arnaud NORENA

THEMES OF THE TEAM

The Neuronal Dynamics and Audition team is a small team with just three researchers (a DR2 CNRS, and two professors, one based in Marseille, the other in Lyon) accompanied since September 2021 by an ITA from the university. The main themes of the team concern a multiscale analysis of neuronal dynamics aimed at understanding the cognitive functions underlying auditory perception in normal humans and patients. For example, they have developed a novel approach to study the link between tinnitis, hyperacusis and the middle ear, developing diagnostic devices and methods for studying a range of pathologies that include misophonia.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The previous HCERES report made a number of recommendations. One suggestion was that the team could aim for top-level journals rather than more specialist journals, but it seems clear that while productivity has been high, they have not yet succeeded in reaching the top journals. It was suggested that the team might aim for an ERC grant, and while that has not been achieved, the team has nevertheless obtained two European grants including a Marie Curie grant and an Innovative Training Network. One suggestion that has clearly been taken on board has been the encouragement to collaborate more with clinicians since the team has active collaborations and publications with researchers in Paris, Toulouse and Montpellier as well as Marseille. In contrast, the recommendation that the team could establish closer collaborations with people working in theoretical research and neuroinformatics has yet to really take form.

WORKFORCE OF THE TEAM: 1 DR2, 2 PROF

Permanent personnel in active employment	
Professors and associate professors	0
Lecturer and associate lecturer	4
Senior scientist (Directeur de recherche, DR) and associate	3
Scientist (Chargé de recherche, CR) and associate	1
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	1
Subtotal permanent personnel in active employment	**9**
Non-permanent teacher researchers, researchers and associates	0
Non-permanent research supporting personnel (PAR)	3
Post-docs	0
PhD Students	1
Subtotal non-permanent personnel	4
Total	**13**

EVALUATION

Overall assessment of the team

The committee considers that globally, the Neuronal Dynamics and Audition team is very good to excellent. Most aspects of the team's activity were found to be very good to excellent, including use of resources, scientific output and links with society. Attractiveness was rated as very good. The team's strengths include the fact that it has been involved in developing a number of novel diagnostic tests that have real utility. It has succeeded in obtaining over €1.9 million in funding during the period, of which 579 K€ comes from various forms of industrial collaboration and valorisation. They have published a reasonable number of articles in leading journals.

Strengths and possibilities linked to the context

According to the list of publications provided by the lab, the DNA team produced 31 publications during the period from 2016–2021, which is a respectable number given that the team only has a few members.
That list includes three chapters and an editorial.
Noticeably, seven of the papers have been cited more than ten times.
Twelve of them are published in the best disciplinary journals that include Ear and Hearing, Human Brain Mapping, Trends in Hearing or PLoS ONE and Scientific Reports.

Weaknesses and risks linked to the context

It would appear that the recommendation made by the previous HCERES evaluation to attempt to publish in higher-profile journals still apply. The team still tends to focus on relatively modest specialist journals, despite having the potential to target more prominent journals.

RECOMMENDATIONS TO THE TEAM

The committee makes the following suggestions.

The team could increase their efforts to develop non-academic partnerships to help overcome some of the technological challenges involved in translating their ideas into viable products that can be used by patients.
Given the relevance of the team's research for the auditory problems faced by many members of the general public, they could increase their efforts to communicate their findings to the wider community.
The team should continue to try to publish in more prominent journals in order to enhance the visibility of their research.
It is vital that team members include the affiliation of the lab when publishing, and not simply mentioning the CNRS and the University.
While the team has a relatively extended network of external collaborations, they could also try to increase research interactions with other teams in the lab and elsewhere in Marseille. In particular, it seems likely that there could be more interactions with researchers involved in computational modelling.
The fusion of the LNC with the LPC to form a new Centre for Research in Psychology and Neuroscience is another opportunity that the team could use to increase its interactions with other researchers working on sensory processing mechanisms.

Team 11 Sensory and cognitive rehabilitation

Name of the supervisor: Mrs. Liliane BOREL

THEMES OF THE TEAM

The 'Sensory and Cognitive Rehabilitation' team studies the cognitive and psychological aspects of sensorimotor capacities and their interactions. The principal objective is to define specific markers of several disorders and to evaluate the rehabilitation processes for each of them and their mechanisms of action. This justifies that the team 11 research is mainly performed in healthy and pathological human subjects. To this aim, the team uses very complementary methodologies from different fields (neuroscience, cognitive psychology, neuropsychology, psychology) that underlie a multidisciplinary approach.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

Previous recommendations addressed to the team included the need to 'concentrate their force on critical topics to increase the rate of high-ranked publications' and to 'valorise their work by publications in journals with higher impact factor'. A significant effort has been made to publish in journals with higher impact factors while maintaining the necessity to publish in journals (despite the lower-impact factor associated with such publications) with a more health practitioners-oriented audience. However, the need to concentrate on the team's forces on critical topics is still relevant, since it could help promote the high level of visibility and productivity that the team deserves.

WORKFORCE OF THE TEAM

Permanent personnel in active employment	
Professors and associate professors	0
Lecturer and associate lecturer	0
Senior scientist (Directeur de recherche, DR) and associate	1
Scientist (Chargé de recherche, CR) and associate	2
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	0
Subtotal permanent personnel in active employment	**3**
Non-permanent teacher researchers, researchers and associates	0
Non-permanent research supporting personnel (PAR)	0
Post-docs	1
PhD Students	8
Subtotal non-permanent personnel	9
Total	**12**

EVALUATION

Overall assessment of the team

The committee considers that, globally, the sensory and cognitive rehabilitation team is very good to excellent. Its resources are very good, and it has very good to excellent attractiveness. Scientific production is also very good. In particular, the team's links with society are excellent as illustrated by the development of software tools to promote cognitive restoration after various brain disorders. The team's apparent multidisciplinarity may result from the presence of several independent research projects, and could be improved by increasing the interactions between team members.

Strengths and possibilities linked to the context

During the evaluated period, the team produced 51 articles (among them, 29 publications with first/last authorship) heterogeneously distributed among team members. This is a very good track record, especially regarding the high proportion of researchers with heavy teaching duties. The journals include several high with a high profile, including Cerebral Cortex, Progress in Neurobiology and Scientific Reports.

The use of very complementary methodologies from different fields (neuroscience, cognitive psychology, neuropsychology, psychology) is the basis on which a real multidisciplinary approach rest. Using this policy, the team demonstrates a great potential to translate research knowledge into rehabilitation tools as exemplified by the SYNCHRO-TC (an e-rehabilitation management software platform) as well as the SleepLab application or Memotechnik software.

Participation in teaching is important, as many team members are associate professors, thereby participating in disseminating science to young students. Public outreach is also very well developed with team members regularly involved in radio and/or TV broadcasts as well as in national newspapers.

Weaknesses and risks linked to the context

One weakness is the teams' already acknowledged difficulties in developing international collaborations, as illustrated by the absence of foreigners/visiting researchers. It is also noticeable that the team has relatively weak interactions with other teams within the LNC.
The team has only been involved in training five doctoral students during the evaluated period, four of whom were supervised by the same researcher (B. Alescio-Lautier) and by two researchers who have not yet obtained an HDR.

RECOMMENDATIONS TO THE TEAM

The efforts to increase the 'sensory and cognitive rehabilitation' team's publication in journals with a wide scientific audience need to be continued. This would be beneficial both for the team (increased visibility) and for the readers (increased translational culture for basic scientists)!
Conversely, and somewhat paradoxically, given the focus of the team on the translation of applications in the health field, the team needs to promote solid and effective links with the clinics. The team could consider the opportunity to recruit MD students or others from paramedical specialities to conduct a PhD project. This could pave the way for the recruitment of future clinical researchers, which could be very beneficial for the team.
Other actions that should be considered might be to create efficient collaborations with clinicians already present within other LNC teams.
An effort should also be made to develop international collaborations. The committee suggests participating in international research forum/programs such as The European Forum for Research in Rehabilitation (EFRR) that encourage the exchange of ideas and the development of collaborative research projects.
This should incidentally increase the opportunity of PhD students to apply for competitive postdoctoral positions, as already recommended in the previous report. In any case, it seems essential that all the researchers obtain their HDR in order to increase the potential number of PhD students.
The fund-raising capacity of the team needs to be strengthened in order to increase the potential number of PhD students and promote the teams' attractiveness for visiting scientists.

Team 12 Multisense & Body

Name of the supervisor: Mrs. Anne KAVOUNOUDIAS

THEMES OF THE TEAM

The aim of the multisense and body team is to characterise the neural basis of the multisensory mechanisms underlying own body and self-perception, i.e. how the central nervous system processes and integrates proprioceptive, tactile and vestibular stimuli. The team develops a multidisciplinary approach based on human electrophysiological measurements (notably microneurography), neuroimaging, psychophysics and cortical recordings. Experiments are performed in typical participants but also in patients with peripheral vestibular loss or limb amputation.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The previous committee recommended to the team to focus its research activity on a more restrained number of projects in order to target higher impact journals. The team established an interesting strategy to follow this recommendation (weekly meetings to discuss and exchange, more allocations for publications in journals with an impact factor greater than 5) and indeed increased its number of publications in high-ranking journals (Nature Medecine, Progress in Neurobiology, Annals of Neurology, Neuroimage, Cerebral Cortex, …) during the evaluated period. The previous committee also encouraged the team to enhance its attractiveness, which was done as one new CNRS researcher (Rochelle Ackerley) and numerous postdoctoral fellows and PhD students were recruited since 2017. To further improve its implication in clinical applications (a point raised by the previous committee), the team welcomed two clinicians from local hospitals and was granted one ANR on phantom pain in amputees (ANR PhantomPain) and another on patients with vestibular disorders (ANR Vestiself). Finally, the previous committee incited the team to improve its international collaborations and to apply more often to European grants. This recommendation was followed as several team members supervised PhD students with international colleagues. If applications to European funding were not all successful, one researcher obtained a prestigious ERC consolidator grant.

WORKFORCE OF THE TEAM

Permanent personnel in active employment	
Professors and associate professors	0
Lecturer and associate lecturer	4
Senior scientist (Directeur de recherche, DR) and associate	1
Scientist (Chargé de recherche, CR) and associate	3
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	0
Subtotal permanent personnel in active employment	**8**
Non-permanent teacher researchers, researchers and associates	2
Non-permanent research supporting personnel (PAR)	2
Post-docs	2
PhD Students	6
Subtotal non-permanent personnel	12
Total	**20**

EVALUATION

Overall assessment of the team

Overall, the Multisense and Body team is an excellent to outstanding team. Its ability to obtain and use resources has been outstanding, and its attractiveness is also excellent to outstanding. During the evaluated period, scientific production was excellent to outstanding, with a very impressive list of publications, some in excellent journals (Nature Medecine, Progress in Neurobiology, Annals of Neurology, …). Links with society were also outstanding, as demonstrated by partnerships with the cosmetic industry and an impressive number of actions aimed at the general public.

Strengths and possibilities linked to the context

The Multisense and body team is well recognised for its multidisciplinary work on the somatosensory and vestibular systems using a combination of behavioural, neurophysiological and neuroimaging approaches. It has notably pioneered the study of complex and naturalistic touch. From a methodological point of view, the team is the only one in France that masters microneurography, the recordings of single fibre afferents in awake humans. The team is also involved in the development of spinal cord fMRI in healthy participants but also in patients with spinal cord injuries and amputees (see e.g. Rowald et al., Nature Medecine 2022). The team's expertise was notably acknowledged through the CNRS bronze medal awarded to one of its members in 2017. Since the last evaluation, two medical doctors arrived, strengthening potential clinical applications.

During the evaluated period (2016–2021), the team published 76 articles (for 10 permanent researchers), some of them in prestigious journals (Nature Medecine, Progress in Neurobiology, Annals of Neurology, Neuroimage, Cerebral Cortex, Cortex, …). A significant number of these publications (26) were based on international collaborations. These publications very often included PhD students and postdoctoral fellows supervised by research in the team (40 publications). All the researchers from the team contributed to the scientific production (every member participated to at least four studies during the evaluated period). The team has a good activity of supervision: during the evaluated period, it hosted thirteen PhD students and two post-doctoral students. Several team members are strongly involved in the management of teaching.

During the evaluated period, the members of the Multisense and body team coordinated one ERC consolidator grant, one Career Integration Grant, three ANRs and one partenariat Hubert Curien AURORA. They were also scientific partners in one ANR and three other grants. Beyond the academic world, the team also developed fruitful collaborations with the cosmetic industry through contracts with L'Oréal and the Chemineau and Clarins laboratories.

The team is highly involved in the sharing of knowledge with the general public and its members participated in numerous actions during the evaluated period (e.g. in primary schools, in TV documentaries, during the Brain awareness week or the European Researcher's Night in Marseille, …).

Weaknesses and risks linked to the context

There is a disparity between the production of the team members (the most productive researcher was involved in 25 publications during the evaluated period while the less productive participated in 4 studies). The committee nonetheless acknowledges that this disparity can be explained by the heavy involvement of some of the team members in teaching management.

RECOMMENDATIONS TO THE TEAM

The committee recommends that the Multisense and Body team continues its very high quality and interdisciplinary research work. It also encourages the team to pursue his interactions with the industry. Finally, the committee encourages the team to pursue its effort to publish more in high-impact journals. It will permit to increase even more the recognition of its research at the international level.

CONDUCT OF THE INTERVIEWS

Date(s)

Start: 29 novembre 2022 à 8 h

End: 30 novembre 2022 à 18 h

Interview conducted: on-site or online

INTERVIEW SCHEDULE

PARTICULAR POINT TO BE MENTIONNED

GENERAL OBSERVATIONS OF THE SUPERVISORS

Le Président de l'université

au

Département d'Évaluation de la recherche - Hcéres

Objet : Observations de l'unité relatives au rapport d'évaluation des experts Hcéres
N/Réf. : VPR/LS/AMS/CM – 23-06

Dossier suivi par : Cécile Merle
Tél : 04 13 94 95 90
cecile.merle@univ-amu.fr

Vos réf : DER-PUR230023277 - LNC – Laboratoire de neuroscience cognitive

Marseille, le mercredi 26 juillet 2023

Madame, Monsieur,

Je fais suite à votre mail du 06/07/2023 dans lequel vous me communiquiez le rapport d'évaluation Hcéres de l'Unité de Recherche LNC - Laboratoire de neuroscience cognitive.

Comme demandé dans ledit mail, je vous indique que les tutelles du LNC, Aix-Marseille Université et le CNRS, n'ont pas d'observation à formuler.

Vous souhaitant bonne réception des présentes,

Je vous prie de croire, Madame, Monsieur, l'expression de mes respectueuses salutations.

Eric BERTON

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2 rue Albert Einstein
75013 Paris, France
T. 33 (0)1 55 55 60 10

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