

Research evaluation

EVALUATION REPORT OF THE UNIT
LEEC - Laboratoire d'éthologie expérimentale et
comparée

UNDER THE SUPERVISION OF THE
FOLLOWING ESTABLISHMENTS AND
ORGANISMS:
Université Sorbonne Paris Nord

EVALUATION CAMPAIGN 2023-2024
GROUP D

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In the name of the expert committee :

Xavier Martini, Chairman of the committee

For the Hcéres :

Stéphane Le Bouler, acting president

Pursuant to Articles R. 114-15 and R. 114-10 of the Research Code, the evaluation reports drawn up by the expert committees are signed by the chairmen of these committees and countersigned by the President of Hcéres.

To make the document easier to read, the names used in this report to designate functions, professions or responsibilities (expert, researcher, teacher-researcher, professor, lecturer, engineer, technician, director, doctoral student, etc.) are used in a generic sense and have a neutral value.

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 Xavier Martini, University of Florida, United-States
Vice-chairperson:	Mr Patrick Kestemont, université de Namur – Unamur, Belgique
Experts:	Ms Marie Challe, Université Montpellier 1 - UM1 Mr Ludovic Dickel, Normandie Université (representative of CNU)

HCÉRES REPRESENTATIVE

Mr Xavier Cousin

REPRESENTATIVE OF SUPERVISING INSTITUTIONS AND BODIES

Ms Pascale Molinier, Université Sorbonne Paris Nord

CHARACTERISATION OF THE UNIT

- Name: name
- Acronym: acronym
- Label and number: num
- Composition of the executive team: composition of the executive team

SCIENTIFIC PANELS OF THE UNIT

SVE Sciences du vivant et environnement
SVE1 Biologie environnementale fondamentale et appliquée, écologie, évolution

p_Scientific panels of the unit

THEMES OF THE UNIT

The research at the unit LEEC focuses on the ontogeny, mechanisms, and functional patterns underlying social behaviour, and its consequences on fitness. The transversal thematic of the unit is to better understand the mechanism leading to individual behavioural variations. This question is investigated for a wide range of organisms from invertebrates to birds and mammals. The unit is also studying flagship species in conservation such as the European Lynx or dolphins. The research of the unit is divided into three main topics: 1) Communication and cognition; 2) Individual differences in behaviour; and 3) Reproductive strategies.

Individual differences in behaviour can appear as early as during juvenile life stages; therefore, ontogeny has a central place in the unit research. The unit demonstrated that individual differences are in some cases short-term responses to handling stress. For instance, on the wild rabbit, differences in behavioural between sibling depend on immunogenetics conditions and/or on the endoparasite loads *i*. Similarly, different behavioural patterns will emerge from sibling depending on the levels of oxidative stress in the mound-building mouse. These individual differences in behaviour have been studied by the team mostly on mammals (rabbit, cat, mouse), but also includes studies on insects (ants), or birds (European starling). The heritability of the behaviour has been the focus on some studies on ants.

Chemical ecology, especially in social insects such as termites and ants are also a strength of the unit. The unit studies chemical communication through cuticular hydrocarbons, alarm pheromones, trail pheromones. Cuticular hydrocarbons are studied in the context of ant speciation. One of the major outbreaks in this area is the finding of associative learning among ants, which may have important implications in the medical field as the unit demonstrated that ants can learn to identify volatile associated with tumoral cells. The research in entomology recently expanded their research around acoustic communication.

Finally, reproduction strategies are studied through polychaete marine worm, rabbit, starling, and ants. In the hermaphrodite polychaete worms, the unit showed a unique behaviour where two individuals will alternate sex every four days and after a successful mating to share the cost of reproduction that is particularly costly during the female stage. In rabbit and starling, the unit investigated how environmental conditions influence affect reproduction.

HISTORIC AND GEOGRAPHICAL LOCATION OF THE UNIT

The Research Unit has been a landmark of the Sorbonne Paris Nord University for 40 years, renowned for the excellence of its research on animal behaviour in France. It was also for a long time one of only three CNRS-University mixed research units (UMR) in ethology dissolved in 2009, due to a major restructuring of the CNRS. Université Sorbonne Paris Nord continues to promote local but nationally significant research in ethology at LEEC, which has become affiliated with Université Sorbonne Paris Nord (i.e. Université Paris 13) as an affiliated unit (Research Unit UR 4443). At the beginning of its history, the LEEC was structured into different research teams, corresponding to research activities focused on different animal models (social insects and rodents, respectively). This structure, mainly due to the particular material, technical and financial needs of the two teams, has limited scientific collaboration between the different members of the unit. At the start of the previous evaluation period 2012–2017, the two teams successfully merged into a single, unified research group (mono-team) in order to increase connectivity between the laboratory member researchers and to further focus on research questions rather than animal models.

Over the past six years, the unit has experienced two new recruitments to its permanent research staff, while two lecturers retired in 2018 and 2022. The latter two associate professor positions, occupied by international researchers recruited in 2020 and 2021, brought a breath of fresh air to LEEC, stimulating the dynamism of existing and new research subjects. In addition, one of the professors became a senior member of the Institut Universitaire de France (IUF) in 2018.

The LEEC is one of the five units of the Faculty of Letters, Languages, Human Sciences and Societies LLSHS, and is located at the Institut Galilée (in building C, 4th and 5th level, and in building E 3rd level) at the Villeteuse campus (Seine Saint-Denis). The LEEC is associated with the doctoral school 'École Doctorale Galilée'.

The LEEC is also strongly involved in training and teaching through research, notably through its master in Ethology, which enjoys a great reputation in ethology/animal behaviour. The master's program extends over two years: The first year ('Master 1') consists of general training in ethology. During the second year ('Master 2'), students can choose between a branch more oriented towards basic ethology and the fundamental understanding of animal behaviour ('Master 2 Fundamental Ethology'), and a branch relatively more focused on applied ethology ('Master 2 Applied Ethology'). Such specialised and applied training in ethology is hardly available in any other French university establishment.

RESEARCH ENVIRONMENT OF THE UNIT

The LEEC laboratory operates in a Human Science University (the faculty Lettres, Langues, Sciences Humaines et des Sociétés in the Galile Institute). This University is its only supervisory body. It therefore has human resources (administrative [one person,] and technical [6 persons]) which are not shared with other laboratories, and its own technical facilities (breeding facilities [insects, polychaetes, rodents) and experimental areas, called 'plateformes'). LEEC which is supported by the Galile doctoral school and benefits from the central university logistical services such as 'Direction de la Recherche' (which helps to develop industrial and commercial activities) or a 'Cellule pour la Recherche'. At the Ile-de-France level, the laboratory is part of the 'Institut Francilien d'Ethology'. This last promotes exchanges between Parisian laboratories and support a shared international student course.

UNIT WORKFORCE: in physical persons at 31/12/2022

Catégories de personnel	Effectifs
Professeurs et assimilés	4
Maîtres de conférences et assimilés	9
Directeurs de recherche et assimilés	0
Chargés de recherche et assimilés	0
Personnels d'appui à la recherche	5
Sous-total personnels permanents en activité	18
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	2
Post-doctorants	0
Doctorants	4
Sous-total personnels non permanents en activité	6
Total personnels	24

DISTRIBUTION OF THE UNIT'S PERMANENTS BY EMPLOYER: in physical persons at 31/12/2022. Non-tutorship employers are grouped under the heading 'others'.

Nom de l'employeur	EC	C	PAR
UNIVERSITÉ SORBONNE PARIS NORD	13	0	5
Total personnels	13	0	5

GLOBAL ASSESSMENT

The research unit LEEC is a small single-team unit located at the Sorbonne Paris Nord University. The unit is part of the Faculty of Letters, Languages, Human Sciences and Societies and is located at the Institut Galilée at Villetaneuse. It is associated with the doctoral school 'École Doctorale Galilée'. The unit consists of thirteen faculty members and six permanent PARs. During the evaluation period sixteen PhDs graduated, and the unit hosted four postdoctoral students. The only IT staff working in the unit retired during the contract and was not replaced. With this exception, the unit is currently well staffed, especially with the addition of two non-permanent PARs funded through grant money.

The main aim of the research program of LEEC is to understand the ontogeny and mechanisms underlying social behaviour and its consequences for evolution and health. These scientific objectives are very good to excellent. The method of study is integrative (using both 'immediate' and 'ultimate' approaches), placing observed behaviour and its mechanical causes in an evolutionary context. To achieve these objectives, the laboratory pursues three major but complementary lines of research on animal taxa used as models: communication and cognition, individual differences in behaviour, and reproductive strategies. The unit disposes of three platforms (chemical ecology, genetics, and physiology and behaviour) that are quite compartmentalised on the biological systems they are working on: the chemical ecology is mostly investigating social insects while the physiology and behaviour platform works typically with rodents. The chemical ecology research provided some of the main highlights in terms of research for the unit with notably the work showing that ants are capable of identifying the volatile form cancerous human cells (article published in *iScience*). Beside the platforms, several unique animal rearing allows researchers conducting research independently within the laboratory. The ants rearing contributes to the attractiveness of the unit with over twenty different species hosted as well as the Polychaeta marine worm rearing that are used to study the evolution of altruism and reciprocity showing that hermaphrodite marine worms adapted their reproductive strategy to share the energetic cost linked to reproduction (x1 *Current Biology*, 2x *Scientific reports*).

While the unit has a very good percentage of grant money in proportion of its total budget (68% for 760 k€ out of 1114 k€), it does not fully compensate the low support received from the University. This creates some tension on unit functioning (e.g. payment of APC, some facilities management). Except for ANR grants and one grant obtained through the private sector (Banque Publique d'Investissement [BPI-France], Neoramus project 70 k€) all the other funding is of limited amount (less than <30k€). However, the LEEC is excellent in providing equal resource access to all researchers and responding equally to the requests of all technical and administrative personnel.

LEEC has an exceptional functioning for its work environment, with collegial decisions, quick problem resolution and strong team spirit between EC, students and PAR. Strategies are put in place to meet everyone's needs and overcome the financial burdens of the unit. LEEC has very good safety procedures. However, lab notebooks are not mandatory, and the unit doesn't use the university data storage. The management of the invertebrate rearing is missing organised communication and detailed data storage.

The unit has an excellent scientific reputation supported by the ECs involvement in journals and scientific societies, and by the organisation of an International Student Course. LEEC has a wide network of international collaborations enabling it to invite or receive foreign junior and senior researchers on a regular basis. The unit has a very good success for competitive grants. However, the effort for grant submission is supported by a limited number of ECs. While LEEC is active in reaching international grants, those grants are of a low amount.

The overall quality of scientific production for the research unit is excellent. The articles are published in leading journals in the field of ethology and behavioural sciences (i.e. *Animal Behaviour* x8, *Journal of Chemical Ecology* x6, *Behavioural Ecology and Sociobiology* x6). Some articles are published as lead authors in generalist journals with a wide audience (i.e. *Current Biology* x1, *iScience* x1 and commentaries in *Nature* x1 and in *PNAS* x1.). One can emphasise an adequate involvement of the students (master and PHD). However, the scientific output of LEEC members is variable and more synthesis papers would have been more appropriate. This heterogeneity in ECs productivity is also observed for the scientific production with three members involved in more than 30 publications each over the period and seven members involved in fewer than two articles per year during the reference period. The unit scientific production is of excellent quality with articles published in leading journals in the field of ethology and behavioural sciences (i.e. *Animal Behaviour*),

The inclusion of the unit's research in society is very good with part of its activities carried out in private or non-university institutes (Parc Astérix, CHU Paris, Police Nationale, etc.). Communication with the general public is strong (39 presentations for students, 27 for the general public, eight interviews in various media, ten articles in non-specialist press and more than 50 actions about the detection of cancer by smell of ants). Given the discipline, themes and models developed, LEEC has a great potential in this area and could be even further exploited.

DETAILED EVALUATION OF THE UNIT

A – CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

Several recommendations made during the previous evaluation have not been followed by any specific actions. For instance, the recommendation of writing more review papers to synthesise topics and concepts that are central to LEEC research projects was partly followed (3 review papers for the evaluation period which are added by 3 books). Similarly, while it was recommended to increase the number of HDR, there was no new HDR during the evaluation period. Currently, only two out of nine MCF have an HDR in addition to the four PR. The hiring of a MCF that already had an HDR cannot be considered as a response to this recommendation. In addition, the heterogeneity in the production of the different researchers is still extremely important. Even if the number of publications per ETP and per year is excellent (3.97), this average is biased by a group of four EC with a high number of publications (between 8 and 45) when another group of four EC have one or no publications during the evaluation period. Evidently, the measures to increase the productivity of these scientists (co-direction and co-supervision of PHD theses, roundtables) are either not enough used, or inefficient. In the end, only two recommendations seem to have been followed: the training in scientific integrity that is now compulsory for students, and the establishment of a transversal thematic in the unit with the study of behavioural diversity. This transversal thematic allows the unit creating a link between scientists who work on a wide diversity of biological models.

B – EVALUATION AREAS

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

Assessment on the scientific objectives of the unit

The scientific objectives of the unit are very good to excellent. The main aim of the research program is to understand ontogeny and the mechanisms underlying social behaviour and its consequences for evolution and health. Various animal taxa are used as models. The method of study is integrative (using both 'immediate' and 'ultimate' approaches), placing observed behaviour and its mechanical causes in an evolutionary context. To achieve these objectives, the laboratory pursues three major but complementary lines of research: Communication and cognition, Individual differences in behaviour and Reproductive strategies.

Assessment on the unit's resources

While the unit has a very good percentage of grant money in proportion of its total budget (68% for a total budget over the evaluated period of 1114 k€), it does not fully compensate the low support received from the University. This creates some tension on unit functioning (e.g. payment of article processing charges APC, some facilities management). However, the LEEC is excellent in providing equal resource access to all researchers and responding equally to the requests of all technical and administrative personnel.

Assessment on the functioning of the unit

LEEC has an exceptional functioning for its work environment, with collegial decisions, quick problem resolution and strong team spirit between EC, students and PAR. Strategies are put in place to meet everyone's needs and overcome the financial burdens of the unit. LEEC has very good safety procedures. Lab notebooks are not mandatory, and the unit doesn't use the university data storage. The management of the invertebrate rearing is missing organised communication and detailed data storage.

1/ The unit has set itself relevant scientific objectives.

Strengths and possibilities linked to the context

The scientific objectives of the unit are very good to excellent. Research at LEEC focuses on the ontogeny, mechanisms and functional patterns underlying social behaviour in three major research axes: (a) Communication and cognition, (b) Individual differences in behaviour, and (c) Reproductive strategies. In order to further unite the research problems carried out in the laboratory and to allow a clearer characterisation of the research, the LEEC has grouped its axes into a general term called 'behavioural diversity'. The unit builds on its main strength and expertise in the area of ethology. The diversity of the biological models (from mammals to invertebrates, including marine worms and social insects for which they are internationally recognised) is a strength of the unit. Interindividual differences in behaviour are complemented by the study of differences in cognitive processes and information processing, and where these can lead to differences in reproductive strategies and variable ecological success. The unit uses a wide range of scientific methods to study the behaviour of their biological models (chemical ecology, physiology and genetics).

LEEC benefitted from the support of the SAIC (Service d'Actions Industrielles et Commerciales), within the university for the management of budgets of external grants and contracts and of the interaction with industrial partners. LEEC was involved in two institutes within the university (Institut Fédératif de Recherche Biomédicale IFRB, and Institut interdisciplinaire en Sciences expérimentales [IISE]) that provided internal grants and potential collaborations to the unit. LEEC is also one of the two founder members of the Institut Francilien d'Ethologie (IFE) which fosters collaborations and exchanges with other units in the Region Ile de France. In addition, LEEC collaborates with other units within the university (ex: le Laboratoire de Physique des Lasers [UMR 7538], Laboratoire d'Informatique de Paris-Nord [UMR 7030]).

Some of the research conducted by LEEC is highly innovative such as the research done on the olfactory learning of ants that are able to discriminate volatiles of human cancerous cells (Article published in *iScience*, 12 citations in one year) or the research done on the evolution of conditional reciprocity with hermaphroditic polychaete marine worms (x1 *Current Biology*, 2x *Scientific reports*).

Weaknesses and risks linked to the context

In several cases, the unit seems to mostly work on its current scientific background with little risk taking, and doesn't exploit their findings to explore new collaborations or new applications. As an example, there is no clear project of developing the research on ants' capacities in cancer cell detection beyond the current findings despite a clear opportunity for collaborations with the medical field. The different biological models seem to be highly compartmentalised and address very different questions, which limit comparisons and the ability to take comparative approaches, this is illustrated by the little number of reviews and opinion papers. Overall, the number of citations for the articles highlighted in the Portfolio is very low (maximum of 12 citations in one year). This may indicate that the unit works on topics appealing to a very small audience.

2/ The unit has resources adapted to its activity profile and research environment, and makes use of them.

Strengths and possibilities linked to the context

The unit has a very good percentage of grant money in proportion of its total budget (68% for 760 k€ out of 1114 k€). Among the grant money, one can mention five projects funded by ANR (total amount 821 k€, two led by the unit) and five international projects funded by ECOS (Evaluation-orientation de la Coopération Scientifique ; all led by the unit for a total amount of 126 k€). This funding is completed by a project funded by BPI-France (Neoramus, 70 k€). The unit takes a small percentage (e.g. 2.5% on ANR grants) of share from the grants obtained to support the functioning of the unit. The unit makes an excellent effort in redistributing common budget for instance by supporting their students: 50% of the Master student stipends are paid through the budget of the LEEC, each postdoctoral student receives €650 per year and an additional €300 or €100 if they supervise PHD or Master students respectively. The postdoctoral students and PHD students also have the opportunity to travel to conferences or for scientific projects through the LEEC budget. The technical staff (PAR) with the support of one non-permanent animal caretaker is in excellent number and globally well trained which facilitates the work of the postdoctoral students and PHD students. The committee noted a strong sense of cohesion within the different members.

Weaknesses and risks linked to the context

The recurrent funding support from the University has decreased by 27% since 2017 and is below what would be expected for a unit of this size with an amount of 4.5 k€/EC/year. This may be due to their specific status of being an experimental unit in a human science university. On twenty grants, fourteen are less than 30k€, making the

unit at risk the years when major grants are not obtained. Notably, the unit had two years with less than 20k€/ETP in total budget research which is extremely low. There is a big gap between the different ECs in their capacity to obtain grants (two ECs are above 300 k€ for the period, eight had no grant or less than 15 k€ during the evaluation period). The first consequence is that only €1000 of the recurrent credit are redistributed to EC. In practice, the unit has limited funds to run the platforms (that only receive 2000 to €2500/year for basic functioning) which force staff to find alternative methods to keep the structure running that does not allow the unit paying for APC for open access journals. It also limits the participation of students to international conferences that were quite low during the evaluation period (25 presentations for 16 PHD students during the evaluation period).

3/ The unit's practices comply with the rules and directives laid down by its supervisory bodies in terms of human resources management, safety, the environment, ethical protocols and the protection of data and scientific heritage.

Strengths and possibilities linked to the context

The parity is globally respected in the unit (12 women, 8 men), especially for the researchers (6 women, 7 men). The unit provides equal opportunities irrespectively of national origin, socio-economic situation, and gender identity. All the research outcomes of the LEEC, such as publication records, grants received, press release, are centralised in electronic databases supported by the administration/secretary of the LEEC. The LEEC has a person in charge of security issues, who works in collaboration with the university's responsible person for hygiene and security to fix security issues when they occur. A document with the safety and hygiene rules as well as for the use of informatics resources in the unit is signed by each employee, intern, and student at arrival. PHD students have a tutor that is not involved in the project and in the supervision of the PHD thesis, who help for administrative issues and psychological support. The unit has its own institutional animal welfare/ethical committee (the SBEA) that validates the protocols of animal experiments carried out at the LEEC and overlooks the application of the 3R principle (Replacement, Reduction and Refinement).

Weaknesses and risks linked to the context

Direction was only masculine during the evaluated contract. There are no organised storage rules for the data (physical or virtual), no centralised cloud storage, this is despite the fact that the University has calculus centre for data storage (MAGI) that the LEEC doesn't use. Having individual data storage systems may create a risk of losing data in case of a student or EC unexpected departure. The use of notebooks is not mandatory in the unit. Since 2020, there is no IT personnel which puts the unit at risk of any cyber-attack. There is no organised communication and detailed storage of rearing data and events for invertebrates. The students are not aware of neither a local referent nor a procedure or psychological unit (at the University level) that they can reach in case of need.

EVALUATION AREA 2: ATTRACTIVENESS

Assessment on the attractiveness of the unit

LEEC has an excellent scientific reputation supported by the ECs involvement in journals and scientific societies, and by the organisation of an International Student Course. LEEC has a wide network of international collaborations enabling it to invite or receive foreign junior and senior researchers on a regular basis. LEEC has a very good success for competitive grants. However, the effort for grant submission is supported by a limited number of ECs. While LEEC is active in reaching international grants, those grants are a low amount. The invertebrate rearing with a unique cultivation of 41 species contributes to the attractiveness of the unit.

1/ The unit has an attractive scientific reputation and is part of the European research area.

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

3/ *The unit is attractive through its success in competitive calls for projects.*

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

Strengths and possibilities linked to the context for the four references above

1/

LEEC established numerous international collaborations during the last contract, both in Europe and outside Europe, mainly in Central and South America. In total, the unit has collaborated with partners from 41 different countries, giving it a high international profile. Many members of LEEC (11) are involved in the editorial boards of peer-reviewed scientific journals specialising in behavioural biology (e.g. *Hormones and Behaviour*, *Social Insects*), as well as journals with a wider readership (e.g. *Functional Ecology*, *Scientific Reports*, etc.). A member of LEEC is Editor-in-Chief of *Mammalian Biology*. This strong involvement in the editorial boards of international scientific journals constitutes excellent recognition of the expertise present at LEEC and increases the unit's international visibility. LEEC also has a strong presence in national and international scientific societies (e.g. Institut Francilien d'Ethologie, International Union of the Study of Social Insects IUSSI). In 2018, a member of LEEC was awarded the title of a senior member of the Institut Universitaire de France (IUF), reinforcing LEEC's reputation. Once a year, the LEEC, through the IFE, organises an International Student Course. This course is organised in collaboration with colleagues from the Laboratoire Ethologie, Cognition, Développement (LECD, Université Paris Nanterre), and brings together an audience of Master and PHD students (100 to 200 participants) for lively discussions on current topics in animal behaviour. This allows recruitment of highly skilled foreign students and contributes to the unit attractiveness.

2/

LEEC has a wide network of international collaborations enabling it to invite or receive foreign junior and senior researchers on a regular basis (e.g. 25 senior researchers during the contract). LEEC provides visiting researchers with working conditions that enable them to carry out effective research stays, i.e. an equipped office, adapted structures equipment and some help to obtain an affordable accommodation. In addition, LEEC aims to integrate visiting researchers into the unit by allowing them to present a seminar and, where appropriate, by involving them in student supervision or specialised courses. The unit also benefits from a university funding programme to host visiting professors (1–3 visiting professors/year). These invitations often lead to joint publications. All of these measures indicate that LEEC is aware of the importance of making its unit attractive to foreign researchers and has put in place a very good reception system.

Newly recruited researchers are quickly integrated into LEEC and its network of international collaborations thanks to the monthly meetings organised by the management board and additional meetings on specific topics. Priority is given to researchers who have recently obtained their HDR in obtaining thesis grants, which is very good.

Doctoral students and postdoctoral students receive a share of the LEEC budget in order to conduct their research and take part in national and international conferences (e.g. €650/year for postdoctoral students, €300/year per supervised doctoral students and €100/year per supervised master's student). Duration of PHD thesis was 3.3 years for students who defended during the evaluated period which is in the mean of thesis duration. Doctoral students also benefit from the technical support provided by the technicians. Monthly seminars enable young researchers to present their results at least once a year. Technical staff takes part in seminars, conferences and technical training courses, have training opportunities, and are mentored to prepare for promotion competitive examination for promotion. The unit is working to have all the temporary staff becoming permanent. The doctoral students are well distributed among the members of the unit who have an HDR and some ECs without HDR have the opportunity to co-chair PHD students. PHD students have the opportunity to train in teaching which may be beneficial for recruitment as ECs, they are also mentored to prepare after-defence steps.

3/ LEEC was involved in 20 projects over the period. This includes five international contracts outside Europe led by LEEC (funded by ECOS-Nord with various Latin American countries funding 14–28 k€, adding up to 126k€) and five national projects funded by the French ANR (for a total of 821 k€, two being led by the unit, we can mention Incog, 261 k€). For the contract as a whole, external funding represents 68% of the unit's total resources, which is very good. This results in a very good proportion of the project led by the unit, 63% of the international and national grants (including 40% of the ANR). LEEC obtained an important contract with the private sector (BPI-France, Neoramus, 70 k€) and had some success with local funding support (7 contracts for a total of 32k€)

4/ LEEC has its own animal facilities, some being particularly innovative (rodents of wild origin; social insects, in particular ants and termites; hermaphroditic marine worms), which makes it autonomous in terms of its animal experiments and is an attraction for other university laboratories that occasionally use the LEEC's animal facilities (1 to 3 visiting foreign researchers each year for 2–3 weeks). It is worth noting the wide variety of ant species (20),

including those of tropical origin, which are generally caught in the wild by members of LEEC and for which maintenance and reproduction methods have been developed so that they can be used in experiments without having to rely on external suppliers, which is remarkable. The unit has also privileged access to a field station for studying European starling populations, thanks to collaboration with the National Museum of Natural Sciences in Madrid.

LEEC also manages three technical platforms used by researchers, doctoral students and Masters students as part of their experiments. These are a chemical ecology platform (chemical analysis of organic compounds using HPLC and GC-MS) to study chemical communication, a genetics platform (molecular phylogeny, genetic relatedness, transcriptomic analyses) and a physiology and behaviour platform (endocrinology, metabolic rate, thermal recordings). These platforms, which are used to study animal behaviour, ecology and evolution, are under the responsibility of pairs of researchers and technicians.

This combination of specialised animal facilities and technical platforms provides excellent technical support for the research carried out at the LEEC and is a real attraction for researchers from other national and international institutions.

Weaknesses and risks linked to the context for the four references above

1/ The participation of LEEC postdoctoral students and PHD students in international conferences is quite low as the unit was present at 25 scientific presentations were given by the sixteen PHD students present at LEEC between 2017 and 2022 which is also a low number.

2/ The number of postdoctoral researchers hosted by LEEC is low (only 4 for the entire contract) and they are all attached to a single member of LEEC, which shows that the unit's members are not very attractive to foreign researchers with a thesis, or that LEEC's senior researchers are very heterogeneous in terms of their ability to obtain external funding to recruit postdoctoral researchers. Office space is limited (9m² per personal) which impairs unit attractiveness.

3/ No European funding was obtained during the evaluated period. The international contracts are of low amount (less than 30k€). While there is a regularly regional and local contracts, their amounts are very small (less than 10k€). There is considerable heterogeneity between LEEC members when it comes to obtaining external contracts (2 researchers obtained above 300 k€ of funding (one will likely retire within the next period), two obtained between 50 and 100 k€ while four obtained less than 15 k€ and others obtained no external funding.

4/ Considering the limited budget available for facilities, the cost of maintaining such a multi-species animal facility may become a major weakness. The risk is increased by the constant changes in regulations on stabling conditions and animal welfare.

EVALUATION AREA 3: SCIENTIFIC PRODUCTION

Assessment on the scientific production of the unit

The overall quality of scientific production for the research unit is excellent, journals are adequately chosen with a good balance between specialised and generalist publications. One can emphasise an adequate involvement of the students (master and PHD). However, the output of LEEC members is variable and more synthesis papers would have been more appropriate.

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

2/ The unit's scientific production is proportionate to its research potential and properly shared out between its personnel.

3/ The scientific production of the unit complies with the principles of research integrity, ethics and open science. It complies with the directives applicable in this field.

Strengths and possibilities linked to the context for the three references above

The quality of scientific production is excellent, with 167 publications in referenced journals during the reference period, representing 3.97/ETP/year. Sixty-one (36.5%) of which were authored by members of the Research Unit in the first or last position. Seventy (42%) of these publications involved PHD students supervised by one or more members of the Unit. The quality of the journals is excellent, with 2/3 corresponding to specialised journals, of which around 1/3 are typically in the field of ethology and behavioural sciences (i.e. *Animal behaviour* x8, *Journal of Chemical Ecology* x6, *Behavioural Ecology and Sociobiology* x6), some articles are published as lead authors in generalist journals with a wide audience (i.e. *Current Biology* x1, *iScience* x1 and commentaries in *Nature* x1 and in *PNAS* x1.), while remaining journals are generalist in the field of biology (i.e. *Trends in Endocrinology & Metabolism* x1). There is a low number of publications in publishers with high acceptance rate (Frontiers, Scientific reports, MDPI...). PHD students co-authored 24% of the articles (40/167), which corresponds to three articles for PHD student (and 2 articles where the student is first author on average) who defended their PHD which is excellent.

Weaknesses and risks linked to the context for the three references above

The output of the unit's members is highly variable, with three members involved in more than 30 publications each over the period and seven members involved in fewer than two articles per year during the reference period. Only 28% of the articles are published in open access, and only 34% of the articles have been entered in the platform HAL.

EVALUATION AREA 4: CONTRIBUTION OF RESEARCH ACTIVITIES TO SOCIETY

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

The inclusion of the unit's research in society is very good with part of its activities carried out in private or non-university institutes (Parc Astérix, CHU Paris, Police Nationale, etc.). Communication with the general public is strong (39 presentations for students, 27 for the general public, 8 interviews in various media, 10 articles in non-specialist press and an more than 50 actions about the detection of cancer by smell of ants), but it could be less restricted to few subjects (about 4 to 5 researchers over 13). Given the discipline, themes and models developed, LEEC has a great potential in this area and could be even further exploited.

- 1/ *The unit stands out for the quality and the amount of its interactions with the non-academic world.*
- 2/ *The unit develops products for the cultural, economic and social world.*
- 3/ *The unit shares its knowledge with the general public and takes part in debates in society.*

Strengths and possibilities linked to the context for the three references above

The unit is punctually involved in actions with non-academic organisms – Paris Hospital (CHU), National Police or Hortobagy National Park (Hungary) for counselling and use of animal behaviour and conservation. Regarding interaction with the economic world, the unit is a partner in a large project funded by BPI-France (Neoramus project) to develop push-pull strategy for rodent control as an alternative to toxic bait. Beyond this expertise of the unit in ethology makes it involved in animal welfare committees in several private companies (Ceva, Asterix Park...).

The unit is involved in some actions such as 'Sciences ouverte', 'Fête des sciences' or 'Savante Banlieue' as well as interventions in school class. The unit is open to school visits and to new students of the university during orientation tour. Communication with the general public is compliant (96 articles in the press [national and international], 8 interviews in media, 27 talks). The unit makes considerable efforts to promote the strengths of its activities to the public: 39 presentations for students, 27 presentations for the general public, eight interviews in various media, ten articles in non-specialist press and an extensive communication, more than 50 actions, on the specific subject of the detection of cancer by the smell of ants.

Weaknesses and risks linked to the context for the three references above

The unit is missing strong interactions with the non-academic and economic world. This is illustrated by the absence of contracts with local agencies and associations. Communication to the public is not well balanced between the members of the unit. Most of the press outlet for the general public (92%) was made from a single study. The unit didn't have Cifre scholarships during the evaluation period and interactions with the industry are limited. There is no training yet provided by the unit to professionals about animal welfare, for instance. Actions aimed at the public are also limited.

ANALYSIS OF THE UNIT'S TRAJECTORY

The unit will continue to focus its efforts on the research on inter-individual differences in the following years. However, some research in new areas may emerge, especially in the medical field with the recent finding that ants are able to detect and learn the volatile chemical compounds emitted by cancer cells. The unit plans to start next year roundtables structuring synthesis articles and increase collaborations. The unit does not have any plan to reduce the number of species studied. In fact, this number may continue to increase, with the recent emergence of studies around bird behaviour, the expected recruitment of new EC, and a more in-depth exploitation of all the species available in the laboratory, particularly ants. The opening up of the laboratory to future societal issues is worth noticing (changes in regulations on the welfare of mammals in captivity, anthropic pressure on the living environment of many insect species...). The focus of research on inter-individual variations lends itself particularly well to this (adaptations, domestication). The average age of the scientific personnel is quite high (56-year-old in average). In the next five years, two PR and two MCF will retire, including one of the most successful for grant funding. On a unit of only thirteen ECs, this will be an important turnaround, which will reshape the structure and maybe the research focus of the unit. Importantly, in the next evaluation period, the team aims to move with a more sustainable operation, with energy saving notably. One EC has been named in 2022 as the representative person for Sustainable Development and Energy Efficiency.

To reduce the risks inherent in a single-university team (financial risks, staff turnover, etc.), LEEC could consider forging closer institutional links with other units in its discipline and becoming attached to a second supervisory body. Risk associated to funding decrease including University funding still exists. Overall, the unit's trajectory is assessed as very good to excellent.

RECOMMENDATIONS TO THE UNIT

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

The committee encourages the unit to increase its collaboration outside of ethology disciplinary laboratories (e.g. ecology, evolutionary biology, medicine, and neuroscience) in order to better exploit their findings. Eventually the goal should be to merge with an established labelled (IRD or CNRS) joint unit. Especially units hosted by the MNHN (such as Mecadev, Isyeb...) have some overlap with the current research conducted by the LEEC.

The committee recommends a better contribution of all ECs to funding search.

The committee encourages that parity is also respected in the future direction.

The committee recommends the general use of laboratory notebooks and encourages the use of the data storage system provided by the university (Magi).

The committee recommends an effort in communicating toward students' information to manage psychological or harassment issues.

Even if this is not yet mandatory, the committee recommends the monitoring of the invertebrate rearing through a notebook or a virtual drive, to anticipate regulation change.

Recommendations regarding the Evaluation Area 2: Attractiveness

The committee recommends that LEEC increases student participation in national and international conferences, which will increase its visibility and attractiveness.

The committee also recommends being included in a growing number of international projects that will increase the unit's attractiveness and thus the interest of foreign postdoctoral researchers. Some of the unit's members have excellent scientific profiles, enabling them to apply for European funding such as from the European Research Council, which would enhance LEEC's attractiveness.

The unit needs to anticipate changes in regulation for vertebrate and invertebrate rearing that may increase the associated costs and put these structures at risk.

Recommendations regarding Evaluation Area 3: Scientific Production

It is extremely important that all the ECs are involved in scientific production. The committee acknowledges the efforts made to encourage ECs with low publication records to be more productive (co-directions and co-supervision of PHD theses and postdoctoral students, roundtables...). Less scientifically producing ECs may be stimulated through association with highly producing ECs at the stage of grant submission and during writing of review articles.

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

The committee recommends improving interactions with non-academic and economic worlds, since the unit develops several topics with high social impact (cancer cell detection, pest behaviour...) which may be of interest for the private sector. Specifically, it is encouraged to reach Cifre scholarship more often to support PHD Students.

The committee encourages developing training, and communication (in professional magazines, or workshops) about animal welfare toward the professional world. The unit could be involved more in In-Service-Trainings (such as Diplômes Universitaires for professionals).

The unit is encouraged to increase communications and outreach activities toward the public and to pursue a policy of incentives to ensure that public communications activities are more evenly distributed among its members.

CONDUCT OF THE INTERVIEWS

Dates

Start: 11 janvier 2024 à 13 h

End: 12 janvier 2024 à 18 h

Interview conducted: online

INTERVIEW SCHEDULE

Évaluation Laboratoire d’Ethologie Expérimentale et Comparée UR 4443 [LEEC] — planning des entretiens

11 Janvier 2024

- 13 h Présentation du comité d’experts et présentation des enjeux de l’expertise Hcéres par le **Conseiller scientifique** [10’]
Auditoire : toute l’unité, tutelles
- 13 h 10 Présentation de l’unité LEEC : par Heiko Rödel et Christophe Féron [20’]
Auditoire : toute l’unité, tutelles
- 13 h 30 Discussion générale du comité avec le directeur et l’équipe de direction ; questions sur le bilan et la trajectoire [40’]
Auditoire : toute l’unité, tutelles
- 14 h 10 *Changement de lien visio*
- 14 h 20 Entretien collectif à huis-clos avec les contractuels [doctorants, post-doctorants et autres CDD « chercheurs ou ITA-BIATS » ; 30’]
Auditoire : membres du comité & conseiller Hcéres, sans tutelles, ni direction de l’UR, ni personnels permanents
- 14 h 50 **Pause** [15’]
- 15 h 5 Entretien collectif à huis-clos avec les personnels d’appuis à la recherche, ITA et BIATS [30’]
Auditoire : membres du comité & conseiller Hcéres, sans tutelles, ni direction de l’UR, ni chercheurs ou enseignants-chercheurs, ni personnels en CDD
- 15 h 35 *Changement de lien visio*
- 15 h 45 Réunion à huis clos des membres du comité et du conseiller scientifique →**visio HCERES**
- 18 h **Fin de journée**

12 Janvier 2024

- 13 h Entretien collectif à huis-clos avec les chercheurs (30')
Auditoire : membres du comité & conseiller Hcéres sans tutelles, ni direction de l'UR, ni ITA-BIATS ou personnels en CDD
- 13 h 30 *Changement de lien visio*
- 13 h 40 Entretien à huis-clos avec les représentants des tutelles : Université Sorbonne Paris Nord (30')
Auditoire : uniquement membres du comité & conseiller Hcéres
- 14 h 10 *Changement de lien visio*
- 14 h 20 Entretien à huis-clos avec l'équipe de direction (30')
Auditoire : membres du comité & conseiller Hcéres, sans tutelles, ni personnels
- 14 h 50 **Pause (15')**
- 15 h 5 Réunion du comité à huis clos, travail sur le rapport
- 6 p.m. Fin de la séance

PARTICULAR POINT TO BE MENTIONED

No particular point to be mentioned

GENERAL OBSERVATIONS OF THE SUPERVISORS

Monsieur Eric Saint-Aman
Directeur du département d'évaluation de la
recherche
Hcéres
2, rue Albert Einstein
75013 PARIS

Villetaneuse, le 26 février 2024

Objet : Rapport d'évaluation DER-PUR250024493 - LEEC - Laboratoire d'éthologie expérimentale et comparée

Cher Monsieur,

Nous faisons suite à votre courriel du 20 février 2024 par lequel vous nous avez transmis le rapport d'évaluation du Laboratoire d'éthologie expérimentale et comparée.

L'université Paris XIII – Sorbonne Paris Nord souhaite remercier au nom de l'ensemble des personnels de l'unité de recherche Monsieur Xavier Martini, Président du Comité, ainsi que les membres du Comité pour la qualité des échanges lors de la visite d'évaluation, ainsi que pour la qualité du rapport provisoire d'évaluation de l'Unité.

Nous nous réjouissons de voir la qualité scientifique du LEEC reconnue par le comité d'évaluation HCERES. Cette unité de recherche en éthologie des comportements sociaux est unique sur notre campus, comme en témoigne d'ailleurs sa bi-appartenance, aux SHS côté UFR, aux sciences biologiques côté École doctorale.

Nous voudrions apporter quelques compléments concernant le financement de l'unité de recherche. Le soutien de l'unité est, en termes de dotation, calculé sur le même per capita multiplié par x membres que les autres unités de recherche de l'établissement. Par ailleurs, le LEEC bénéficie du per capita le plus élevé, réservé normalement aux unités de recherches en sciences expérimentales. Mais il s'agit d'une petite équipe donc la dotation est au pro rata. Cependant, ce n'est pas le seul soutien financier de l'USPN. Il faut en effet y ajouter la participation du LEEC à une plateforme et une structure fédérative labellisées par la Commission Recherche qui apporte d'autres ressources, plusieurs financements par l'Appel à Projets d'établissement, la possibilité de professeurs invités et des subventions colloques, l'accès aux contrats doctoraux. Par ailleurs, nous avons tout récemment accordé un bureau au niveau du campus Condorcet à la fédération francilienne d'éthologie dont le LEEC fait partie afin de favoriser les interactions avec les enseignants-chercheurs du campus et en particulier avec les membres de la plateforme santé-sociétés du CNRS. Notre soutien est donc loin d'être négligeable, même si l'unité peut considérer qu'il est sans doute encore insuffisant.

Concernant les APC, notre politique est en train d'évoluer dans un engagement vers la science ouverte et nous suivons les directives du consortium Couperin. Il est certain qu'un regroupement avec une UMR serait souhaitable, sous réserve qu'elle n'infléchisse pas l'originalité des recherches du LEEC. Elle permettrait, notamment, de régler les problèmes d'accès aux bases bibliographiques spécifiques, réellement trop couteuses pour une aussi petite unité.

UNIVERSITÉ SORBONNE PARIS NORD MEMBRE :



@univ_spn / Université Sorbonne Paris Nord



Le poste d'informatique n'a pas été renouvelé faute d'accord avec les psychologues (le poste était partagé et il paraît difficile d'en créer un second). Pour le reste, nous nous associons à l'ensemble des recommandations, notamment celles qui concernent l'augmentation de la part d'autofinancement, pour laquelle la Direction de la recherche possède des compétences en termes de montage de projets.

Je vous prie de croire, Monsieur le Directeur, en mes sincères salutations.

Le Président de l'Université Sorbonne Paris Nord



Christophe Fouqueré

The Hcéres' evaluation reports are available online:
www.hceres.fr

Evaluation of Universities and Schools
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