

Research evaluation

## EVALUATION REPORT OF THE UNIT Bioc - Structures biomoléculaires et cellulaires

# UNDER THE SUPERVISION OF THE FOLLOWING ESTABLISHMENTS AND ORGANISMS:

École polytechnique/Institut polytechnique de Paris,

Centre national de la recherche scientifique - CNRS

## **EVALUATION CAMPAIGN 2024-2025** GROUP E

Rapport publié le 25/04/2025



## In the name of the expert committee :

Isabelle Landrieu, Chairwoman of the committee

For the Hcéres :

Coralie Chevalier, president

In accordance with 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 exact certified data extracted from the deposited files by the supervising body on behalf of the unit.

## MEMBERS OF THE EXPERT COMMITTEE

Chairperson:	Ms Isabelle Landrieu, Centre national de la recherche scientifique, CNRS, Villeneuve d'Ascq
	Mr Elian Dupré, CNRS, Villeneuve d'Ascq (representative of the research supporting personnel)
Experts:	Mr Ludovic Pelosi, Université Grenoble Alpes — UGA (representative of the CNU)
	Mr Antoine Taly, CNRS. (representative of the CoNRS)

## HCÉRES REPRESENTATIVE

Ms Anne-Marie Di Guilmi

## REPRESENTATIVES OF SUPERVISING INSTITUTIONS AND BODIES

Mr Hugues Lortat-Jacob, CNRS Mr Kees Van Der Beek, Ecole polytechnique



## CHARACTERISATION OF THE UNIT

- Name: Structural Biology of the Cel
- Acronym: Bioc
- Label and number: UMR 7654
- Composition of the executive team: Mr. Thomas Simonson, Unit Director; Mr. Emmanuelle Schmitt, Vicedirector

#### SCIENTIFIC PANELS OF THE UNIT

SVE Sciences du vivant et environnement

SVE3 Molécules du vivant, biologie intégrative (des gènes et génomes aux systèmes), biologie cellulaire et du développement pour la science animale

#### THEMES OF THE UNIT

The principal research conducted within the Bioc laboratory pertains to protein biosynthesis, encompassing areas such as translation initiation, mRNA post-transcriptional modifications, and ribosome assembly. The fundamental scope of these studies has been expanded to encompass interests in biotechnology and synthetic biology, including the genetic code expansion and de novo synthesis of proteins with a specific function. This core interest is complemented by studies on cell morphogenesis and the cytoskeleton. The research conducted at Bioc has yielded findings with implications in the biomedical and biotechnology domains.

#### HISTORIC AND GEOGRAPHICAL LOCATION OF THE UNIT

Bioc was founded in 1975 as a joint CNRS-Ecole Polytechnique research unit. Bioc occupies about 1000 m2, mostly in the new building 84.

#### RESEARCH ENVIRONMENT OF THE UNIT

Bioc is the only laboratory of the Ecole Polytechnique affiliated with CNRS Biology. The Bioc researchers teach electively biology courses at Ecole Polytechnique. All chairmen of the EP Biology Department since its creation were Bioc members. Bioc participates in the IP Paris "Engineering for Health" initiative (E4H), created in 2022, although it has no representation in E4H steering. E4H federates IP Paris teams in physics, mechanics and computer science with "medical device" and a "biomolecular engineering" federating themes. Bioc has interactions with the LOB (Optics and Biosciences lab, CNRS Physics) that includes several biology teams.

Bioc is one of four founding members of the Cimex (Interdisciplinary Center for Electron Microscopy), an EP service unit that provides electron microscopes for physics, chemistry and biology, including a Titan Themis (FEG-300kV) transmission electron microscope, with liquid-phase and cryogenic sample holders. Cimex participates in research and teaching in EP and the Paris-Saclay area.

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maîtres de conférences et assimilés	2
Directeurs de recherche et assimilés	6
Chargés de recherche et assimilés	4
Personnels d'appui à la recherche	15
Sous-total personnels permanents en activité	27
Enseignants-chercheurs et chercheurs non permanents et assimilés	5
Personnels d'appui non permanents	0
Post-doctorants	3
Doctorants	7
Sous-total personnels non permanents en activité	15
Total personnels	42

#### UNIT WORKFORCE: in physical persons at 31/12/2023



DISTRIBUTION OF THE UNIT'S PERMANENTS BY EMPLOYER: in physical persons at 31/12/2023. Non-tutorship employers are grouped under the heading "others".

Nom de l'employeur	EC	С	PAR
EC POLYTECHNIQUE	2	0	8
CNRS	0	6	7
AUTRES	0	4	0
Total personnels	2	10	15

## **GLOBAL ASSESSMENT**

The Bioc laboratory is currently composed of five teams that address basic questions related to protein biosynthesis regulation, through RNA modification or RNA homoeostasis, and the ribosome assembly and homoeostasis. In addition, one team focuses on the cell morphogenesis and the cytoskeleton. Bioc laboratory research has an impact in the biomedical and bioengineering fields.

The global quality of the Bioc scientific production is excellent.

At the end of the current period, an incoming researcher initiated a new team with the support of the CNRS. The topics of this team are very well integrated into the laboratory environment and will contribute in particular to strengthening its visibility in the field of Archaea (e.g. book editor: "Archaea: Methods and Protocols" in Methods in Molecular Biology 2022). For the next period, the laboratory will welcome a new additional team focused on developing studies on infectious prions and strengthening the cell biology component of the laboratory. Seed funding has been acquired and an L3 laboratory will be installed. The bioinformatics team will be closed in its current configuration. The laboratory direction, with the support of the EP, has taken all steps to ensure that this expertise, which is a distinctive and essential feature of the laboratory, will be maintained in the future.

The Bioc laboratory has an excellent visibility stemming from its rather unique position as a CNRS Biology lab at the Ecole Polytechnique. Bioc laboratory has demonstrated an excellent capacity to attract funding through competitive calls to allow its project to proceed in the best conditions. The Unit has contributed to the Cimex by its projects, supporting the installation of a cryo-EM microscope, accessible to the community.

The laboratory has also trained 25 PhD researchers and nine postdoctoral researchers demonstrating the attractiveness of its research project and underscoring its dedication to academic mentorship.

The laboratory has managed an excellent exploitation of its expertise, with a large grant for education and research from Servier. Lab members have disseminated their knowledge by an important contribution to teaching Biology at Ecole Polytechnique. They have been in contact with the public by e.g. taking the opportunity to join broadcasts or welcome visits by school classes.



## **DETAILED EVALUATION OF THE UNIT**

# A - CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

#### The unit is lacking international grants and is absent from PIA investments

The comment remains unresolved for the current period, despite multiple international collaborations (26 of 91 published articles are co-authored with laboratories located abroad). An Advanced ERC proposal was, however, submitted but unsuccessfully (despite solid scores). One "International laboratory" (LIA) with the Tomsk and Moscow Cancer Research Centers in Russia was established.

#### Collaborations between teams could be further strengthened to exploit potential synergies

Two ANR grant applications have two teams as coordinator/partner. Four articles were co-authored between teams. A laboratory PhD/postdoc researcher seminar was established. This remains an important comment for the next period, especially with the recent arrival of two new teams and the high potential of interdisciplinary expertise within the laboratory.

#### No Cifre fellowships have been awarded to foster collaborations with industrial partners

They are still no CIFRE fellowships but this is clearly compensated by increased valorisation efforts, specifically the "Chaire Servier", which raised 750 k€ and was renewed.

#### Foreign students need of some kind of mentoring and asked for more courses in English

All 3A, M1, M2, and bachelor's courses are now given in English, including course documents, and are open to Bioc students and postdocs. (None participated in the last two years.) Mentoring exists at the team level.

## Students and postdocs should be given more opportunities to present their preliminary results in a very informal way to exchange and discuss about their projects and scientific difficulties

Informal student presentations take place regularly within each team but it may not offer the same level of project challenges as Unit-wide presentation. Efforts in this direction are provided by the launch of a lab-wide annual meeting, including student posters and talks.

# The strategic interactions with the environment should be defined, especially with the EP, in order to be part of their biomedical engineering program, without losing the curiosity-driven projects and fundamental science but by being a driving force in the elaboration of this program.

Bioc works to make biomolecular engineering an important part of E4H but has still no representation in E4H steering. Biotechnology and synthetic biology are increasing at Bioc, which would match the missions included in E4H.

## **B - EVALUATION AREAS**

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

#### Assessment on the scientific objectives of the unit

The assessment on the scientific objectives of the unit is excellent.

The Bioc laboratory conducts a multi-scale research on fundamental biological and biomedical questions. It integrates all dimensions from the atomic to the supramolecular and cellular levels. The Bioc laboratory shows its excellent ability to interact with several disciplines. The scientific objectives of Bioc are very well integrated into its environment and follow the priorities of its supervisory bodies.



#### Assessment on the unit's resources

The resources of the laboratory to develop its project are considered excellent by the committee. The Unit has equipment for biochemistry/biophysics and cell biology, as well as access to computing time. It has privileged access to the Cimex for cryo-electron microscopy. It shares some equipment within EP with the LOB laboratory. It will benefit from newly renovated P2 and P3 laboratories. Its location and network of collaborators allow equally easy access and know-how transfer from the close by synchrotron facility.

#### Assessment on the functioning of the unit

The assessment on the functioning of the unit is excellent.

The Bioc laboratory is organised into five teams and it shares resources such as the expertise of its engineers, budget and equipment. The laboratory follows the rules set by its supervisory bodies. The members of the Bioc laboratory benefit from a convivial and stimulating atmosphere, an approachable direction and a sense of purpose in teaching Biology through research.

#### 1/ The unit has set itself relevant scientific objectives.

#### Strengths and possibilities linked to the context

Bioc addresses basic questions related to protein biosynthesis regulation, through RNA modification or RNA homoeostasis, and the ribosome assembly and homoeostasis. In addition, one team focuses on the cell morphogenesis and the cytoskeleton. Research at Bioc has an impact for biomedical applications, mainly in cancer. Among several model organisms, Archaea has become more important and strengthened by the arrival of a new PI with expertise in the field. Biotechnology, more specifically biotechnology and synthetic biology, including the genetic code expansion and de novo synthesis of proteins with a specific function has also been supported by the Unit, sustained by bioinformatic capacity of one team and in-line with the objectives of the E4H initiative (engineering for health).

#### Weaknesses and risks linked to the context

None

## 2/ The unit has resources that are suited to its activity profile and research environment and mobilises them.

#### Strengths and possibilities linked to the context

Recurring funds are shared between the teams to ensure equipment maintenance, repair or acquisition (FPLC systems, SEC-MALS, microFPLC, Spectrofluorimeter, Stopped-flow, ITC, Quantitative PCR, pipetting robots, crystallisation plate viewers, incubators). The biochemical & biophysical instruments, optical microscopes and cell culture rooms are available to the whole laboratory. In addition, pooled overhead funds from ANR grants allowed new acquisitions, e.g. an autoclave (50k).

Support staff (4.20 full-time equivalent) is shared between teams: computers are managed with the help of an engineer from the bioinformatic team, glassware is maintained by a shared technician, a financial administrator manages the budget and a secretary supports HR and missions. In addition, a Research engineers is assigned to each team, except for one team, which has two, and the new team, which hopes to fulfil a vacant position. The EP Biology Department participates in acquisition and maintenance of some equipment because it is used for experimental teaching.

#### Weaknesses and risks linked to the context

As a risk, rather than a weakness, resources are optimised and shared but it remains important to be able to replace any external mobility to ensure the smooth operation of the laboratory (e.g. one open engineer position for the new team needs to be fulfilled). The laboratory benefits from excellent lab space but its attractiveness could lead to some space constraints and overload of some key equipment (e.g. L2 laboratory) in the future.



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

#### Strengths and possibilities linked to the context

The Unit follows the rules of its supervisory bodies, including to ensure cyber security. Radioactivity manipulations remain in use in the laboratory (although they seem to decline) and security and hazard rules are communicated to the laboratory (via posters and one annual meeting).

Data storage and backup are supported by a specific disk server, located in a dedicated building at Ecole Polytechnique.

#### Weaknesses and risks linked to the context

Sustainability concerns have not yet been considered at the level of the laboratory.

## EVALUATION AREA 2: ATTRACTIVENESS

#### Assessment on the attractiveness of the unit

The attractiveness of the unit is considered excellent by the committee.

The Bioc laboratory has an excellent visibility due to its rather unique position as a CNRS Biology at the Ecole Polytechnique. The Bioc laboratory has demonstrated an excellent ability to attract funding through competitive calls and new researchers to support its scientific goals. Bioc has excellent infrastructure, including privileged access to a cryo-EM microscope and computing power.

#### Strengths and possibilities linked to the context

Laboratory seminars are organised monthly. The laboratory has shown its excellent capacity to attract researchers to its project. Two tenured scientists arrived in 2018: one through the CNRS entrance competition and one through mobility (Inserm researcher). In addition, two new PIs arrived in 2023 (DR2 CNRS & MCF EP). The net increase since 2018 was positive with two tenured scientists (four arrivals, one retirement and one outgoing mobility), including one team leader. The shared equipment facilitated the integration of the new team. In addition, an attractive package was assembled for the new team with support from the laboratory and the supervising bodies.

The laboratory demonstrated the competitiveness of its research as nine ANR and one INCA grants were obtained on the period, three as coordinators of the grants. Funding was diversified with additional grants from charities and foundations (5 ARC, 1 Fonds St Michel), one large grant from a company (Servier, mécénat enseignement et recherche) and one grant from the Ministry of Defence. Two contributions to PhD completion were obtained from INCA and one PhD fellowship from the FRM. One LIA mobility scheme was established (with Russia).

Team members gave invited or contributed talks at 33 international and 23 national conferences. They coorganised eight national and 6 international meetings, including one at the well-regarded CECAM in Lausanne (2019), an EMBO Workshop (2019), and the European Crystallography Meeting (2020). International collaborations accounted for 26 of 91 published articles.

Bioc was represented in learned societies as a member of the council of the Société de Biologie Cellulaire de France (SBCF) and member of the SFBBM (since 1998) and vice-chair of the SFFBBM (2013-2019) or "Chargé de Mission" since 2020 and currently vice-chair of the thematic group "Archaea". Two prizes were awarded for a PhD research and one team received the "Distinguished Team" Prize from the Fondation ARC pour la Recherche sur le Cancer.

A total of 25 PhD researchers and nine postdoctoral researchers were trained in the laboratory during the period. A complete pipeline for cryo-EM data collection is available at Bioc, comprising a Glow Discharge Cleaning System and an automatic plunge freezer system. Cimex, an EP service unit, of which Bioc is one of four founding members, provides a FEG-300kV cryo-microscope equipped with a Falcon 3 detector. The Soleil synchrotron is



easily accessible for data collection (X-ray diffraction and/or cryo-EM). Cimex will also be acquiring a cryoEM grid clIP Parising system (clIP Parising station, MiTiGen) to facilitate interfacing with the latest-generation cryo-microscope platforms (including at the synchrotron). Cryo-EM data processing and crystallography is possible thanks to five GPU machines shared for bioinformatics, including an in-house AlphaFold server. Data storage on the microscope (60 TB) is connected to Bioc machines in the computer room with optical fibre. A GPU machine is directly connected for on-the-fly processing. A disk server is dedicated to cryo-EM data backup. Each of the five storage disks (one on each gpu machine) is mirrored nightly on a backup disk of the same size (130 TB total).

Due to the arrival of a new team, one L2 laboratory will be upgraded to an L3 level and a new L2 laboratory constructed.

Researchers have opportunities to teach at the EP. All Bioc members are involved in teaching by research, in their different capacities: logistic organisation, supervision, courses, writing educative content, etc.

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

No international/EU grants or participation to networking mobility/activity at the EU level were formalised (campus France, COST actions...) except for the LIA mobility scheme established with Russia which had to be interrupted because of the international situation.

Bioc lacks space for further development.

#### EVALUATION AREA 3: SCIENTIFIC PRODUCTION

#### Assessment on the scientific production of the unit

The laboratory had an excellent scientific production reflecting its multiscale approach.

Strengths and possibilities linked to the context

During the review period, Bioc produced 91 research or review articles, five book chapters, and four books. 45 articles and all five chapters articles had a Bioc member as the last author; 26 were part of an international collaboration.

Publications reflected the laboratory expertise in biochemistry, microbiology, molecular/cell biology, structural biology, computational biology and synthetic biology, allowing multi-scale approaches. Team members have published their research in journals ranging from specialised but well-regarded journals (e.g. Biochemistry, Protein Science, scientific reports) to high visibility disciplinary journals (e.g. Nucleic Acid Research, RNA, J. Struct. Biol., PLoS computational Biology, Nature protocols, J Biol Chem, Febs journal Angewandte Chemie) and journals with a large audience (e.g., Nature Cell Biology 2021, Science Advances, Nature Communications, Cell reports, Communications Biology, EMBO reports, EMBO Journal). In addition, softwares are publicly shared on GitHub. Interestingly, Proteus, which is open source, has a physical basis for its predictions, allowing the force field to be fine-tuned to specific modifications (e.g. post-translational modifications) that are still difficult to access with the deep learning methods that have emerged.

Several of Bioc's productions stand out as scientific highlights of their project, and the research topics show all competitiveness in their field of research.

The Proteus software has been used to design de novo synthetic proteins, such as PDZ domains (Scientific Reports, 2020) or a methionyl-tRNA synthetase with catalytic efficiency, which was the design criterion (PLoS Computational Biology 2020). For the latter, both first authors were PhD students and the work was carried out as an internal collaboration with two Bioc teams, allowing allying computations with wet-lab demonstration.

Bioc has also built up a historical expertise in archaea, now reinforced by a new team with international visibility in this field. Using structural biology approaches, they show how the archaeal 5B and 1A initiation factors work together to induce a conformation of the initiator tRNA that facilitates the assembly of ribosomal subunits (NAR 2023, PhD student as first co-author). This result allows comparison with translation initiation in eukaryotes in an evolutionary biology approach.

Original approaches have also been developed to characterise post-transcriptional modifications of RNA, for example identifying the catalytic complex between the m6A methyltransferase METL5 and the TRMT112 protein as responsible for the modification of the human small ribosomal subunit, using a combination of in vitro, in cell and structural approaches (NAR 2019, NAR breakthrough article). They also studied the interaction of TRM proteins and the activation of methyltransferases (MTases) in Archaea (NAR 2018, NAR 2020). A notable highlight of the research, which led to the Arc Foundation's Equipe à l'honneur award, is the demonstration of the role of branched actin networks in the initiation of cell division. This involves the Arp2/3 complex, which contains the



ARPC1B protein. Without this protein, the division signal is interrupted, and in breast cancer, overexpression of the ARPC1B protein is associated with a poor prognosis (Cell Research 2019).

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

None

## EVALUATION AREA 4: CONTRIBUTION OF RESEARCH ACTIVITIES TO SOCIETY

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

The overall assessment about the contribution of the unit to the society is excellent. Research at the Bioc laboratory has an impact on human health. The laboratory has made excellent use of its expertise, with a large grant from Servier for teaching and research. The members of the laboratory have disseminated their knowledge by making an important contribution to teaching at the Ecole Polytechnique and have taken advantage of many opportunities to inform the general public and promote scientific careers.

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

Bioc has developed projects with potential biotechnological or medical impact. Bioc provided training in cryo-EM to the company Sanofi and received private funding to support cancer-oriented research, in particular a large grant from Servier (Mécenat enseignement & recherche). The IP Paris Executive Master program has also been used to train professionals. Eight CNRS researchers at Bioc, six of whom hold professorships at EP, teach at EP and disseminate their scientific knowledge and expertise.

Bioc actively communicated through social media, press releases, broadcast interviews and contributions to newspaper articles. Bioc members participated in the annual Fête de la Science and an Art & Society symposium at EP. Videos on RNA vaccines and Covid were produced and posted on YouTube. High school interns were regularly hosted for vocational week and the laboratory was visited by school classes.

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

None



## **ANALYSIS OF THE UNIT'S TRAJECTORY**

For the next period, the laboratory will welcome the activity of two new researchers as team leaders, who joined the laboratory at the end of the previous period. One of them is incoming with a team (with two additional researchers) that focused on developing studies on infectious prions, a new topic for the laboratory. Seed funding has been acquired and an L3 laboratory will be installed. An engineer of Bioc will join this new team and an additional IR-EP is expected to be recruited. The L3 laboratory will need support. This is a domain of research which is a break from previous focus, posing an opportunity but also a challenge to build synergies. The other team is focused on RNA and ribosome homoeostasis and has expertise in the Archae model, which will expand the capacity to address scientific questions related to the evolution of the genetic code translation. The synergy is clear with other Bioc teams, for example, to implement structural biology and genetics on Archae (e.g. investigate the structure of Archaea pre-ribosomal assemblies). Finally, the arrival of a new assistant professor is an important step to prepare the long-term future of an existing team.

At the same time, computational biology is at risk, given a scheduled retirement, which is a strong loss, given the research that was conducted during the period, joining force between computational biology and experimental to develop some very original lines of synthetic biology by expanding the genetic code. It endangers the stated objective of the laboratory to increase its biotechnological impact. The head of the lab has presented a clear plan to overcome this challenging situation, which implementation will require support.

The laboratory will benefit from the technological investment of the previous period in cryo-EM, coupled to fantastic access to high-end instrumentation, in-house and at the nearby synchrotron to investigate the interplay between messenger RNA, transfer RNA, and ribosomes. In addition, a new project will implement state-of-the art fluorescent microscopy techniques (including super-resolution) and Cryo-electron tomography to obtain in situ information (e.g. on the ribosome organisation), in collaboration with a nearby team (LOB laboratory) and thanks to an international collaboration (Heidelberg, Germany).

RNA epitranscriptomics research will benefit from established networks, results and expertise built on a long-term investment in the field to explore new models of medical relevance in neurodevelopmental defects, through collaborations. This will open the door for an increased translational activity.

Study of cell migration will build on the laboratory expertise on mRNA translation, and its results of the last period on the actin polymerisation pathway RAC1-WAVE-Arp2/3, to join the study of the local mRNA translation and actin polymerisation in protrusions. This is an original approach that could bring new insight into a yet poorly explored interplay involved in cell transformation and metastasis formation.

Finally, opportunities to explore kinetic or in situ (cryo-ET) approaches in structural biology are challenging objectives that could provide exciting new results in translation mechanisms. Bioc is well positioned to address these challenges, by its expertise, network, infrastructure and preliminary results in that direction.



## **RECOMMENDATIONS TO THE UNIT**

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

Bioc needs to continue its efforts and dialogue with its supervisory bodies to ensure that the computing expertise remains strong in the laboratory. It will be important for the new team to be supported by an engineer in the future, a process that is well underway and should come to fruition. Finally, the Committee recommends that the new direction takes every opportunity to encourage interaction between the teams in order to build on the existing synergies.

#### Recommendations regarding the Evaluation Area 2: Attractiveness

None but given the high visibility of some research conducted at Bioc, it seems to the committee that there is the potential to attract large EU grant(s), if judged appropriate.

Recommendations regarding Evaluation Area 3: Scientific Production

Keep up the good work. Reinforce your internal interactions when appropriate.

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

The committee believes that given the potential provided by its biotechnology and biomedical-oriented program, scientific results could be more broadly exploited including by increasing interactions with maturation offices and/or with pharmaceutical companies, when judged appropriate.



## **TEAM-BY-TEAM OR THEME ASSESSMENT**

Team 1:

Biocomputing and structure

Name of the supervisor: Mr. Thomas Simonson

## THEMES OF THE TEAM

The team has a background in molecular modelling and de novo protein design

## CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The previous report noted that an effort to disseminate the Proteus software more largely would be beneficial and that high impact article would be desirable in that context. The team has successfully followed that advice, publishing in high-profile journals (PLOS Comput. Biol.; Scientific reports).

The weakness of the team associated with its limited size had been noticed with a recommendation to reinforce itself. The situation is only stronger today given the future retirement of the PI and announced closure of the team. However, the team and lab head have presented their past and ongoing efforts to allow maintaining the modelling activity.

The recommendation to focus on selected collaborations appears to have been successfully followed as shown by the publications mentioned above.

## WORKFORCE OF THE TEAM: in physical persons at 31/12/2023

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maîtres de conférences et assimilés	1
Directeurs de recherche et assimilés	1
Chargés de recherche et assimilés	0
Personnels d'appui à la recherche	1
Sous-total personnels permanents en activité	3
Enseignants-chercheurs et chercheurs non permanents et assimilés	1
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	1
Sous-total personnels non permanents en activité	2
Total personnels	5

## **EVALUATION**

#### Overall assessment of the team

**The overall assessment of the team is excellent.** The team has a strong expertise in molecular modelling and computational protein design. The team is well respected and visible as illustrated by invitations to conferences and contributing reviews received by the PI. Noteworthy, the team has developed a physicsbased approach which is very competitive for systems with limited data like RNA/Archaea. The main issue requiring scrutiny and continued efforts is the planned retirement of the PI which implies that a new PI need to be hired to maintain the modelling activity in the unit at the best level.



#### Strengths and possibilities linked to the context

The team has a great potential.

First it has a strong expertise in the field of molecular modelling and protein engineering whose potential is illustrated by the 2024 Nobel prize in chemistry. Noticeably, while deep-learning approaches are blooming, the team has a complementary physics-based approach. This is a key asset for systems with limited data like RNA molecules and Archaea organisms and therefore offers both a competitive advantage and opportunities for renewed collaborations with experimentalists of the unit. The team is inserted in a research unit that has a strong complementarity (biochemistry, structural biology) offering opportunities for collaborative works combining experimental and theoretical approaches, as demonstrated by several publications during the period (e.g. Protein Science 2023). The Proteus software has been used to design de novo synthetic proteins, such as PDZ domains (Scientific Reports, 2020) or a methionyl-tRNA synthetase with catalytic efficiency, which was the design criterion (PLoS Computational Biology 2020). For the latter, both first authors were PhD students and the work was carried out as an internal collaboration with 2 Bioc teams, allowing allying computations with wet-lab demonstration. Six invited articles (including Curr Opin Struct Biol, J Phys Chem Feature Article) were published and a book edited (Springer).

The team published thirteen research articles in excellent specialised journals, as well as two book chapters, four invited reviews, and two books, with an important contribution to authorship from the early-stage researchers. Importantly, the Proteus software is openly shared with the community, including a manual (220 pages) and extensive, documented test cases.

During the period, one grant was coordinated by the team (Ministry of Defense) and computing time was secured (Supercomputer grant, acquisition of GPU-based computers). The team was also partner in three other projects, from diverse sources of funding (ANR, Charity, EU).

The team leader gave invited talks to two national and six international conferences, and contributed to organising one meeting. Other team members contributed to disseminating the team's research and one has obtained a prize at an international meeting (Best Poster). The team leader is editor in Frontiers in Molecular Sciences, Journal of Computational Biophysics and Chemistry and board member of Scientific Reports. He contributed his expertise to the selection committee to evaluate the project (e.g. EIC pathfinder panel, DFG) or for recruitment (e.g. tenure for junior professor in the US) at the national and international levels.

The modelling expertise relies on a competent team beyond its PI with an assistant professor and an engineer. It is also supported by the possibility to hire motivated students with excellent academic background from Institut Polytechnique. Five PhD students and two postdoctoral researchers were trained in the team during the period.

#### Weaknesses and risks linked to the context

The main threat for the team is the retirement of its PI, that forces its, hopefully temporary, closure.

#### Analysis of the team's trajectory

The team has a background in molecular modelling and protein design that is both strong and highly respected nationally and internationally. During the evaluated period, the team has successfully improved its impact through the diffusion of articles in highly regarded journals in the field (PloS Comput. Biol.; Sci. Rep) and the diffusion of the software Proteus. The team has also improved its complementarity with other teams of the unit, e.g. to develop some very original lines of synthetic biology by expanding the genetic code.

The team will be closed because of the retirement of its PI. Indeed, despite past effort from the team it was not possible yet to secure the arrival of a new PI. The head of the lab has presented a clear plan to overcome this challenging situation, which implementation will require support.

## RECOMMENDATIONS TO THE TEAM

None



#### Team 2:

Translation mechanisms

Name of the supervisor:

Dr: Mr. Yves Mechulam and Ms. Emmanuelle E Schmitt

## THEMES OF THE TEAM

The main activity of the "Translation Mechanisms" team is to identify molecular specificities of the ribosomal translation initiation machinery in the three domains of life, mostly Archaea, using structural and biochemical methods. During this term, a strong emphasis was put on the development of tools for the determination of structures of ribosomal complexes using cryo-electron microscopy and acquiring cryo-EM skills. A new axis on post-translational modifications of eIF2 in cardiomyocyte diseases was also started in the team and still being developed. A separate topic on selenium toxicity was hosted by the team during the period.

## CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The team was encouraged in their effort to use cryo-EM techniques, and they succeeded in their endeavour by being founders of the Cimex project which led to the acquisition of a Titan Themis (FEG-300kV), and recruiting a postdoc working on time-resolved cryo-EM devices. Organisation of a focused international conference to increase the visibility of the research was advised and the team participated in the organisation of the Molecular Biology of Archaea EMBO meeting at Ecole Polytechnique in June 2024.

## WORKFORCE OF THE TEAM: in physical persons at 31/12/2023

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maîtres de conférences et assimilés	1
Directeurs de recherche et assimilés	2
Chargés de recherche et assimilés	2
Personnels d'appui à la recherche	3
Sous-total personnels permanents en activité	8
Enseignants-chercheurs et chercheurs non permanents et assimilés	2
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	0
Sous-total personnels non permanents en activité	2
Total personnels	10

## **EVALUATION**

#### Overall assessment of the team

The overall assessment is excellent. The team has produced high quality research during the period and is highly recognised in the field of Archaea and protein translation. Their technical skills in cryo-EM are also recognised.

#### Strengths and possibilities linked to the context

During the reference period, the team had an excellent production of 25 original research articles and three invited reviews and many in top tier journals such as Nucleic Acids Research, Communications Biology or Protein



Science with twelve publications coming from international or national collaborations and three publications from internal collaborations at the unit level. Seventeen publications are from first or last authorship positions with PhD students having at least one first authorship.

The team was successful in obtaining two grants from the ANR with one as coordinator, one FRM grant as well as a project from Action Interdisciplinaire de Défense, for a total of 621k € during the reference period. Team leaders are active as reviewers for top tier journals (Nature, Nature communications, Nucleic Acid Research...) and participates in international (Gordon Research Conference e.g.) and national conferences as well as in evaluation bodies for different organisations (INRA, CNRS...), showcasing their excellent scientific reputation.

The team is highly involved in teaching at Ecole Polytechnique but also in other master degrees and also contributed to MOOC classes. They also contribute greatly to teach through internships and organise workshops. Cryo-EM expertise of the team was also transferred to industrial partners through training.

Three PhD students successfully defended their thesis during the period and a former postdoctoral fellow obtained a permanent position in the team. Good opportunities in learning and using diverse technical skills are highly valuable and help alumni in getting positions.

#### Weaknesses and risks linked to the context

No grants were obtained on the eIF2 research topic which can undermine the work on this project.

#### Analysis of the team's trajectory

The team will build up on its strong points to continue their research on translation mechanisms and extending them to new areas like leaderless mRNAs translation and aberrant translation initiation in human disease. The implementation of time-resolved cryo-EM also gives very bright prospects.

## RECOMMENDATIONS TO THE TEAM

None



#### Team 3:

Translation and degradation of eukaryotic mRNAs

Name of the supervisor: Mr. Marc Graille

## THEMES OF THE TEAM

The team Translation and Degradation of Eukaryotic mRNAs aims to understand the functions of posttranscriptional modifications (or epitranscriptomic marks) in eukaryotic RNA. The team's goal is to decipher the role of these modifications in essential biological processes such as mRNA maturation, translation, and decay, as well as their impact on cell proliferation, organ development, and the consequences of pathogenic mutations.

## CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The 2020 Hcéres report called for more opportunities to present the team's research at international meetings in order to develop international visibility. Indeed, such visibility is important for successful international grant applications. During the reporting period, the team leader was invited to two international conferences to present recent results obtained in RNA epitranscriptomics, thus addressing the weaknesses raised above. Moreover, the team leader reviewed grant applications for Polish National Science Center (NCN, Poland), the Fonds National pour la Recherche Scientifique (FNRS, Belgium), German Research Foundation (DFG, Germany), Wellcome Trust (UK) and he was a member or chair of the Polish NCN expert panels for Life Sciences in 2020, 2022 and 2023, demonstrating strong international visibility.

## WORKFORCE OF THE TEAM: in physical persons at 31/12/2023

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maîtres de conférences et assimilés	0
Directeurs de recherche et assimilés	1
Chargés de recherche et assimilés	0
Personnels d'appui à la recherche	1
Sous-total personnels permanents en activité	2
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	1
Doctorants	3
Sous-total personnels non permanents en activité	5
Total personnels	7

## EVALUATION



#### Overall assessment of the team

The overall assessment of the team is outstanding.

Despite its small size, this team has shown a strong commitment to advancing scientific knowledge, publishing numerous research articles in prestigious international peer-reviewed journals, thereby solidifying its reputation as a leader in the field. The team has participated in national funding calls, achieving a high success rate in securing grants. This success has enabled the team to train six PhD students, underscoring its dedication to academic mentorship and the development of the next generation of researchers.

#### Strengths and possibilities linked to the context

During the evaluation period, and despite being reduced to a single permanent researcher since December 2022, the team has significantly strengthened its expertise to become one of the leaders in its field. The team published around 16 research articles in prestigious international peer-reviewed journals (NAR, EMBO Rep, Nat. Com., Scientif Rep.). Additionally, they contributed to 4 invited reviews, making a substantial impact on the field of RNA research. Importantly, the team is highly dedicated to academic training. Indeed, they trained two Bachelor students, three Master's students, and four PhD students, all of whom successfully defended their theses, with corresponding publications. Additionally, two more PhD students are currently progressing. This commitment to mentorship underscores the team's role in developing the next generation of scientists. The team has consistently achieved success in national funding calls, with the team leader serving as coordinator for two ANR-funded projects and as a partner on four other ANR grants. The research was also supported by two grants from the Fondation ARC. These funds enabled the hiring of two post-doctoral fellows, as well as two "ingénieurs d'étude" positions. Between 2018 and 2023, the total resources obtained from public funding and national associations amounted to 944 k€, ensuring the team's capacity to sustain its cutting-edge research. The team's international visibility is bolstered by numerous collaborations with research groups from Germany, Belgium, and other countries. The team leader is recognised as an expert and frequently serves on foreign grant application panels for countries such as Poland, Belgium, Germany, and the UK. In addition to research activities, the team leader has taken on various roles within the scientific/academic community. He is a member of the Consultative Commission of Université Paris-Saclay and has served on two selection committees for doctoral fellowships at graduate schools. Furthermore, he is actively involved in the boards of the French RNA Research Group (GDR) and the Department of Biology at Institut Polytechnique de Paris. The team has also been proactive in promoting its research and engaging with the public. The team leader regularly shares updates on published articles through social media platforms, and press releases on the CNRS and Ecole Polytechnique websites. During the Covid-19 pandemic, the team leader created two educational videos explaining the principles of PCR tests and mRNA vaccines. He was also featured as one of two experts interviewed for an article on mRNA vaccines published in Polytechnique Insights. His commitment to science outreach extends to in-person events, such as public lectures at the IP Paris Science Festival and in a public library in Massy. Moreover, he gave presentations to middle school students about research professions, the educational pathways required, and the organisation of a research laboratory.

#### Weaknesses and risks linked to the context

Since the departure of a permanent researcher, the team leader has been the sole permanent researcher within the group. This shift has placed increased responsibility on the team leader, not only for driving the scientific direction of the team but also for managing the administrative, mentoring, and collaborative aspects of the research. Although the team benefits from substantial technical support, including skilled engineers and technicians, the imbalance between permanent and non-permanent staff - primarily composed of postdocs and PhD students - creates challenges for maintaining a stable and sustainable research environment. Non-permanent staff bring valuable energy and fresh perspectives to the team, but the transient nature of these roles means that expertise and continuity are often lost as team members complete their contracts and move on. This constant turnover can disrupt ongoing projects and lead to gaps in knowledge transfer, making it difficult to sustain long-term research goals and maintain momentum. Furthermore, without additional permanent researchers to share the workload, the team leader faces significant pressure to secure funding, supervise students, and manage day-to-day research activities, which may impact the ability to fully explore new scientific directions or expand collaborative networks.



#### Analysis of the team's trajectory

Through a combination of scientific excellence, strong mentorship, consistent success in securing competitive funding, and active engagement with the public, the team has established itself as a benchmark in RNA research, making lasting contributions both academically and within the broader scientific community.

## RECOMMENDATIONS TO THE TEAM

To ensure the long-term viability of the team's research and maintain its competitive edge, expanding the number of permanent researchers is a strategy worth considering. If the principal investigator supports structuring the team in this manner, the team's environment appears well suited to welcoming additional researchers, thereby enhancing its overall potential.



#### Team 4:

Ribosome and RNA homoeostasis and disease progression

Name of the supervisor:

Mr. Sébastien Ferreira-Cerca

## THEMES OF THE TEAM

The "RNA and ribosome homoeostasis" team joined the Bioc laboratory in February 2023. This team aims to better understand the principle of RNA and ribosome homoeostasis to contribute to the emergence of an improved conceptual framework regarding the evolution of RNA metabolism(s) in general and to provide significant information about functional convergence and divergence within the different domains of life.

### CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

None

## WORKFORCE OF THE TEAM: in physical persons at 31/12/2023

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maîtres de conférences et assimilés	0
Directeurs de recherche et assimilés	1
Chargés de recherche et assimilés	0
Personnels d'appui à la recherche	1
Sous-total personnels permanents en activité	2
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	1
Sous-total personnels non permanents en activité	1
Total personnels	3

## **EVALUATION**

#### Overall assessment of the team

The overall assessment of the team is excellent.

To facilitate its establishment in 2023, the team received financial support to access the laboratory's facilities, as well as a PhD fellowship. Additionally, the team leader is actively engaged in responding to project calls. The team possesses unique expertise in the genetic manipulation of Archaea and the analysis of their genomes and the laboratory is fully equipped for these activities. Collectively, this financial and technical support will enable the team to make a strong start.

#### Strengths and possibilities linked to the context

From 2018 to 2023 the team has published a total of 16 international peer-reviewed journals and four reviews. In addition, the engineer who joined the team in 2023 has published two articles (2022 and 2023) resulting from work prior to his arrival in the team. Since his arrival at the BIOC, the team leader has published two collaborative articles (Germany and Belgium). One is signed as corresponding author. As one might expect, the only PhD student supervised since October 2023 has not yet been published. Thus, in the last years, the team leader has contributed to major advances in the understanding of ribosome biogenesis in Archaea. Currently, the team's



funding appears to rely solely on financial support from CNRS Biology. However, between 2018 and 2023, the team has benefited from over 750 k€ in grants from the German Research Council. In 2023, the team has submitted 4 ANR proposals, including three international ones (1 as Scientific Coordinator PRCI DFG-ANR, 2 as Scientific Partner PRCI FWF-ANR, PRC ANR, and 1 as Scientific Participant PRC ANR). The team leader is therefore very active in responding to national calls for projects. The team contributes to teaching within the Bachelor and Engineer Curricula at Institut Polytechnique de Paris. The team leader is regularly invited to national and international conferences on RNA biology and/or Microbiology, or as a guest speaker in diverse research institutions (4 invitations in 2023). The team leader is an Associate Editor at Frontiers in Microbiology (section Biology of Archaea (since 2019) and section RNA Processing and Regulation (since 2023)). He has co-edited a research topic "Archaeal Ribosomes: Biogenesis, Structure and Function" (2022) at Frontiers in Microbiology: Biology of Archaea and edited a book "Archaea: Methods and Protocols" Method in Molecular Biology. The team leader has co-organised an international symposium on "RNP dynamics" (2022) with a special keynote by Nobel Laureate Prof. Dr. Joachim Frank (130 participants, 50k€ sponsorship secured). He is a regular reviewer for peer-reviewed journals, funding agencies (3 invitations accepted in 2023), and PhD thesis examiners (3 in 2023). Finally, the team leader is an initiator and committee member of the Archaea Power Hour. The team's international outlook is therefore undeniable, as is its reputation. In 2023, the team welcomed two M2 and two M1 students. Since October 2023, a PhD student from Ecole Polytechnique has also started his thesis. Thus, despite its small size, the team is highly dedicated to academic training. Publications are communicated to a larger audience via communication on social media. Important breakthroughs are also communicated via press releases (CNRS and Institut Polytechnique de Paris). The team actively participates in "Fête de la Science" and hosts school pupils. Consequently, the team contribute up to its size to share its knowledge with the general public as well as some action of the dissemination of science.

#### Weaknesses and risks linked to the context

Scientific output relies on a small team of two permanent staff (DR CNRS and AI) and one non-permanent (PhD from October 2023). Consequently, the team's long-term future will strongly depend on recruiting permanent co-workers (CR, MCF, etc.) and securing funding.

#### Analysis of the team's trajectory

Arriving in 2023, the team has already demonstrated its capacity to seamlessly integrate into its new laboratory environment, showcasing both scientific excellence in its research field and proactive engagement in securing funding.

## RECOMMENDATIONS TO THE TEAM

To ensure the long-term sustainability of the team's research and maintain its competitive edge, increasing the number of permanent researchers is essential, as is securing stable funding. This would provide continuity in leadership and expertise, and enable the team to expand its efforts and amplify its contributions to the scientific community.



#### Team 5:

Cytoskeleton and cell morphogenesis

Name of the supervisor: Mr.

supervisor: Mr. Alexis Gautreau

## THEMES OF THE TEAM

The team "Cytoskeleton in cell morphogenesis" is focused on understanding the role of the actin cytoskeleton in the remodelling of cell membranes through the Arp2/3 complex. They study the regulation and deregulation of this molecular machine in normal and cancer cells by combining biochemistry and cellular biology. The team aims to contribute to fundamental understandings such as mechanisms of cell transformation and mechanosensing to more applied aspects such as targeting the actin cytoskeleton in precision medicine of cancer or better understanding of cancer progression, which could be of high societal impact.

## CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The team was encouraged to further explore opportunities to interact with the non-academic world and patronage from Servier of 600k€ was obtained, which represents a solid first tie. Although no direct products or start-ups were created, interesting discoveries on cell migration were made and are used toward this goal.

## WORKFORCE OF THE TEAM: in physical persons at 31/12/2023

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maîtres de conférences et assimilés	0
Directeurs de recherche et assimilés	1
Chargés de recherche et assimilés	2
Personnels d'appui à la recherche	1
Sous-total personnels permanents en activité	4
Enseignants-chercheurs et chercheurs non permanents et assimilés	1
Personnels d'appui non permanents	2
Post-doctorants	2
Doctorants	3
Sous-total personnels non permanents en activité	8
Total personnels	12

## EVALUATION

#### Overall assessment of the team

The overall assessment is excellent. The team has produced high quality research during the period and is supported by many grants. Team leader is highly recognised in the field, allowing invitation in international conferences and hosting of meetings and schools. This leads to attract PhD students to the team and fostering international collaborations.

#### Strengths and possibilities linked to the context

During the reference period, the team had an excellent production of 24 articles, most of them being original research papers and many in high visibility journals such as Cell Research or Nature Communications with



international, national and internal collaborations. Eleven of those publications are from first or last authorship positions with PhD students having at least one first authorship.

The team was successful in obtaining many grants from competitive calls stemming from the ARC (3 grants as coordinator) or INCA (1 prize and 1 as partner) foundations as well as 4 ANR with 2 as coordinator). They also received support from the CNRS for an emergence project and as an associated International Laboratory. The total amount of funding obtained through those various means is 1595 k€, demonstrating excellent recognition by funding agencies. Of note, other funding was obtained for postdoc fellowship or PhD fellowship ARC, INCA, FRM and Ligue Nationale contre le Cancer for a total of 570 k€.

Team leader was invited in many international and national conferences to present the team's work and also organised or participated in the organisation of conferences. He also undertakes editorial responsibilities as a member of several editorial boards such as Review Commons, and participates in different evaluation bodies as an expert (ERC, FNRS...), emphasising the excellent scientific reputation of the team.

Eight PhD students were welcomed during the period with five having defended their thesis and lasting bonds are established with former alumni. One team member is preparing his HDR, showing a commitment to have new PhD students. Post-docs are well integrated in the lab and have the possibility to expand their own projects and collaborative works. All this shows the excellent quality of the hosting policy of the team.

The team is highly involved in education, as emphasised by patronage from Servier to host Polytechnique students. Of note, teaching material created by the PI has led to the publication of an academic textbook. Dissemination to the general public was also taken into account with press articles and interviews, participation in Fête de la Science...

#### Weaknesses and risks linked to the context

As evaluated by the PI, maintaining the level of funding through multiple small grants is challenging and bigger European funding could be pursued, when judged appropriate.

#### Analysis of the team's trajectory

The team will change its research focus in the next contract but by relying on their present expertise and in the natural continuity of their previous investigations. A new project on local translation of mRNAs will also benefit from the expertise of other teams in the unit and will reinforce their bonds.

## RECOMMENDATIONS TO THE TEAM

Rebuilding collaborations like the one who existed with Russian investigators to have international students and exchanges and the ability to have research projects with patient samples should be a priority in the context of the team's cancer research.



## CONDUCT OF THE INTERVIEWS

#### Date

**Start:** 13 December 2024 at 8 a.m.

**End:** 13 December 2024 at 7 p.m.

Interview conducted: online

#### INTERVIEW SCHEDULE

- 8h30 Présentation des membres du comité et du déroulé de la visite. Isabelle Landrieu
- 8h40 Présentation des activités de l'unité. Thomas Simonson
- 9h10 Démarrage de la traduction. Yves Mechulam/Emmanuelle Schmitt
- 9h40 Terminaison de la traduction stabilité des ARNm. Marc Graille
- 10h10 Bioinformatique structurale. Thomas Simonson

#### 10h40 Pause

- 11h00 Cytosquelette et contrôle de la mobilité cellulaire. Alexis Gautreau
- 11h30 Homéostase de l'ARN et du ribosome. Sébastien Ferreira-Cerca
- 11h55 Présentation de la trajectoire. Emmanuelle Schmitt
- 12h30 Discussion interne comité et déjeuner
- 13h30 Réunion avec chercheurs et enseignants-chercheurs
- 14h00 Réunion avec ITA-BIASS
- 14h30 Réunion avec étudiants et post-docs
- 15h00 Discussion interne comité
- 15h30 Réunion avec les représentants des tutelles
- 16h00 Réunion avec la direction de l'unité actuelle (Thomas Simonson) et future (Emmanuelle Schmitt)
- 16h30 Finalisation du rapport
- 18h00 Fin de la visite

#### PARTICULAR POINT TO BE MENTIONED

None



## GENERAL OBSERVATIONS OF THE SUPERVISORS

The institution responsible for submitting the application, which is also responsible for coordinating the response on behalf of all the research unit's supervisors, did not submit any general observations.

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

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