Research evaluation

EVALUATION REPORT OF THE UNIT

IPS2 - Institute of Plant Sciences Paris-Saclay

UNDER THE SUPERVISION OF THE FOLLOWING ESTABLISHMENTS AND ORGANISMS:

Université Paris Saclay

Centre national de la recherche scientifique - CNRS

Institut national de recherche pour l'agriculture, l'alimentation et l'environnement - INRAE

Université d'Évry-Val-d'Essonne

Université Paris Cité

EVALUATION CAMPAIGN 2024-2025

GROUP E

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High Council for evaluation of research and hihter education

In the name of the expert committee :

Danièle Werck, chairwoman of the committee

For the Hcéres :

Stéphane Le Bouler, acting 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 certified exact data extracted from the deposited files by the supervising body on behalf of the unit.

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Ms Anne Monsoro-Burq, Vice-Présidente Recherche université Paris Saclay

Ms Christelle Monville, Vice-Présidente Recherche université d'Evry

Mr Norbert Rolland, Chef Département INRAE BAP

CHARACTERISATION OF THE UNIT

- Name: Institute of Plant Sciences Paris-Saclay
- Acronym: IPS2
- Label and number: UMR 9213 (CNRS) and UMR 1403 (INRAE)
- Number of teams: 12
- Composition of the executive team: Mr Martin Crespi (DU), Mr Florian Frugier (DUA), Mr Abdel Bendahmane (DUA) and Mr Arnaud Charpentier (DUA)

SCIENTIFIC PANELS OF THE UNIT

SVE2 : Productions végétales et animales (agronomie), biologie végétale et animale, biotechnologie et ingénierie des biosystèmes
ST1 : Mathématiques

THEMES OF THE UNIT

The Institute of Plant Sciences Paris-Saclay (IPS2) uses an integrative approach to investigate growth and development of model plants. Its main objectives are to better understand the molecular and genetic mechanisms controlling fundamental processes and their regulation by endogenous and exogenous signals resulting from biotic and abiotic stresses. Results obtained on model plants are translated to crops for contributing to sustainable agriculture and innovation and generating novel plant-derived products.

The Unit was organized in 12 teams gathered in three scientific departments and also hosts 5 platforms within the departments. The department "Developmental genetics and genomics" gathers 5 teams: (a) Flower and carpel development (FloCaD); (b) Regulatory and non-coding RNAs in root plasticity (REGARN); (c) Chromatin and development (ChromD); (d) Signaling pathways controlling legume root system development (SILEG); (e) Quantitative genomics and epigenomics (Q-Lab). It hosts the EPITRANS platform for epigenomics and the platform for translational biology. The department "Physiology and signaling" includes 3 teams: (a) Oxidative stress, redox signaling and chromatin (CCARS); (b) Signaling and stress (STRESS); (c) Signaling, regulation and metabolic interactions (SIREMETAB). It also hosts the metabolomic platform. The department "Biotic interactions and networks" gathers 4 teams: (a) Genome dynamics and pathogen resistance (GDYNPATH); (b) Genetic control of the symbiosis (SYMUNITY); (c) Organellar gene expression (OGE); (d) Genomic networks (GNET). It hosts the POPS platform dedicated to transcriptomics and the Interactomics platform.

HISTORIC AND GEOGRAPHICAL LOCATION OF THE UNIT

The UMR IPS2, located on the Paris-Saclay Campus, was created in 2015, It resulted from an important restructuration and consolidation for 3 of the 4 Plant Biology Institutes involved in the Cluster of Excellence or labex SPS "Saclay Plant Science". The merger included the former Institute of Plant Biology (IBP, Orsay), Research Unit of Plant Genomics (URGV, Evry) and Institute of Plant Sciences (ISV, Gif-sur-Yvette), IPS2 started its first quinquennial period (2015-2020) in three different locations in 2015, and its regrouping was completed by March 2016. It now gathers about 200 staff (110. permanent + 90 non-permanent).

The aim of IPS2 creation was to strengthen the existing local potential by improving synergies and to create a Plant Science unit with higher visibility at national and international levels.

The Unit depends on CNRS, INRAE and three universities (Paris Saclay, Evry-Val d'Essonne, and Paris-Cité).

RESEARCH ENVIRONMENT OF THE UNIT

IPS2 belongs to the circle of 14 entities of University Paris-Saclay (UPSaclay), one of the top 20 academic ranking world universities and one of the leading European campuses in Agriculture and Plant Sciences (Saclay Plant Science, SPS). In addition to IPS2, SPS gathers 5 Research Units : IJPB (Institut Jean-Pierre Bourgin), I2BC (Institute for Integrative Biology of the Cell), GQE (Quantitative Genetics and Evolution), BIOGER (Risk Biology and Management in Agriculture) and URGI (Research Unit in Genomic Info), and belongs to the labex SPS "Saclay Plant Science". It thus benefits from several cutting edge complementary platforms, and of the IdF-Versailles-Saclay centre to facilitate collaboration with private partners and IP protection, the SATT (Technology transfer accelerator office) Paris-Saclay and the Paris-Saclay "Plug-In" platform to coordinate funding and access advanced resources. The SPS labex also provides potential help to organize well-structured outreach activities. Scientific collaboration is mainly developed with the Institut Jean-Pierre Bourgin (IJPB) and iDEEV Institut Diversité, Écologie et Évolution du Vivant). In addition, two Collective Scientific Infrastructures (ISCs), POPS and EPITRANS hosted in the Unit have national and international significance.

IPS2 emphasized its role in the Training-Research-Innovation continuum in plant biology. Through close relationship between three universities (Paris-Saclay, Paris Cité, and Evry Val d'Essonne). IPS2 Professors oversee a range of academic programs, including Licenses (professional and academic), Master's degrees, and coordinate the Doctoral School on Plant Sciences in the frame of PIA EUR-SPS (University School of Research–Saclay Plant Sciences).

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

Catégories de personnel	Effectifs
Professeurs et assimilés	9
Maitres de conférences et assimilés	17
Directeurs de recherche et assimilés	12
Chargés de recherche et assimilés	11
Personnels d'appui à la recherche	56
Sous-total personnels permanents en activité	**105**
Enseignants-chercheurs et chercheurs non permanents et assimilés	1
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	39
Sous-total personnels non permanents en activité	**40**
Total personnels	**145**

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	C	PAR
INRAE	0	10	24
U Paris Saclay	12	0	17
CNRS	0	13	12
U Paris-Cité	10	0	1
UEVE	4	0	1
Autres	0	0	1
Total personnels	**26**	**23**	**56**

GLOBAL ASSESSMENT

IPS2 uses an integrative approach to investigate growth and development of model plants. Its main objectives are to better understand the molecular and genetic mechanisms controlling fundamental processes and their regulation by endogenous and exogenous signals resulting from biotic and abiotic stresses. Results obtained are translated to crops for contributing to sustainable agriculture and innovation and generating novel plant-derived products.

These scientific objectives are excellent, original and ambitious. They integrate fundamental and applied science and perfectly align with the strategy of its governing bodies. Yet, they would benefit from more focus and synergies.

Despite having limited support staff, IPS2 has a large research staff, two strategic technical platforms (EPITRANS and POPS) and very strong statistical and bioinformatic support. Its regrouping is obviously a success since the unit is now one of the flagship French Units in Plant Science. Its excellent international impact and visibility are demonstrated by the obtention of five ERC grants. The arrival of new team leaders, scientists, foreign visitors, and

students is a good indicator of its attractiveness. The Unit has also obtained many ANR (78) and international grants, launched a range of funded international collaborations, implemented several translational projects with the private sector, and hosted a LabCom and two start-ups. This provided the Unit with excellent resources, adequate to achieve its scientific objectives. Yet the repartition of resources was unequal between teams and platforms. Current infrastructures are aging and require building renovation and greenhouse extension.

IPS2 produced an impressive number of publications in very highly respected journals (in Science, Nature Communications, Nature Plants, Proceedings National Academy of Sciences USA, PLOS Genetics....) contributing to seminal articles in diverse fields. Overall, the scientific production is excellent qualitatively and quantitatively, while unequal between teams ranging from very good to outstanding. Four patents have been filed. Among many highlights: the ground-breaking work deciphering the molecular mechanisms that drive the development of unisexual flowers and fruit shape in cucurbits (Science 2022; Nature Plants 2022, 2023; Current Biology 2022); the discovery of the complex antagonist regulation loop triggered by nitrogen status involving systemic signaling peptides CRA2/SUNN to control root and nodule development in legumes (Nature Communications 2020, Current Biology 2020); the characterization of wheat 3D chromatin architecture into genome territories and transcription factories and the alterations of the 3D chromatin organization of enhancer-promoter interactions during heat stress responses (Genome Biology, 2021; Nature Communications 2023); the functions of lncRNAs in regulating target gene transcription via chromatin conformation and post-transcriptional RNA splicing (Molecular Cell 2020; Molecular Plant, 2022; EMBO Report, 2020; Plant Cell, 2023).

The Integrity and ethics policies are excellent. IPS2 also plays an important role in teaching Plant Sciences, Cell and Molecular biology in the Paris area (3 Universities) for Master and PhD programs. It has participated to the launch of an international Master in Plant and Microbial Systems Biology and has trained 44 PhD students, many international, the number of which could still be increased.

IPS2 actively addresses societal challenges through strong collaborations with industry, impactful translational research, a LabCom and hosted startups, and diverse outreach initiatives. Overall, its translational activity is excellent, but unevenly distributed among teams, and while its connections with industry are robust, those could be further extended and public engagement might be broader.

So far, the two main weaknesses of the Unit are communication with the public, which was mostly limited to a participation to the SPS site initiatives, and gender imbalance in management, as only 2 women were team leaders out of 12 and none contributed to the management of the Unit.

For the next 5 years, IPS2 has designed and started to implement a very good strategy to keep at the forefront of Plant Sciences. The Unit will emphasize translational science (all teams working on both model and crop plants) and promote predictive biology through modelling and bioinformatics. The project takes into account the IPS2 scientific originality, the latest scientific developments and technological breakthroughs for the development of existing and novel tools and platforms to support the evolution of its scientific projects and its recruitment strategy. Climate change and plant resilience emerges as the dominant priority. Although this priority is not original in the current scientific landscape, the way it will be addressed by IPS2 and the exploitation of all aspects of the available internal resources makes this plan relevant. It could however better seek to find and develop an original and focused niche that would increase its visibility.

Taken together, IPS2 belongs to the top 10% of research organisations focussed on plant biology at world level.

DETAILED EVALUATION OF THE UNIT

A - CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

A first recommendation underlined the importance of upholding a robust and focused foundation in fundamental science while fostering a consistent flow of innovative ideas that can be applied practically, keeping attractive of new talents.

IPS2 remained focused on its main driving lines and clearly reinforced its fundamental research notably through the obtention of five ERC grants. The international visibility in plant epigenomics and genomics, physiology, microbial interactions increased during the evaluated period, for example through the publications of highly cited articles. IPS2 attractivity is also shown by the appointment by INRAE of a Professor from Estonia as a DR and new team leader in 2024, to bolster the STRESS team's efforts in climate change and kinase signalling. A new team on Genomics and Epigenomics (Q-Lab), wa also established during the reporting period.

The previous panel emphasized the significance of enhancing external coherence and visibility, along with cultivating a consistent corporate identity and internal communication (via internal use of English language). Platforms were encouraged to continually align their activities/investments with the institute strategy.

The Unit has found a federative common research theme in Climate change. As already mentioned, it has also improved its visibility and consolidated an international dimension.

Improvement of internal communication was achieved by establishing a Communication Committee. This committee has implemented various initiatives, including the publication of highly cited papers, updates on PhD student defenses, and announcements of major grants and awards received by the unit staff. Use of English for internal communication, discussions and seminars was promoted, facilitating interactions among teams, international staff, students, and visitors.

Through their integration into teams, the platforms were associated to the Unit strategy to develop new methodologies, notably in epigenomics and transcriptomics. The increase in technological capacities of IPS2 led to many international collaborations.

The previous committee highlighted the importance of strengthening IPS2 efforts to align missions and strategies with INRAE Versailles, while capitalizing on the complementarity of plant research in the Paris area, in particular with the plant genetics groups of IDEEV and AgroParis Tech.

IPS2 collaboration and synergy with research centers in Paris-Saclay Campus have notably increased, in particular via integration of IPS2 into EUR SPS and welcoming of AgroParisTech students. Sharing of facilities, potential collaborations, common grant applications on ecological genomics with IDEEV are ongoing. They will fully exploit complementary strengths and expertises, particularly in the field of agronomical applications and field phenotyping, an area that is particularly relevant with the arrival of a new recruits.

B - EVALUATION AREAS

Guidelines for all areas of evaluation (1, 2, 3 and 4): Considering the references defined in the unit's evaluation guidelines, the committee ensures that a distinction is made on the outstanding elements for strengths or weaknesses. Each point is documented by observable facts including the elements from the portfolio. The committee assesses if the unit's results are consistent with its activity profile.

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

Assessment on the scientific objectives of the unit

While resulting from the fusion of three different institutes, IPS2 has set excellent, original and ambitious scientific objectives integrating fundamental and applied science, which perfectly align with the strategy of its governing bodies (CNRS, Universities and INRAE). It could yet benefit from even more focus, synergies and translational activities.

Assessment on the unit's resources

Despite a limited number of support staff, IPS2 has a very good number of personels, some excellent platforms and has been very successful in raising external national, international (5 ERC) and private fundings, providing excellent resources that are adequate to achieve its scientific objectives. Yet the repartition of resources is unequal between teams and between platforms. Current infrastructures are aging and require renovation of the building and extension of the greenhouse facilities.

Assessment on the functioning of the unit

In spite of a very good to excellent functioning of this unit affiliated with five supervising bodies, more internal communication should be encouraged through different channels and more clear rules could be implemented.

1/ The unit has set itself relevant scientific objectives.

Strengths and possibilities linked to the context

IPS2 investigates the processes that control plant growth and development, and the mechanisms of plant adaptation to biotic (bacteria, virus or fungi) and abiotic (water, heat, CO2) stresses. IPS2 studies a wide range of plants (from model plants to various crops). This work is based on many analytical and integrative approaches (from molecules, genes, metabolomics, transcriptomics, genomics/epigenomics, cells, organs to the whole plant and their interaction with the environment). Furthermore, the unit develops computational and translational biology towards crops and agriculture. Thereby IPS2 may contribute to solve major global challenges, such as food security, climate resilient sustainable agriculture, and transformation to bioeconomy.

The unit is structured in three departments with specific aims: 1) to use developmental plant genetics and genomics for a better understanding of plant growth and development and knowledge-based precision agriculture; 2) to understand hormonal, metabolic and redox signaling for addressing agricultural challenges; 3) to identify novel strategies for the (bio)-control of plant responses to beneficial and pathogenic organisms. These aims are highly relevant, and several excellent achievements have been made, notably related to the determination of flower sex, genomics/epigenomics/non-coding RNAs of model plants and crops, and molecular signaling and networks mediating plant responses to environmental cues.

Major developments in epigenomics together with the combination of biochemistry and genomics (e.g. HiC, ChiaPET, ChIP, ChIRP and others) also contribute to the excellent international visibility of IPS2. Several ERC grants were awarded to the leaders of three teams of the unit (FloCaD, ChromD and Q-Lab), highlighting their outstanding contributions to the research in their fields.

IPS2 objectives are in line with the national strategy of its governing bodies, establishing a successful continuum from fundamental research (CNRS) up to training through research (Universities) and applied agronomical perspectives (INRAE). With regard to agronomical applied perspectives, the FloCaD team is particularly active in collaborating with several European and French seed companies.

Weaknesses and risks linked to the context

Frequently the goals of the research performed by IPS2 teams addresses more than one of the scientific objectives outlined in the different departments. This may question the structural delineation of departments and/or the specific scientific objectives of the different departments.

While all relevant, the focuses of the Unit members are relatively dispersed, and the Unit cannot post a strong overaching priority that could further improve its visibility.

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

IPS2 hosts over 100 permanent staff members (about 1/3 CNRS, 1/3 INRAE and 1/3 Universities) and over 80 non-permanent ones (mostly PhD students and postdocs). In addition to the 12 research teams, 5 platforms are included in the IPS2 teams, and 2 of them (EPITRANS and POPS) are labelled as ISC (Infrastrures Scientifiques Collectives). These platforms provide important support on advanced technologies and also help to foster collaborations within the unit between different teams as well as with scientists outside of the unit.

During the evaluated period, IPS2 has obtained about 24,6 M€ external funding, with 59% representing national funding, 29% international (mainly european) funding and 12% private resources, notably with 5 ERC, 15 H2020 and 78 ANR projects. This makes IPS2 excellent to oustanding in raising external funds.
IPS2 is located on the Paris-Saclay Campus and is one of the major players involved in the Cluster of Excellence or labex SPS "Saclay Plant Sciences". The labex not only provides funding but also creates good opportunities to IPS2 for strong scientific interactions with other research units (IJPB, AgroParis-Tech, iDEEV, I2BC).

Weaknesses and risks linked to the context

Success in fund-raising greatly varies between teams and often all possible sources (especially CPER, international or private) are not fully exploited.

The Unit mentions several issues related to the building, the greenhouses and the staff.

There are problems with the maintenance of the building. A risk is that the current state of IPS2 facilities and research/teaching buildings will not be in line with the Unit ambitious targets, with issues such as water leaks through windows and roof, frequent heating problems and inadequate electrical infrastructure. Limited logistical support from Paris-Saclay University for maintenance leads to the misappropriation of research funds to maintain suitable working conditions, notably by resolving heating and temperature control problems.

The capacity and quality of plant growth facilities are not sufficient to match the Unit evolution and priorities.

The unit experienced loss in support staff (mainly CNRS) during the recent years. The lack of competitiveness with the private sector makes it difficult to recruit qualified personnel and to maintain human resources.

Upcoming retirements of three group leaders with high visibility will require swift replacements.

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

IPS2 implements a robust Scientific Heritage Management thanks to advanced monitoring systems for biological materials, such as freezers and growth chambers, safeguard of critical scientific assets.

High-Quality IT Infrastructure hosting of most servers at Paris-Saclay University is expected to ensure robust security, efficient data management, and fulfillment of CNRS and INRAE standards. Team-specific data access and collaborative transfer spaces protect intellectual property and facilitate inter-team cooperation.

The Unit created a working group on sustainable activity research (ARS), which established the first IPS2 carbon footprint analysis. The unit's efforts to balance research productivity with sustainability provide a model for environmentally conscious scientific practices.

The Unit has a business continuity plan that was improved during the Covid-19 pandemic. This ensured the preservation of critical resources and enabled remote operations through laptops, VPNs, and collaborative tools. Regular meetings of the Laboratory Council and Scientific Council ensure timely and collective decision-making and solve operational challenges.

The Unit has set an active staff hosting policy, requiring awareness to internal regulations, informatic charter and commitment to scientific integrity, through written contract and by on site practical presentation of the health and security issues, modes and procedures of the services and platforms, for newcomers as well biannual renewal for all staff.

Weaknesses and risks linked to the context

The carbon footprint analysis highlights a significant environmental impact (10 tonnes of eCO□/year per scientist, two-thirds of which comes from consumables and services), with few immediate solutions that do not compromise research productivity. The limited scope for reducing emissions without affecting the quality or quantity of research outputs poses a strategic challenge. Growing societal expectations for sustainable practices may put additional pressure on IPS2 to reduce its environmental impact, which may require resource-intensive adaptations.

A too strict team-specific data security policy for Intellectual Property and Data Management Risks could lead to inefficiencies and risks of losing valuable interdisciplinary insights. The growing reliance on digital systems could increase vulnerability to data breaches or mismanagement if cybersecurity measures are not continuously updated. The recent attack on the informatic system of Paris-Saclay that generated serious problems for the Unit also points to failure and risk concerning IT security of the University Information System.

EVALUATION AREA 2: ATTRACTIVENESS

Assessment on the attractiveness of the unit

IPS2 benefits from some exceptional platforms (EPITRANS, POPS) and very strong statistical and bioinformatic supporter modeling and data analysis. It has an excellent to outstanding attractiveness as demonstrated by its capacity to raise major competitive national and international funding (such as 78 ANR and 5 ERC grants) and to attract new team leaders, foreign visitors and students.

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

2/ The unit is attractive because of 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

The focus of the Unit on genetic and molecular biology of model plants, its translation to crops and agricultural systems, its long tradition of quality provides an undeniable international visibility and attractiveness.

The scientific reputation of the Unit is shown by numerous invitations of unit members at numerous conference and workshops, notably more than 80 at international level (Gordon Conference Chromatin Structure function-2022 Spain [ChromD], Gordon Research Conference, Post-Transcriptional Gene Regulation- 2022, Newry USA [OGE], 31st International Conference on Arabidopsis Research -2021 (USA) [Quatrano], EMBO Meeting Plant Genome Stability and Change [ChromD], 21st International Conference on Nitrogen Fixation- 2019 Wuhan [SILEG], International congress of Genetics IGS-2018 BraziL [REGARNS], KAAB International Symposium: Frontiers in Plant Science & Biotechnology, 2018 Niigata (SIREMET]), and by endorsing editorial responsibility in highly reknown journals (Molecular Plant, Journal of Plant Cell Physiology, New Phytologist, Journal of Experimental Botany, Plant Cell & Environment, Plant Physiology).

Unit members have organized/co-organized more than 20 international congresses over the evaluation period including the 4th Adam Kondorosi Symposium 2019 Gif-sur-Yvette, 2nd SPS International Conference: Plant sciences for the future, XI international Symposium of ETHYLENE 2018, Crete, XII international Symposium of ETHYLENE 2023, Toulouse.

Several members of the Unit participated in international research steering bodies and advisory committees for governmental agencies such as ESF, NSF (USA), FNRS (Belgium) and FWO (Netherlands), and at national advisory committees (CSS INRAE, CNU 66, and CoNRS (Plant Biology section).

During the evaluated period, IPS2 researchers were awarded the CNRS Bronze Medal, Gold Medal of the French Academy of Agriculture, PhD Medal of the French Academy of Agriculture, the First Prize LAURIER INRAE (Section Scientific breakthrough), and two professors were nominated at IUF.

The Unit recruited senior and junior researchers, including two DR INRAE and one CR CNRS, and provided them financial, logistic and administrative support.

The Unit has established a strategic approach to target efforts on calls in frame with its research priorities, expertise, and potential impact. This was very successful in competitive national and international calls including 2 ERC advanced grants, 1 ERC consolidator grant, 1 ERC starting grant, 1 ERC POC, 10 Horizon 2020/Europe european grants (5 coordinated by IPS2) and 78 ANR projects (24 coordinated by IPS2).

The Unit is also highly attractive through the major equipment and an array of technological platforms mastered by its scientific personnel, which includes Interactomics, Metabolomics, the ISC POPS in transcriptomics, and EPITRANS, encompassing Epigenomics and Translational Biology. The strategic importance of POPS and EPITRANS were recognized by INRAE as a "Collective Scientific Infrastructure". The Unit has dedicated technical

and administrative personnels for the operation, maintenance, optimization, budgeting and compliance of equipment, facilities, and platforms.

At international level, IPS2 established two associated international laboratories (LIA) with universities in Argentina and China.

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

The Unit has identified a weakness to recruit international candidates. The salaries and welcome package are less attractive than in other EU countries. IPS2 also faces big difficulties for the recruitment of informaticians and bioinformaticians, the salaries of French civil servant being not competitive with the private sector.

With respect to the development of major equipments and technical skills, the Unit has identified an urgent need to establish a plant genomic edition platform to implement this technology in crop species.

In addition, the specific needs of the Unit for management of big data analysis is not efficiently taken into account with respect to centralisation of informatic infrastructure services by UPSaclay.

EVALUATION AREA 3: SCIENTIFIC PRODUCTION

Assessment on the scientific production of the unit

Overall the scientific production of IPS2 is on average excellent qualitatively and quantitatively. It is however unequal between teams ranging from very good to outstanding, with highlights in fields as diverse as plant reproduction biology, chromatin architecture, roots and nodule development or non-coding RNA function. The Integrity and ethics policies (with chart) are excellent.

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 scientific production is excellent quantitatively (446 articles in peer-reviewed journals,1.85 publications by FTE/year) and qualitatively (20% are published in outstanding-level journals aimed at a wide audience). 33% were produced through international collaborations. A large majority of published articles are in open access (87.7%). Nearly half of the production (47%) resulted from research led by the Unit teams (first, last or corresponding author position), illustrating the dynamism of IPS2. Pioneering research resulted in excellent/outstanding publications. Articles were published not only in the best plant journals but also with a significant proportion reaching high-standard multidisciplinary journals (Science, Nature Communications, NAR, TAG, Genetics, EMBO J., eLife...). The productivity ranges between outstanding and very good for all teams. Among many highlights: the sequence of high impact articles (Science 2022; Nature Plants 2022, 2023; Current Biology 2022) and patents derived from ground-breaking work deciphering the molecular mechanisms driving the development of unisexual flowers and fruit shape in cucurbits (FLOCAD); those (Nature Communications 2020, Current Biology 2020, Trends in Plant Sciences, 2021) revealing the complex antagonist regulation loop triggered by systemic signalling peptides CRA2/SUNN controlled by nitrogen status influencing root and nodule development in legumes (SILEG); breakthrough characterization of wheat 3D chromatin architecture into genome territories and transcription factories and demonstrating alterations of the 3D chromatin organization of enhancer-promoter interactions in tomato heat stress responses (Genome Biology, 2021; Nature Communications 2023) (CHROMD); the mechanistic insights into functions of lncRNAs in regulating target gene transcription via chromatin conformation and epigenetic modifications post-transcriptional RNA splicing (Molecular Cell, 2020; Molecular Plant, 2022; Genome Biology, 2022; EMBO Report, 2020; Plant Cell, 2023) (REGARN). Four patents have also been obtained.

The Integrity and ethics policies (with chart) are excellent. It must be stressed that this production takes place within a controlled framework. Indeed, IPS2 was one of the pioneer testers for the CNRS e-laboratory book and has now implemented its use, providing opportunities to improve research integrity. Noteworthy, additional efforts were made to promote integrity and ethics by creating an institute charter to raise awareness among all staff.

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

No real weaknesses were identified except the publications (18%) in predatory journals that should be banned in the future. But the management of the institute is aware of the problem and is proposing a pro-active policy to resolve it.

Only 9% of the publications resulted from internal collaboration within IPS2.

The Institute platforms (genomics and bioinformatics) have an active policy to ensure that data is conserved and stored correctly. However, the recent attack on the Saclay university campus highlighted the need to strengthen IT security.

The production in terms of high-impact articles and patents is unevenly distributed between teams.

EVALUATION AREA 4: CONTRIBUTION OF RESEARCH ACTIVITIES TO SOCIETY

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

Overall the quality of translational activities of the institute is excellent, but unevenly distributed among teams. The unit is engaged in partnerships with many companies of the private sectors via funded projects, a LabCom and hosts startups. It promotes knowledge dissemination via programs like "Plants and People" and citizen science projects. While its connections with industry are robust, those could be further extended and broader public engagement remains an area for growth.

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

Through a very diverse set of actions, interactions of IPS2 with the non-academic world cover three major societal challenges: (i) plant domestication and the preservation of plant biodiversity, (ii) agroecology and the transition towards high-yield low-input agriculture, and (iii) the links between climate change and agriculture. IPS2 has long-term collaborations with the European seed industry (SAMUTAGENE project) and French companies like Gauthier Semences, Syngenta, Limagrain Vilmorin, and Jouffray-Drillaud. It benefits support from SATT Paris-Saclay for innovation projects, including 4 POC'UP pre-maturation and 2 maturation projects. The Unit is partner of the CARNOT Plant2Pro network, which resulted in 6 applied research projects focusing on practical innovations. IPS2 also collaborates with SYMRISE (perfume industry) since 2017. Industrial partnerships resulted in 33 contracts with private companies for a total funding of 5,692 k€. To be mentioned are 4 patents (with two licences), 4 Cifre PhDs and the LabCom BioAdapt. For example, a common laboratory was set up in 2022 with Gautier Semences to improve plant resilience to environmental stresses, allowing collaboration with industry personnel and sharing of infrastructure and resources. This demonstrates IPS2 strong involvement in translational research and supports maintenance, equipment and research. IPS2 hosts start-ups by providing space within its building for 2-3 years, which allows collaboration on joint projects. For example, it hosted NEOPLANTS (2019–2023), which has now established its own laboratory. It currently hosts GENOMINES (2022–2025) and is in discussion with a new start-up.

Translational research and technology transfer are largely empowered by the EPITRANS platform that provides mutagenized collections from 19 different species including crops, enhancing genetic engineering capabilities for public and private sectors. Outreach and public engagement are fully integrated in the activity of most groups through the dissemination of research findings via a website, networks, and newsletters, hosting regular visits from students and the public, conferences and news articles/books directed to a broad scientific community or the general public. Participation to debates in society includes contributions to social media and multimedia content, the "Plants and People" program, in addition to which the H2020 INCREASE citizen science initiative promotes seed conservation through decentralized seed sharing.

The 27 assistant professors and professors belonging to three Universities and hosted in IPS2 are providing a very significant investment in education and training with more than 5,000 hours of teaching.

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

Beyond the significant funding obtained through private collaborations and valorized patents, mainly by a few teams (FLOCAD, OGE, SIREMET), the output of IPS2 interactions with the non-academic world is difficult to quantify. Indeed, despite hosting or supporting start-ups, including one managed by a former PhD from the institute, IPS2 has not yet directly spun off a company from its research. Moreover, most teams have very little interaction with the private sector if any. IPS2 is very well positioned to engage about the role of plant sciences in addressing global challenges like food security or climate change, and is doing so primarily towards specific groups, such as school students or niche scientific communities. However, there are opportunities for broader public engagement, such as through popular media or public debates still underrepresented. Although nearly all teams are involved in newsletters and targeted network communication, outreach towards a general audience remains somewhat scarced, which may reduce participation and the effectiveness of these programs in the long term and reduce the funding of science.

ANALYSIS OF THE UNIT'S TRAJECTORY

The IPS2 was created in 2015, from the merger of 3 of the 4 Plant Biology Institutes involved in the labex SPS "Saclay Plant Science". Initially structured around 11 teams and 3 departments, the Unit created a new team in 2021 to reinforce its strength in genome dynamics. Five technological platforms are integrated into some of the teams to boost their dynamics and maintain them at a state-of-art level. Another originality of the IPS2 stems from its choice to host start-ups not issued from the Unit discoveries but implementing projects in collaboration with its members.

This grouping and organization are obviously a success with IPS2 currently stemming as one of the flagship French Units in Plant Science and a worldwide reputation. Its international impact and visibility are demonstrated by the obtention of several ERC grants, i.e. two ERC advanced (2021, 2024), one Consolidator (2022), one Starting grant (2021), and one Proof Of Concept in 2022. The Unit has also obtained many ANR (78) and international grants, launched a wide range of funded international collaborations, implemented several translational projects with the private sector (4 Cifre PhDs), and hosted two start-ups and a LabCom. IPS2 produced an impressive number of high-impact publications (in Science, Nat. Commun., Nat. Plants, PNAS, PLOS Genetics....), contributing to seminal papers on plant reproduction, epigenomics, small RNAs and crop genomes. Four patents have been filed. Strategic platforms aimed at translational research, some recognized by INRAE as "Collective Scientific Infrastructures", open to national and international collaborations have been implemented, in particular POPS and EPITRANS. IPS2 also plays a key role in teaching Plant Sciences, Cell and Molecular biology in the Paris area for Master and PhD programs. The Unit has participated to the launch of an international Master in Plant and Microbial Systems Biology, to the SPS outreach initiative "Des sciences et des hommes" and to the H2020 INCREASE Citizen Science Experiment.

So far, the two main weaknesses of the Unit were communication with the general public, which was mostly limited to a parcipation to the SPS site initiatives, and gender imbalance in management, as only 2 women were team leaders out of 11 and none contributed to the management of the Unit.

For the next 5 years, IPS2 plans to pursue in the same direction, yet emphasizing translational science (all teams working on both model and crop plants) and promoting predictive biology through modelling and bioinformatics. Departments will be suppressed and replaced by three strategic axis addressing societal challenges, such as climate change and sustainable agriculture. Innovation targets are Trait engineering, Bioalternatives to agrochemicals, and Genomic enabling breeding. Each axis will be coordinated by a binome of team leaders. This change is meant to increase interaction and transversality between existing departments, so as to encourage the teams to be involved in several axis. The selected strategic axes are: 1) Climate change and plant resilience; 2) Chromatin organisation and dynamics; 3) Signaling and development. Axis 1 emerges as dominant from a survey, with all teams involved, defining a reorientation of the IPS2 priority. This priority will keep flexible and decided in a consensual manner.

Although not strongly original in the current scientific landscape, this plan is relevant, matches the priorities of all supervising bodies and funding sources, and keeps permitting the exploitation of all aspects of the available internal resources and expertise.

The teams listed below (11 again) will be redefined, with 3 creations considering the retirement of 3 team leaders. Notably, the STRESS team will be reinforced with a co-leader recruited as DR INRAE in 2024. Given that the staff cannot be anticipated to increase significantly, it makes sense to maintain a limited number of teams with suitable critical mass and co-leaderships allowing the Unit to enhance synergies or to anticipate future retirements. Still, 3 women only will be team (co-)leaders, a problem that will take time to correct. IPS2 operational management evolves with two Deputy Directors, one in charge of research strategies and innovation and the other of management issues. The Unit could not find a third Deputy Director (especially no woman) and instead has decided to name Direction Committee delegates dedicated to representation at University Paris-Cité, Scientific animation, Sustainable research, interaction with Doctoral schools and Plant Science Master, two of which being women. More will be identified, still aiming at gender balance. Thus, a third scientific deputy Director, who is a woman is now nominated as Administrator of the unit and is a member of the Direction Committee (2 men and 1 woman).

Concerning the private sector collaborations, IPS2 will enhance its ongoing partnerships via the EPITRANS platform, the LabCom BioaAdapt and the Plant2Pro initiative, and seek novel collaborations. For example, the Unit still keeps lab space open for hosting start-ups and promote knowledge transfer. The platforms will stay integrated into some teams to favour their dynamics, but with a notable change in the metabolomic platform. Initially dedicated to primary metabolism, the latter will expand to specialized metabolism, notably to volatile compounds to match the requirements of a new ERC project. Dedicated equipment was purchased to this end, which currently only allows qualitative analyses.

For the near future, IPS2 has to face at the same time the renewal of the retiring personnel (in particular renowned PIs), the strengthening of the existing (some new) teams and the creation of new teams proposing new approaches in the frame of novel priorities. The priorities currently identified are Cell biology, Single-cell omics, and Spatial transcriptomics, notably regarding root developmental plasticity, evolutionary and/or ecological dynamics in crop plants, and energetic trade-offs between beneficial interactions (symbiosis) and plant immunity. IPS2 is currently seeking to recruit talented young scientists in these fields. All these topics and methodologies are indeed major stakes. Yet refocusing on a limited number of them, in particular those close to what made IPS2 reputation, would be important to optimize synergies and best benefit from its current high international visibility. Different methodological approaches of the same or closely related scientific question(s) could lead to optimal outputs.

To improve its performance, attractivity and allow rupture research, the Unit has identified 4 key technologies, instruments or methodologies that it plans to implement with the support of its governing bodies. The first one is a genome editing facility for centralizing expertise and development of transformation protocols and CRIPR-Cas9 editing technologies. This facility was already initiated and recently supported by a CNRS part-time engineer position. A renewal of the lab spaces dedicated to in vitro culture is currently implemented to this end. The second is a reinforcement of AI to move deeper into predictive biology and modelling. This includes new methodologies for the sequencing of native RNA populations at the cellular and subcellular levels. The third is the implementation of high throughput phenotyping capacities that currently constitute a bottleneck for the teams focused on environmental adaptation and climate change. Some tools have been already acquired in the frame of the most recent recruitment and ERC funding (multi-cuvette gas exchange system and automated camera surveillance of flower visitation). However, adequate environmentally controlled space and equipment for automatic phenotyping, in particular for large-size plants, are still missing. Finally, IPS2 aims at further enhancing the EPITRANS capacity via the creation of more mutant libraries and the use of novel screening techniques, notably to detect deletions in regulatory sequences. All these tools would obviously be useful for most if not all teams and would enhance IPS2 attractiveness but would also require more space and personnel that are difficult to obtain in the current context. In such an occurrence, the priority could be to recruit new teams and to adapt technical priority accordingly. Screening facilities and platforms available in other units with larger premises on the Saclay site could be (and already are) exploited in the meantime.

Overall, the Unit has designed and started to implement a very good strategy not only to make its current projects successful but also to keep at the forefront of Plant Sciences. This includes the choice of priorities well-fitting current societal challenges and priorities of its supervising bodies and potential funding agencies. The project takes into account the IPS2 scientific originality, the latest scientific developments and technological breakthroughs for the development of existing and novel tools and platforms (such as reduction in scale in omics approaches and predictive biology and modelling), to support the evolution of the unit and team scientific projects and its recruitment strategy. It could however better seek to find and develop an original niche that would increase its visibility.

Team trajectories: With the retirement of its group leader at the end of 2025, SIMUNITY will not be renewed and the research topic will be discontinued. With one exception, the team members elected new teams at the institute to develop new projects.

Two other team leaders will retire in 2026:

In REGARN, that remains on a positive and excellent trajectory with new recruitments compensating departures. In the next mandate the team will be led jointly by a CR CNRS and a CR INRA and change its name to FunRNA. The FunRNA team will include all the former REGARN team staff and will focus on the functional conservation/diversification of ncRNAs in Arabidopsis and tomato.

Anticipating the retirement of the team leader (12/2025), the SIrEMETAB team redefined its objectives and contours. The beneficial bacteria topic will integrate SiLAB, which appears a rational move. The new team "Linking energy status to plant acclimation" (RESILIENCE) will focus on energy status of the plant defined by NAD+ status and its manipulation, currently transgenic overexpression of AtLASPO, and the possibility to alter energy status in non-GMO plants. The ambitious program of the new team aims to link energy status to gene expression control under stress, including epigenetic controls, to development under stress and to search for non-GMO energy rich plants. This trajectory involves collaborative project and state of the art technology to decipher the contribution of NAD+ to growth, climate resilience. Activity and development of the PMM platform still associated with the team will be actively pursued, involving several national and international collaborations.

The other teams pursue positive trajectories:

SILEG trajectory is excellent and ambitious, with projects clearly dispatched between the members of the team, but not yet financially supported at the date of the submission of the SED. It is worth noting the team leader involvement as future director of the IPS2, but will be supported by new recruitments.

The ChromD team will continue to investigate mechanisms controlling the chromatin dynamics in the context of plant development and response to stress. The team organization changed from two to one leader only. This was a successful strategy, improving the focus and integration of the scientific topic. The recruitment of two young associate professors has further strongly improved the team's capacity. Together with its excellent fundings, it is very likely that this team will reach an outstanding level.

FloCaD proposes to pursue on the same outstanding trajectory with now two team co-leaders and five main priorities. In parallel, it will continue its transfer activities, coupling the LabCom that provides access to elite plant material with the EPITRANS plaform to accelerate its output. Overall, this anticipated trajectory is very ambitious, promising, all lines being relevant and most already well-funded.

The Q-LAB was created in 2021 and its current trajectory is excellent. The outcome of the team projects are expected to make significant contributions to understand how variations in epigenetic silencing of TEs shape the mutational and epimutational potential in plants.

CCARS trajectory shows promising, with a strong focus on developing new insights into redox regulation of salicylic acid pathways. Expanding into crop species aligns well with translational goals, but greater integration across team members and increased engagement in international collaborations could strengthen long-term impact.

The STRESS team plans to focus its activities on the crosstalk between climate changes and immunity. The recent recruitment of a DR2 INRAE, who will co-direct the team, provides novel and interesting opportunities. His expertise in stomatal physiology will reinforce the capacities of the team improve the competitiveness of the team to raise funding associated with the climate change issue.

GDYNPATH that will be renamed GEDY will intensify research on bean genomic diversity and immunity, with the development of new approaches for functional studies. This trajectory is consistent with the team expertise, relevant and well-structured, it would strongly benefit from new recruitments.

OGE, after the departure of the former team leader, has been led by a CR since 2022. In spite of the recruitment of an IE in December 2023, the team size was significantly reduced. In the next mandate, OGE plans to develop in parallel the platforms (POPS and InterActome) and the team's own project. The maintaining of POPS is strongly demanded by INRAE. Developing epi-transcriptomics and micro-transcriptomics (single cell/nucleus and spatial transcriptomics) in POPS is certainly encouraged. The scientific project of the team that aims to understand how plastid gene expression regulates plant response to stress, including a broad range of sub-projects, however, appears too ambitious.

GNET is advancing through a balanced focus on methodological development and applied research. Framing their research within the context of climate change strengthens its relevance, while their interdisciplinary approach positions them to contribute significantly to the understanding of plant resilience in changing environments.

RECOMMENDATIONS TO THE UNIT

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

The committee fully supports the choice to suppress the departments and to replace them with strategic axes to increase the flexibility of the interactions between teams. The Unit is also encouraged to anticipate the upcoming team leader retirements with an active search for possible competitive recruits. The current increasing visibility of IPS2 is the best asset for attracting new talents.

The whole spectrum of the funding possibilities should be more extensively explored by the Unit and all teams, in particular potential funding from the region, international agencies and private sector. A large regional grant might help to restore and expand the facility. An important point is to reinforce IT security of the site, and the Unit is now well aware of it.

Recommendations regarding the Evaluation Area 2: Attractiveness

The committee fully agrees with the urgent need to establish a plant genomic edition platform. The ongoing international competition requires advancing at the forefront of technology. Considering the advances in directed mutation technology and the evolution of European regulation on GMO classification, the unit has appropriately identified the importance to establish this platform and to secure the scientific personnel to implement this technology in crop species. This will increase the potential of the Unit in translational research.
Development of other tools or technical platforms would require more space and personnel that are difficult to obtain in the current context. In such an occurrence, the priority could be to first recruit new teams and to adapt the technical priorities accordingly. Screening facilities and platforms available in other Units with larger premises than IPS2 on the Saclay site could be exploited in the meantime.

The Unit should not overlook the importance of presenting its data at international meetings for the initiation of international collaborations, and the attraction of PhD, post-doc candidates and new competitive recruits. Likewise, a stronger involvement of the Unit in organizing international conferences and workshops would further improve attractiveness for international candidates.

Given its problem to involve women in leadership, the unit may rethink its policy of recruitment so as to attract women with managerial capacities.

Recommendations regarding Evaluation Area 3: Scientific Production

The Unit focus on high-impact publication is strong and should be maintained. Teams willing to increase their publication standards may organize/participate in mentoring programs and peer-review workshops. It is recommended to promote open science and preprints. Manuscripts uploaded to platforms like bioRxiv can receive feedback and reach a broader audience. They allow to disseminate results regularly while improving studies to the desired standard. The Unit may encourage timely deposition of datasets to platforms like NCBI, ENA, or public databases to boost publication visibility.

The balance (50/50) between own production and collaboration is well-equilibrated and should be maintained. Pursuing new global partnerships, joint projects, and co-authorship opportunities may enhance the lab global footprint. Promoting more intra-Unit and interdisciplinary collaborations to increase the proportion of co-authored papers across teams would allow to better exploit the team complementarity.

There is a need to address the (limited number of) publications in predatory journals. For this, a policy strengthening awareness campaigns for instance by incorporating periodic training on journal selection and best publishing practices or establishing an internal advisory committee to evaluate target journals before submission should be adopted.

Futher increasing the team involvement in translational biology should help to increase both the patent output and publication impact.

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

Both translational and outreach activities should be expanded to a wider number of teams since they are currently unevenly distributed. Some teams do not fully exploit private funding possibilities provided by the local environment and the current Unit research lines. While IPS2 is well-positioned to address global challenges, the Unit could benefit from expanding its outreach to engage wider audiences through popular science writing, public talks, or collaborations with media outlets.

Through the IPS2 Communication Committee, the unit could create a formal system to mobilize more researchers into public engagement, reducing reliance on a few key individuals. This may include providing workshops or incentives for researchers to improve their science communication skills and actively participate in public dialogues, foster entrepreneurship through training or dedicated support, and assess the influence of outreach activities on societal understanding. The actions towards Society taken during the previous term are fruitful and should be continued.

TEAM-BY-TEAM ASSESSMENT

Team 1: Voies de signalisation contrôlant le développement su système racinaire des légumineuses (SILEG)

Name of the supervisor: Mr Florian Frugier

THEMES OF THE TEAM

The SILEG team works on the signalling pathways controlling the root nitrogen-fixing symbiotic nodulation according to mineral nitrogen availability and environment variability in legume plants. They mainly focus on the signalling molecules (peptides, microRNA, non-peptide hormones promoting nodulation in low mineral nitrogen conditions), the root regulatory pathways triggered by these signals and the systemic pathways between root and shoots controlling the whole plant nutritional status.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

Overall, the SILEG team received an excellent evaluation. The previous committee pointed out that given the low number of permanent staff, the team should restrict the number of short-term trainees to limit the time-consuming investment that is required. The committee also pinpointed that the small size of the team limited the funding possibilities and the absence of non-academic partners.

The team still welcome many master's students, but since some of them are then selected for PhD, this turns out to be a positive investment for the team. A new assistant professor recently joined the team, increasing a bit their size which is still limited but highly efficient.

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

Catégories de personnel	Effectifs
Professeurs et assimilés	1
Maitres de conférences et assimilés	1
Directeurs de recherche et assimilés	1
Chargés de recherche et assimilés	0
Personnels d'appui à la recherche	2
Sous-total personnels permanents en activité	**5**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	5
Sous-total personnels non permanents en activité	**5**
Total personnels	**10**

EVALUATION

Overall assessment of the team

SILEG is an excellent team. Despite having a limited number of scientists, its dynamism allows excellent productivity. The team fundraising capacity is excellent but could still be improved at the international and private levels.
The committee was concerned that the appointment of the team director as head of the unit may weaken the team. This issue should be solved by the arrival of two ECs, a researcher and a part-time lab manager.

Strengths and possibilities linked to the context

The team has grown slightly since the last mandate and continues its upward trajectory. This is all the more remarkable since most research staff is teaching, which reduces research time. The productivity is excellent (with 20 articles and 5 reviews), with regular publications in multidisciplinary journals (Current Biology, Nature Communication, Science Report...), raising the profile of the team's work. Its international reputation is illustrated by regular invitations to give lectures at international conferences (2 per year on average) and multiple collaborative works (attested by 6 publications). We would also like to underline the success of this team in securing and expanding its financial sources (15 contracts with half as coordinator for over 1.2 M€).

The team enjoys an international reputation justified by the quality of its work on nodulation and the control of root architecture in legumes. It made significant and continuous progress in this field. In 2019, the team identified the role of TML in an inhibitory peptide/LRR receptor pathway named CLE/SUNN for nodulation control by shoot. This pathway and the CEP/CRA2 pathway identified by the team previously are both coordinated by the miR 2011/TML module. The team also demonstrated the transcriptional control of the production of the two peptides by cytokinins and rhizobial Nod factors. SILEG ability to stay focused and to move forward is particularly noteworthy, and its discoveries on the control of root architecture represent significant advances. This area of research is attracting more and more attention, putting the team in a good position for the future.

Weaknesses and risks linked to the context

The team lab manager left in June 2024, leaving SILEG with very limited technical support (50% T/C) when its PI takes the direction of IPS2. Fortunately, the arrival of a part-time lab manager should improve the situation.

The small size of the team and the teaching duties of 2 of the 3 scientists mean that the team leader was responsible for most of the representation (conferences) and publication work (author for correspondence), but the arrival of 3 additional scientists is expected to provide significant reinforcement.

As the team leader accepted the responsibility to head IPS2 for the next contract, a redistribution of his tasks within the team will be needed to maintain the same dynamism.

Attractiveness is very good (10 non-permanent staff, with 5 PhD students), although, regrettably with a limited number of post-doctoral students, which would make the team even more dynamic.

In the reporting period, the team obtained an EU-Horizon grant, even though currently no other international grant was obtained.

The team has no partnership with, nor funding from the private sector and few outreach activities.

Analysis of the team's trajectory

The trajectory of the team is excellent and ambitious, with projects clearly dispatched between the different members of the team, but not yet all financially supported at the date of the submission of the SED. It is worth noting the team leader involvement as future director of the IPS2.

RECOMMENDATIONS TO THE TEAM

The team leader will have to take care that his future responsibilities as head of the Unit do not impact SILEG productivity, and that supervision tasks are shared to limit the risk. The arrival of a new scientist with an ATIPE should contribute to increase even more the dynamism of the team.

The team would benefit of better exploiting all types of funding sources, including international agencies and private sector. In this respect, the translational potential of the team's topics could be better exploited.

The team policy mostly focuses its funding on technical staff or PhD students for its fixed-term contracts. However, recruiting post-doctoral students would allow SILEG to prepare candidates for competitions to strengthen the team research component.

Team 2: LES ARNs régulateurs de la plasticité racinaire (REGARN)

Name of the supervisor: Mr Martin Crespi

THEMES OF THE TEAM

The REGARN team investigates the mechanisms of action of non-coding RNAs (ncRNAs) in root growth and development. They use a wide range of approaches in cell biology, genetic, genomic and molecular biology on *Arabidopsis thaliana* and *Medicago truncatula*. They particularly address the roles of ncRNAs in root plasticity by exploring genome and ecotype diversity and dissect the molecular mechanisms triggered by ncRNAs in root developmental processes.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The previous recommendation regarding the limitation of the number of plant species studied and making strategic choices has been addressed. The recommendation to better distribute the tasks within the team members and to favour the emergence of additional scientific leaders (HDR) has been partially followed but becomes more urgent with regard to the retirement of the team leader in 2026.

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

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maitres de conférences et assimilés	3
Directeurs de recherche et assimilés	2
Chargés de recherche et assimilés	2
Personnels d'appui à la recherche	2
Sous-total personnels permanents en activité	**9**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	5
Sous-total personnels non permanents en activité	**5**
Total personnels	**14**

EVALUATION

Overall assessment of the team

REGARN remains an excellent research team. Supported by excellent projects and resources, its production is excellent qualitatively and quantitatively. Translational and outreach activities would need more attention. With the foreseen retirement of its current leader, refocusing the team's projects is properly anticipated.

Strengths and possibilities linked to the context

This medium-sized team has excellent human ressources. The funding resources are also excellent: the team successfully raised a large number of funds/grants (2 KAUST, 1 MSCA, 10 ANR coordinating 3 of them, 8 labex, 1 BASF and 1 FRM) with a total of 2,285 k€ notified during 2018-2023. Team members were invited in 15 national/international scientific conferences (11 for the team leader).

Their work focuses on the identification and characterization of lncRNAs and miRNAs/siRNAs in roots in Arabidopsis and Medicago. Their findings are very interesting regarding the mechanistic functions of lncRNAs in the transcriptional and post-transcriptional regulation of target genes.

During the evaluated period, REGARN published 32 research articles (12 coordinated by the team and the others from collaborative contributions) and 9 reviews, with a majorly in high-ranked journals (Nature Plants, Molecular Cell, Genome Biology, EMBO Report, Molecular Plant, Plant Cell, Plant Physiology).

The team demonstrated that the Arabidopsis lncRNA *MARS* interacts with LHP1, a protein binding with H3K27m3, forming a chromatin loop that brings an enhancer close to the promoter of a target gene (*MRN1*) and regulates the expression of its neighboring genes (Molecular Plant 2022). The Arabidopsis lncRNA *APOLO* recognizes distant genomic loci through sequence complementarity, forming DNA-RNA duplexes (R-loops), and by decoying LHP1 modulates local chromatin 3D conformation and expression of target genes (Molecular Cell 2020). More recently, in a collaboration work, they showed that *APOLO* also interacts with the methylcytosine-binding protein VIM1 and that the *APOLO*-VIM1-LHP1 complex regulates the transcription of the auxin biosynthesis gene YUCCA2 by dynamically determining DNA methylation and H3K27me3 deposition over its promoter during the plant thermomorphogenic response (Genome Biology 2022). These findings provide important support and mechanistic insight to the function of lncRNA in chromatin conformation and 3D organization.

The team also demonstrated that the Arabidopsis lncRNA *ASCO* controls alternative splicing of pre-mRNA subsets through interaction with the spliceosomal components/factors PRP8, SmD1 and NSRa (EMBO Rep 2020). An interplay between RNA splicing and posttranscriptional silencing of sense transgenes (S-PTGS) was more recently uncovered through the characterization of SmD1 and another spliceosome component PRP39a. They suggested that, beyond their splicing functions, SmD1 and PRP39a are involved in S-PTGS by preventing the degradation of transgene aberrant RNAs (Plant Cell 2023).

The team leader has an exceptional recognition/visibility: director of the unit, member of CNRS section and University council, associate editor of *Plant Cell Physiology,* jury member of several local and national/international evaluation committees, organizer/member of the advisory board of 5 international meetings, and invited speaker of 11 international conferences.

Weaknesses and risks linked to the context

Compared to permanent staff, the number of non-permanent personnels (PhD and particularly postdocs) was relatively low. Short stay duration of postdocs and CDDs may rise difficulties to release more publications. The diversity of funded projects has dispersed the focus of the team. While the assistant professors of the team contribute nicely to the university teaching activities/responsibilities, the team had very limited translational activities and no specific contribution to communication to large public activities.

Analysis of the team's trajectory

The team remains on a positive and excellent trajectory. One professor retired in 2021, one young CR INRAE researcher was recruited in 2021 and one senior DR INRAE (close to the age of retirement) joined the team in 2020. Following the retirement of the REGARN team leader in 2026, the team will be led jointly by a CR CNRS and a CR INRA and change its name to FunRNA. The FunRNA team will include all the former REGARN team staff and will focus on the functional conservation/diversification of ncRNAs in Arabidopsis and tomato.

The team gained an excellent international visibility for their work on ncRNAs in Arabidopsis and Medicago. The team project will include tomato as a new plant in the study, in line with the strategy of the unit. The potential novelty gained through studies on tomato concerning the functional mechanisms of ncRNAs remains to be demonstrated. Regarding the mode action of lncRNAs in either transcription through chromatin remodeling or post-transcriptional splicing, it should be considered that transcription and splicing are known to be tightly associated.

RECOMMENDATIONS TO THE TEAM

The future team leaders are urged to get their HDR qualification to be independent and extend the capacity of the team to supervise PhD students. Most of the current external fundings were contracted to the current team leader, only one ANR (315 k€, 2021-2025) was contracted by a young team member (as participant) and one labex (38 k€, 2021-2028) to another. Thus, raising fundings by the young staff of the team becomes urgent.

The co-leadership by two young team members for the next period well reflects their complementary scientific expertise. Synergy and focus on common research targets will be essential to maintain the team long-standing excellence.

Team 3: Dynamique des chromosomes (ChromD)

Name of the supervisor: Mr Moussa Benhamed

THEMES OF THE TEAM

The ChromD team uses genetic, genomic and epigenomic approaches to gain insights about mechanisms controlling the chromatin dynamics in the context of plant development and response to abiotic stresses.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The previous committee noted the dispersion of two groups working on different research topics, This has been well-resolved with only one team leader. The publications and projects of the team are clear and more integrated.

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

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

EVALUATION

Overall assessment of the team

The ChromD team is excellent to outstanding. It has demonstrated an outstanding capacity in raising external funds (including an ERC Consolidator and a TERC during the period). The scientific production of the team is excellent to oustanding, both qualitatively and quantitatively. It has an excellent international visibility. Its interactions with the socio-economic world and outreach activities could be improved. The team's project is in a good continuity and highly interesting.

Strengths and possibilities linked to the context

ChromD has a medium team size. During the evaluated period, 4 PhDs thesis were defended, and another 4 PhDs are underway.

The team has demonstrated an outstanding capacity in raising external funds. They successfully obtained 1 international contract (with KAUST), 2 European (1 ERC and 1 H2020), 14 ANR (2 coordinated), 2 local labex projects, 2 projects with private companies (FUTURAGENE and Gautier Semences), and 1 contract from FRM (Fondation pour la Recherche Medicale), leading to an impressive total of 4,996 k€ notified during 2018-2023.

The scientific production of the team is excellent. ChromD published 51 research articles (12 driven by the team and the others from collaborative contributions) and 10 reviews, mostly published in top ranked journals (Science, Nature Communications, Nucleic Acids Research, Genome Biology, ---). Noteworthy, PhD students signed at the first position in 10 of these articles. Among many interesting scientific findings, the contributions of the team to the understanding of 3D genome organization are remarkable. By generating and integrating Hi-C, ChIP-seq, Hi-ChIP, and RNA-seq data, they provided a robust insight into the genome topology and epigenetic landscape in the important crop hexaploidy wheat. They demonstrated that the heat-stress transcription factor HSFA1a alters 3D chromatin organization of enhancer-promoter interactions in tomato. Also, their work about the E2FA and E2FB transcription factors in regulating replication stress response and plant growth in Arabidopsis (Molecular Plant, 2023) is highly remarkable.

Team members are involved in administrative activities/responsibilities as a member of CNRS Section and the director of Doctoral School of Plant Sciences of Paris-Saclay University. The team leader was awarded an IUF position.

Weaknesses and risks linked to the context

The advances/innovations in technology in genomics/epigenomics achieved by the team are excellent and prestigious. Yet its scientific objectives are not clear enough. Concerning data management and storage, the team largely relies on big data exposed to security failures.

Although the team contributes nicely to the university teaching activities/responsibilities, there is little contribution to outreach activities for the public. Organization of conference/congress/symposium could also be considered in the future.

Most of the funding grants has or will be soon reaching the end.

Analysis of the team's trajectory

For the assessed period, the team organization changed from two leaders to one leader only. This was a successful strategy, resulting in a better integration of the scientific topic. The recruitment of two young associate professors has further greatly improved the team capacity. Together with the excellence of the team fundings, it is likely that this team will reach an outstanding level. The team will continue to investigate mechanisms controlling the chromatin dynamics in the context of plant development and response to stress.

RECOMMENDATIONS TO THE TEAM

Raising new fundings is becoming urgent. Meanwhile, cautions should be taken to more precisely define scientific objectives and better focus the research topics. The existing good skills of the team in cell biology could be more explored to complement the genetics, genomics and epigenomics approaches.

Fundings from seed companies is interesting. Yet, interactions with private companies (seed or omics) could be reinforced to have more impact on innovative technologies and/or breeding (with possible patents).

Management and storage of big data need to be more clarified, organized and secured. This is also essential for the large number of collaborations based on the omics technologies provided by the team.

Team 4: Développements floral et carpellaire (FloCaD)

Name of the supervisor: Mr Abdelhafid Bendahmane

THEMES OF THE TEAM

FloCad focuses mainly related on plant reproduction, with projects at the interface between fundamental research and plant breeding. Five axes were developed during the past period, mainly on melon and tomato: 1) Sex determinism, 2) Plant-pollinator interaction, 3) Carpel development and fruit set, 4) Glandular trichome development and 5) Interspecies crosses. Characterization of agricultural traits and engineering of leader alleles are largely conducted via a joint laboratory BioAdapt in partnership with the seed company Gautier Semences and through the generation of prototypes with breeding companies. To better explore plant (epi)allelic diversity, the team has established a dedicated TILLING platform EPITRANS.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The recommendation to pursue publishiing at highest level and to apply for public and private grants (including ERC) was followed beyond expectations and with outstanding success.

Concerning the reinforcement of the international position of the team for projects concerned by glandular trichomes and organisation of inflorescences, several collaborations were implemented. The clary sage project was supported by collaborations with the company SYMRISE and with the technical institute ATEIPMAI for field production tests. Basic research on glandular trichome development and function is now also supported by significant dedicated funding and involves both French and international (US, Brazilian) complementary partners. For the inflorescence project, a Dutch company sponsored a Cifre PhD thesis.

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

Catégories de personnel	Effectifs
Professeurs et assimilés	1
Maitres de conférences et assimilés	0
Directeurs de recherche et assimilés	2
Chargés de recherche et assimilés	1
Personnels d'appui à la recherche	7
Sous-total personnels permanents en activité	**11**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	5
Sous-total personnels non permanents en activité	**5**
Total personnels	**16**

EVALUATION

Overall assessment of the team

FloCad produces groundbreaking science and is outstanding from many points of view: its project that addresses major agricultural challenges using original and relevant models, its exceptional self-funding capacities, its impressive scientific production, its very effective integration of academic research with translational activity.
The trajectory of the team keeps on the same line and is very promising, given its current targets, capacity and already available funding.

Strengths and possibilities linked to the context

The project of FloCad strongly integrates basic and applied research focused on crop plant reproduction thus leading to potential impact on crop yields. This totally fits the priorities of the governing bodies, funding and the socio-economic world.

This medium-sized team includes a LabCom BioAdapt and platorm (EPITRANS) with on total 6 support staff members and 4 researchers. From those, 4 support staff are dedicated to the platform and one to the LabCom (with one of the researchers). The unique EPITRANS TILLING platform provides an excellent asset for both the team basic research and translational activities.

FloCad funding capacities are outstanding, including 77 projects funded during the assessed period (for a total of 14,215 k€), 49 in coordination, including 5 EU (2 ERC Advanced SEXYPARTH (ongoing) and NECTARGLAND (new), 1 ERC-POC HYBRIDSEED, one large collaborative project TOMRES), 19 ANR (3 in coordination), 20 involving directly or indirectly socio-economic partners (see below). This resulted in exceptional average self-funding of 592 k€/FTE/year, well balanced between international (38%) and national (35%) funding agencies and private sector (26%).

Accordingly, the scientific output is exceptional qualitatively and quantitatively corresponding to 2.1 articles/FTE/year, mostly in the leading international journals in Plant Sciences (3 Nature Plants, 1 Molecular Plant, 3 Journal of Experimental Botany, 3 Horticulture Research, 4 Plant Journal...), but also in the best journals dedicated to a broader audience (3 article in Science, 2 Nature Communcations, 2 Current Biology, 3 Nature Genetics, ...). Twenty-one of them have members of the team in lead positions including some of the most prominent. To be particularly highlighted, the sequence of high impact articles (Science 2022; Nature Plants 2022, 2023; Current Biology 2022) and patent derived from the team's ground-breaking work deciphering the molecular mechanisms driving the development of unisexual flowers and fruit shape in cucurbits. This revealed the mode of action of the WIP zinc-finger transcription factors and the role of ethylene in the development of the plant reproductive organs. This work has important outcomes for the control of plant flower sex and plant breeding.

The translational activity of FloCad is very intensive. The team set up exceptional translational research platform EPITRANS for the generation and screening of a large collection of EMS mutants of 19 species. This allows them to engineer leader alleles in partnership with seed companies. A novel software was designed for the exploitation and management of the mutant collections (SENTINEL and SENTINDEL). A gene editing service on tomato and melon was established. The LabCom BioAdapt was created with Gautier Semences to exploit new biosensors for the prediction of plant stress response. The team obtained 20 operating and well-funded contracts with private partners (Gautier, SYMRISE, TAKII, GENOMINES, Vilmorin, Rijk Zwaan, BMH, Syngenta, VCO). Three patents were filed cuttently leading to two 2 licenses. Non-exclusive licenses of engineered mutants were provided to seed companies, as well as support to the creation of three start-ups by former doctoral students or post-docs. This translational activity has generated 3,773 k€ funding for the team and close to 420 k€ for the platform.

Team members, particularly its leader, are highly visible and regularly invited to present seminars and conferences in international meetings and institutes. He is also a member of the SAB of the German Federal Ministry of Education and Research and an advisory board member of Molecular Plant. For his discoveries he was recently awarded the Gold Medal of the French Academy of Agriculture (2022) and the first Prize LAURIER INRAE (2018).

Weaknesses and risks linked to the context

The number and diversity of fundings and projects may lead to burn-out. Their management seems to become an enormous challenge. Managing their publication, protection and transfer output may become a challenge as well.

The support personnel on fundamental research activities is very limited given the team number of funded projects.

The plant growth facilities are a limitation for effective translational research and no funding is planned for equipment maintenance.

The team lost competence in cell biology with the retirement of a team member.

FloCad contributes to the Plant and Society Group of Saclay Plant Sciences, the Fêtes de la Science, and to discussions at the French Academy of Agriculture. It advertises its most important discoveries through SPS channels, but its outreach activities remain mainly restricted to the academic and private sectors.

Analysis of the team's trajectory

FloCad proposes to pursue on the same trajectory with now two team co-leaders and five main priorities. 1) Sex determination in unisexual flower development with focus on cucurbit species harboring sex chromosomes. This will bring new insight in the evolution of sex genes and chromosomes and to produce plant prototypes that improve hybrid seed production. This line will also now include epigenetic regulations. It is supported by the ERC HybridSeed; 2) Plant-pollinator interaction, a line considerably reinforced by the ERC NectarGland, an ambitious integrative approach that aims at understanding nectary development, nectar production and chemistry of pollinator attraction; 3) Fruit set in cucurbits, focused on causal mutations of parthenocarpy in melon and supported by multiple private fundings; 4) Interspecies crosses, at the mechanistic level. This topic is supported by the private project MelOpen phase 2 project and the PEPR DIVEDIT; 5) Glandular trichome initiation and development in clary sage and tomato. in collaboration with the company SYMRISE. In parallel, FloCad will continue its transfer activities, coupling the LabCom that provides access to elite plant material with the EPITRANS plaform to accelerate its output. Fast neutron mutagenesis will be introduced to generate new collection of mutants as well as CRISPR/Cas9 technology for more effective functional identification of mutants and solving the hurdle of gene families.

Overall, this anticipated trajectory is very ambitious, promising, all lines being relevant and already well-funded. While most projects are based on a solid background and technologies and tools already well established in the team, some are riskier than others. They rely on external collaborations and/or new technological developments that may be more complex to implement. Given the current workload of the team, some lines of the project could be at least temporarily delayed or refocused to ensure success of the main priorities.

RECOMMENDATIONS TO THE TEAM

Considering its current funding and number of running projects, the team should consider hiring a lab manager and personel dedicated to contract management. A pause in project diversification could be a good idea.

Facilities and equipment maintenance are indeed a problem that could be solved either charging public and private users or applying for specific funding at the Unit level.

Given the strong impact of the team work on agriculture, the FloCad members should consider occasional outreach actions dedicated to a broader public as interviews, videos or conferences, even though it is time-consuming.

Team 5: Genomique et épigenomique quantitatives (Q-Lab)

Name of the supervisor: Mr Leandro Quadrana

THEMES OF THE TEAM

The Q-Lab team is aiming to provide major insights in our understanding of the mechanisms controlling activities of Transposable Elements (TEs) and to investigate the consequences of TE mobilization for within species variation.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

Not relevant. This is a new team created in 2021 in IPS2.

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

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maitres de conférences et assimilés	0
Directeurs de recherche et assimilés	0
Chargés de recherche et assimilés	1
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	2
Sous-total personnels non permanents en activité	**2**
Total personnels	**4**

EVALUATION

Overall assessment of the team

The young Q-lab team is excellent, on an outstanding track. Its leader received an ERC Starting Grant and a CNRS-Momentum grant and was awarded the CNRS Bronze Medal in 2021. His scientific production is excellent. The team project is ambitious.

Strengths and possibilities linked to the context

The PI is an excellent young scientist. In 2021 he obtained an ERC Starting Grant and he was awarded by the CNRS Bronze Medal as well as honored by a CNRS-Momentum grant. His work is internationally recognized. Since 2018, he published 17 research articles, with 7 of them signed at first and/or last/corresponding author position, and the majority of them appeared in top-ranked journals (1 Nature Plant, 2 Nature Communications, 1 EMBO J, 1 Nucleic Acids Research, 1 Genome Biology). His findings made significant contributions to our understanding of the mechanisms controlling TE activity in plants, as well as in developing cutting-edge techniques to study TE mobilization and chromatin dynamics in plants. He is highly visible and frequently invited to give lectures in conferences and in prestigious institutions all over the world.

His fund-raising capacity is excellent, with 2,210 k€ of national and international funding (including 1ERC, 2 ANR, 1 CNRS Momentum) raised for its four first years of activity.

Weaknesses and risks linked to the context

The team size is currently very small (with the team leader alone as permanent staff).

Analysis of the team's trajectory

The team was created in 2021 during the assessed period and its current trajectory is excellent. The questions addressed are as follows. How can we reconcile the extensive variation in TE insertion polymorphisms observed among natural populations with the scarcity of transposition events that can be recapitulated in the lab? How do accidental DNA methylation changes arise despite the multiple molecular mechanisms that ensure the faithful transgenerational transmission of epigenetic states? What are the consequences of natural transposition for an organism's fitness, and what is the role of DNA methylation in within-species variation? These questions are highly relevant in current research. The outcome of the team research project will make significant contributions to understand how variations in epigenetic silencing of TEs shape the mutational and epimutational potential in plants.

RECOMMENDATIONS TO THE TEAM

The PI is urged to recruit permanent staff to increase the team size. As noted by the PI himself, the team needs to be supported by recruiting more permanent members to ensure the continuity and long-term consolidation of the research lines and innovative methodologies.

In the meantime, an improvement on the number of non-permanents (postdocs and PhDs) should also be considered and this requires securing more funds beyond 2025.

Team 6: Changement climatique et signalisation rédox (CCARS)

Name of the supervisor: Mr Graham Noctor

THEMES OF THE TEAM

CCARS investigates the role of redox systems in the plant responses to biotic and abiotic stress conditions. This includes revealing the roles of reactive oxygen species, the glutathione-ascorbate pathway, and the thioredoxin system. Over the last period, the team's investigations extended to the interactions between redox factors and phytohormones and redox regulation of chromatin-modifying enzymes.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The previous Hcéres evaluation recommended increasing the team size, integrating group efforts, targeting larger grants with less cumulative administrative burden and to generally explore more funding sources. Team size overall was kept stable over the reporting period, but the team leader now has a second affiliation in China. Its benefit for the team is unclear. The team obtained 3 ANR grants, but no bigger international ones. Management of new fundings acquired during the period has been shared between the team members.

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

Catégories de personnel	Effectifs
Professeurs et assimilés	2
Maitres de conférences et assimilés	1
Directeurs de recherche et assimilés	0
Chargés de recherche et assimilés	1
Personnels d'appui à la recherche	2
Sous-total personnels permanents en activité	**6**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	4
Sous-total personnels non permanents en activité	**4**
Total personnels	**10**

EVALUATION

Overall assessment of the team

Overall CCARS can be ranked very good to excellent. The team is highly visible and has demonstrated excellent qualitative and quantitative scientific outputs. Its funding capacity is good to very good, and outreach activity very good. The planned recruitment of an associate professor in 2025 addresses the challenges posed by upcoming retirements and positions the team to maintain its capacity and impact in the coming years.

Strengths and possibilities linked to the context

The CCARS team comprises a small yet highly skilled core staff of 2.5 FTE researchers with a high teaching load (two full professors, one associate professor, and one research associate), and 2 technical support personnel. The research focus related to redox biology and plant responses to climate change. The group includes recognized international experts, with the team leader having been listed as a Clarivate Highly Cited Researcher for multiple years during the assessed period, reflecting the global impact of their work. While no longer listed toward the end of the reporting period, this recognition underscores the team influence in the field. A professor from this team has a second affiliation in China which makes the team attractive for Chinese post-docs and PhD students.

The team achieved very good productivity, with 1.6 article/FTE/year based on core work presented in the self-evaluation report, and excellent productivity of 2.4 article/FTE/year when outputs from secondary affiliations are included. These publications appeared in very good to excellent international speciality journals like The plant Journal (2), Plant Physiology (3), Annual Reviews in Plant Biology (1), with 80% of them as first, last or corresponding authors. These metrics highlight the team ability to deliver high-quality research despite its small size and substantial teaching responsibilities.

The team expertise in oxidative stress, reactive oxygen species, and thiol-based redox systems has led to significant advances in understanding plant responses to environmental stress. The planned recruitment of an associate professor in 2025 is a proactive step to maintain capacity and continue building on the team contributions. Their international collaborations and ongoing efforts to integrate redox biology with broader physiological and environmental studies position the team as a key contributor to address challenges linked to climate change.

The team has a very good outreach activity that involves several permanent and non-permanent members via YouTube video (1), diffusion articles (4), interviews (2) and participation to public open days.

Weaknesses and risks linked to the context

While the CCARS team is highly visible, also due to an impressive output of review articles, it has relatively few collaborative publications.

While regular, the team funding remains limited (54 k€/FTE/year) and does not fully exploit all potential funding sources, particularly international and private-sector opportunities, which could diversify resources and support larger-scale projects.

One team member second affiliation in China contributes to a broader publication output, though not all these contributions are directly reflected in the report.

Despite the significant agronomic potential of the team's work, particularly in addressing climate change-related challenges, there is minimal focus on translational activities. This limits the application of their findings in crop improvement or agricultural practice.

Analysis of the team's trajectory

The team trajectory is excellent, with a clear focus on advancing the fundamental understanding of redox regulation, particularly in salicylic acid pathways. Planned projects leverage in-house resources and expertise to address critical questions in plant stress biology, ensuring relevance within the context of climate change and demonstrating potential for agronomic applications. An associate professor recruitment planned for next year is a key opportunity to strengthen the team, especially considering an anticipated departure of a senior member in the coming years. Ensuring the successful integration of the new member into the team and securing funding for ongoing and future projects will be critical to maintaining the team productivity and impact. Greater integration among team members and stronger engagement in international collaborations (besides China) could further enhance the team long-term success.

RECOMMENDATIONS TO THE TEAM

To strengthen its position and impact, the CCARS team should maintain a team size aligned with its objectives and strategic priorities, ensuring it has the capacity to achieve its goals effectively. More actively engaging in collaborations, both within IPS2 and internationally, could help showcase the team unique skills and increase the value of its contributions. Re-establishing a working website or maintaining a social media presence would improve the team visibility and make it more approachable.

The team work on salicylic acid pathways presents an opportunity to explore pathogen-related funding, which could align well with global priorities in plant health and resilience. While balancing teaching responsibilities with research remains an ongoing challenge, fostering greater collaboration across projects and targeting translational opportunities could help the team expand its impact and attract additional resources.

Team 7: Signalisation et stress (STRESS)

Name of the supervisor: Mr Jean Colcombet

THEMES OF THE TEAM

The team studies the protein-kinases involved in signalling pathways triggered by environmental modifications. Their recent work focused on seed dormancy control and crosstalks between PAMP-Triggered Immunity (PTI) and Effector-Triggered Immunity (ETI).

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The team was recommended to apply for funding and to more actively search for industrial partners. This last point remains unsuccessful. The team activity was based on contracts that generated approximately 1 million €. Most funding, however, resulted from prior grants, and only 225 k€ were raised since 2019.

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

Catégories de personnel	Effectifs
Professeurs et assimilés	1
Maitres de conférences et assimilés	1
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	**6**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	2
Sous-total personnels non permanents en activité	**2**
Total personnels	**8**

EVALUATION

Overall assessment of the team

The team activity is assessed as very good. Despite limited support staff and low funding, the team maintained a very good level of publication. Their scientific expertise in kinases has led to several collaborations attested by 15 publications in addition to the 6 resulting from their own scientific activities. The arrival of an INRAE DR2 and the focus on climate change are very positive developments, which should strengthen the team dynamism. The team also needs to raise its international profile to facilitate its growth.

Strengths and possibilities linked to the context

The team has recognised experience in the field of phosphorylation signalling. The approach is perfectly appropriate and provides an opportunity to address crucial scientific and societal issues where phosphorylation regulatory cascades play a crucial physiological role.

This is reflected in its ability to publish a very good number (28, of which 6 as first/last or corresponding author, i.e. 1.16 articles/FTE/year) of articles in excellent international journals (Plant Cell, Plant Communications, Journal of Experimental Botany, PLoS Genetics, EMBO Reports...). It should be noted that the work on the pathways

triggered by various pathogens led to articles as first and/or corresponding author (Plant Communication 2023, Journal of Experimental Botany 2022 and Plant Cell 2020).

The recent arrival of a new research director, specialising in stomatal opening and gas exchange, is clearly an excellent development for the team, strengthening its ability to address its scientific objectives. This should provide an opportunity to expand the collaboration network of the team and help to stabilise its funding.

The very significant involvement of two members of the team in M1 and M2 teaching (535 h/year) and in administration with the vice-presidence of the University of Evry limits their research activities but also provides for the team a strong opening to recruit talented young students. The team excellent scientific dissemination activities for the general public are also noteworthy.

Weaknesses and risks linked to the context

The team funding was rather limited (44 k€/FTE/year) during the evaluated period, but a recent ANR funding should improve the situation.

This is likely due to the team visibility, which appears limited outside France. The main collaborations are national, except for those with the former head of the team who moved abroad.

The technical support of the team is very limited (with currently 1 IR for 4 and soon 5 FTE scientists with the arrival of a new DR). The low number of grants/contracts currently available means that this gap cannot be filled by using fixed-term contracts. This points to a need for optimisation of the task distribution within the team.

The team scientific productivity (6 leading research articles,15 as collaborators and 6 reviews or book chapters) is respectable but could be improved given the number of scientists in the team (5 FTE). It is regrettable that the team numerous collaborations (15 articles), are not reflected in terms of funded projects.

Analysis of the team's trajectory

For the next contract, the team plans to focus its activities on the crosstalk between climate changes and immunity. For this, it will use plants grown in an outdoor-like fluctuating environment matching expected conditions for the end of the century. More precise details on those conditions would have been welcome due to the different scenarios existing on climate change. The long-standing involvement of the team leader in the creation of the Climate Change Laboratory (CClab), the IPS2 technical platform created to offer growth and phenotyping facilities for facing future climate modifications are serious guarantees to secure the feasibility of these experiments.

The recent recruitment of a DR2 INRAE, who will co-direct the team provides novel and interesting opportunities that should be exploited. His expertise in stomatal physiology will reinforce the capacities of the team to address scientific topics related to climate change. This should improve the competitiveness of the team to raise funding associated with this essential issue.

RECOMMENDATIONS TO THE TEAM

The team must take advantage of its recent expansion to increase its international visibility and its search for funding to ensure its long-term stability. An internal redistribution of tasks might improve the team efficiency.

Although competitive, the field of plant pathology is a source of funding because of the economic stakes involved. The team must valorise this opportunity to raise public funding and develop translational activity through collaborations with the private sector.

Given the team extensive experience and investment in new technologies (e.g. single cell transcriptomics) with other IPS2 colleagues (OGE team), it should be able to target even more ambitious publications.

In recent years, the STRESS team has invested a lot of energy in methodological development to study biotic and abiotic signalling pathways and to identify multiple actors such as kinases and their targets (Molecular Cell Proteomics 2018, SCANNER project in collaboration with the OGE team). Focusing now on their characterisation should be an opportunity for developing new collaborations. This would be facilitated by increasing scientific communication within plant community.

The team has decided to translate part of its activities from plant model to crops (wheat and tomato) to improve their resilience to climate change. While this is an important societal issue and may open new funding opportunities, it would be advisable to carry out some of this work in association with experts of these species for optimal efficiency and to limit staff dispersion.

Team 8: Metaboactions (SIREMETAB)

Name of the supervisor: Mr Michael Hodges

THEMES OF THE TEAM

The team's first aim is to understand the primary metabolism and acquire basic knowledge to improve crops in a changing climate. A first line of research is the regulation of enzymes involved in photorespiration and the impact of photorespiration on stomatal movements. The team also uses beneficial endophytic bacteria to improve plant growth under climate change and limiting nitrogen conditions. A third topic is centered on stress mitigation by improving NAD biosynthesis and recycling through overexpression in crop species of key enzymes of NAD biosynthesis. A fourth topic is to decipher the role of plastids, mitochondria and retrograde signaling during skotomorphogenesis in stress conditions. In addition, the team manages the PMM platform for metabolomic and isotopic analyses.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

Funding efforts were successful in the current period, notably for translational research, but support from EU grants and other open competitive grants (ANR) has decreased. The departure of permanent researchers (professor and assistant professor) before 2018 was only compensated by the arrival of a new HDR researcher (CR CNRS) and HDR to an assistant professor. Concerning the scientific strategy, increased collaboration with the other teams of IPS2 was expected based on the involvement of extensive omics in the team project. This was indeed the case with 7 collaborative projects with IPS2 teams and various collaborations with SPS EUR teams in the current period.

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

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maitres de conférences et assimilés	3
Directeurs de recherche et assimilés	1
Chargés de recherche et assimilés	2
Personnels d'appui à la recherche	5
Sous-total personnels permanents en activité	**11**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	3
Sous-total personnels non permanents en activité	**3**
Total personnels	**14**

EVALUATION

Overall assessment of the team

The team performance has been rated as very good. The team has a good funding capacity, a good to very good scientific production including collaborative publications. It has excellent interactions with the private sector. The team has a strong potential for translational research on resilience of crop plants in changing environment. In agreement with the upcoming retirement of its leader, the team trajectory realistically involves integration of the BEB thematic into the SiLAB team and has very good plans to refocus the future RESILIENCE team at the role of energy balance and retrograde signalling.

Strengths and possibilities linked to the context

SIREMETAB has a significant size and a very good balance of researcher/support personnel (11 permanent staff, including 7 researchers/assistant professors -5.5 FTER- and 4 technical staff). Significant resources are dedicated to the PMM platform: 1 IR and 1.5 FTE ITA.

The team has a strong and ancient background in fundamental research on photorespiration and primary metabolism, with more recent translational activities aiming to improve crop growth and resilience in the context of climate change, in line with the priorities of the research unit and the societal demand.

Overall, the scientific production is excellent quantitatively when the PMM platform activity is included, with 64 publications (2.84 publications/FTE/year) (including 12 original articles in very good to excellent journals (Proceedings of the National Academy of Sciences USA, Plant Physiology, Plant Cell & Environment), 13 review articles in excellent to very good journals (Trends in Plant Sciences, Frontiers in Plant Sciences, Free Radical Biology Medicine) and book chapter, including 18 articles in leading position, as well as 39 collaborative publications. Excluding the collaborative publications of the PMM platform, the scientific productivity of the team is good.

The funding of the team is good, including the coordination of 1 ANR program (REGUL3P) that ended in 2019, increased support for translational research (155+106k€), stable support based on PMM service contracts (343 k€), and several low-amount PIA labex ANR, for a total of 1010 k€ during the evaluated period (i.e. 30.6 k€ /FTE/year).

The Metabolomic platform supported by the team has a remarkable collaborative publication record and self-funding capacity. Hosting the platform has the potential to generate synergy with the research group.

The translational research is increasing and resulted in EU and USA patent extension of a French patent concerning a solution to improve plant growth and resilience to environmental stress by overexpression of NAD generating enzymes in model plants. The transfer to crop plants is currently evaluated, supported by funding from SATT UPS Saclay, COMUE and Carnot Plant2Pro. The newly developed program on beneficial endophytic bacteria to plant has also a strong potential for applied research.

Team implication in training is strong (3 PhD thesis defended and 3 current PhD students, 12 M2). Team members are teaching and endorse teaching responsibilities (M2 Plant science program, organization of student internship, teaching unit responsibilities) at UPS. They also instigated and coordinated the organization of 2024 EUR SPS-CEPLAS joint summer school for early career researchers. Training sessions were organised by the PMM on metabolomics and mass spectrometry.

Weaknesses and risks linked to the context

Apart from the PMM collaborative publications, the number of original publications of the team remains low (slightly higher than 1 publication /FTE/year). Nevertheless, these articles are of very good quality.
Funding should be improved, at European and ANR level, and more opportunities for translational research contracts (actually most are over) are in discussion and hopefully secured for the future.
The team has to improve its international recognition and collaborations.
The team research program involves too many topics with respect to the size of the team.

Analysis of the team's trajectory

Anticipating retirement of the team leader (12/2025), the team redefined its objectives and contours. The beneficial bacteria topic (plant growth-promoting bacteria such as Enterobacter sp. SA 187 will integrate the "Signaling pathways regulating Legume root system Architecture through Beneficial bacteria" team (SiLAB), which appears a rational move. The analysis of the regulatory mechanism of photorespiration enzymes by phosphorylation and redox will be terminated.

The new TEAM "Linking energy status to plant acclimation" (RESILIENCE) will focus on energy status of plant defined by NAD+ status and its manipulation. This is currently implemented via overexpression of AtLASPO, and the possibility to alter energy status in non-GMO plants will be tested. The ambitious project of the new team, aims to link the energy status to the control of gene expression and development under stress, including epigenetic controls and to identify non-GMO energy rich plants. The trajectory involves state-of-art technology and collaborative projects with both academic (Münster, Utrecht and Lund Universities, and short term EMBO fellowship to visit a lab in 2024), and private (currently establishing partnership with Bayer Crop Science, Darween Biosience and Neoplants) to decipher the contribution of NAD+ to growth and climate resilience. It fits well with the axes 1 and 2 of the IPS2 trajectory.

Activity and development of the PMM platform will be actively pursued, involving several national (MetaboHub Bordeaux, Angers) and international collaborators in Brazil, Australia, Japan, Spain.

RECOMMENDATIONS TO THE TEAM

A critical point for the new team RESILIENCE will be to confirm the benefit of NAD+ overaccumulation in crop species. The team will need to secure funding for its ambitious translational projects. The team project to maintain a fundamental research program on energy metabolism and regulation will be essential to develop the basis for future translational research activity.

Team 9: Dynamique du génome et résistance aux agents pathogènes (GDYNPATH)

Name of the supervisor: Ms Valérie Geffroy

THEMES OF THE TEAM

The GDYNPATH group focuses on the molecular basis of disease resistance against fungal and viral pathogens in common bean. Focus of their research over the period includes the Inventory of NLR immune receptors in the genome of pea, analysis of their epigenetic regulation (DNA methylation and sRNAs), the identification of an atypical resistance gene against anthracnose and resistance genes against bean common mosaic necrosis virus (BCMNV) and (bean pod mottle virus (BPMV) in common bean, and setting up of a virus-induced gene silencing (VIGS) strategy for functional analyses in bean and pea.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The previous committee recommended to increase the size of the team to tackle their ambitious project. GDYNPATH recruited a technician in 2022 but lost an IE in 2018 and a part-time (40%) technician in 2021, and one retirement is planned in 2026. Thus, recruitment will remain a major challenge for the period to come. Another recommendation was to increase interactions with non-academic partners interested in bean crops. Funding of a Plant2Pro program is a move in this direction, but the efforts could be further increased given the rising interest in legume crops to meet societal demand.

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

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maitres de conférences et assimilés	2
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	**4**
Enseignants-chercheurs et chercheurs non permanents et assimilés	1
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	2
Sous-total personnels non permanents en activité	**3**
Total personnels	**7**

EVALUATION

Overall assessment of the team

This very good team has long-term recognized expertise on immunity in legume plants. The scientific production is of very good quality, relevant and original, but remains somewhat limited in its ambition due to the small size of the team (and difficult personal situations over the past period). The team achieved a very good level of funding, interactions with the private sector and the society are excellent.

Strengths and possibilities linked to the context

The research of the team combines classical molecular biology approaches with modern genomics, providing both functional and evolutionary insights into legume immune responses. The funding raised during the period (1,116 k€, i.e. about 100 k€/FTE/year) was very good, regarding the small size of the team, and included some EU funding. The team published 15 articles (1.33 articles/FTE/year) including 9 as lead team, which is very good considering its size and other duties. The articles were published in part in excellent plant biology journals (The New Phytologist, Journal of Experimental Botany), but also quite a lot with questionable publishers (Frontiers/MDPI). Outreach activities of the team were rated excellent, targeting diverse groups of the public through multiple communication channels. In addition to the historical focus on important resistance loci, the team engages in promising diversity studies and innovative functional genetics strategies. Together with recognized expertise on these models, this enabled a creative and productive research.

Weaknesses and risks linked to the context

The team remains small (2 research FTE and 1 support staff member), which increases the risk of not achieving its objectives.

The implementation of the proposed project is slowed down by the challenge of functional studies in crops, but it could open more opportunities for original findings and sources of funding for the team.

The departure of an emeritus at the end of 2026 will reduce the outreach activity of the team.

Analysis of the team's trajectory

Given the limited size of the team, it may be advisable to emphasize activities that can be partly outsourced, performed in collaboration or may be less labor intensive than elaborate wet lab biology. The proposed focus on the analysis of bean genomic diversity aligns well with this view and is well adapted to the team forces. Difficulties related to functional studies in bean calls for the use of heterologous systems and the adaptation of existing molecular screening methods, which is also a direction chosen by the team. In addition to being adapted to the particular situation of the team, the proposed strategy will reinforce opportunities for a multidisciplinary research spanning functional molecular biology, genomics and evolutionary biology. In spite of past contributions to this field, the team's trajectory does not involve epigenetic studies. This would have been possible given the context of the unit, but this choice may result from the necessity to keep a strong focus. Funding allowing the team to initiate the diverse aspects of the project is identified and available, strengthening the feasibility of the project. In spite of positioning in the climate change axis as first topic, this theme is not very explicit in the proposed trajectory. There is no clear recruitment strategy presented (type of skills needed, level and timing of expected recruitment).

RECOMMENDATIONS TO THE TEAM

In line with the unit's project, the team is recommended to limit publications in grey journals (Frontiers, MDPI). Their excellent cutting-edge research is not published in the journals it deserves. The team should favor community journals and post research on preprint servers for quick dissemination. The proposed research program should enable combining genomics, functional studies and evolutionary insights which is timely and should lead to significant insights.

The committee recommends to set up a recruitment strategy (skills, integration in research program of the team, unit and institution, level and timing of recruitment). They should emphasize the novel opportunities it will create to be attractive to young researchers, partners and institutions. The proposition to welcome scientists previously working in IPS2 teams discontinued on other plant-microbe interactions is very relevant regarding the societal demand around the new team's questions/models.

Maintaining strong and productive collaboration is also of prime importance. As previously noted, partnership with private sector could be increased given the work on crops.

The team is recommended to put efforts into communicating their results beyond the community working on the same models, such as through generalist plant biology or plant-microbe conferences. Training in genomics and evolutionary biology (or strong collaboration with such experts) is recommended to address part 1 of the project. Reinforcing interactions with local platforms might compensate for lack of personnel and strengthen creative research.

The team has a strong investment in teaching and has a very dynamic policy of communication towards students and the society. This could be leveraged to increase the attractiveness of the team locally.

Team 10: Expression du génome des organites (OGE)

Name of the supervisor: Mr Etienne Delannoy

THEMES OF THE TEAM

The OGE team has a proper research topic aiming to understand the processes involved in the regulation mechanisms of plastids and mitochondria activity, from transcription to translation with a particular focus on transcriptomics. In addition, the team manages the Plant Transcriptomic Platform (POPS) and the InterAtome Platform.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The previous committee urged the team to improve its publication output and grant success. Significant improvements have been made. From 2018 to 2023, the team has reached a total of 83 publications, with 17 of them (13 research articles and 4 review/chapter articles) being signed at 1st or last author position and the rest of them by collaborative contributions. The team has coordinated 2 ANR grants and has participated or coordinated several low-amount grants at European (1 H2020), national (1 ANR), local (7 labex), and social/territorial (4 projects) levels. Total funding amounted to 2,597 k€ notified during the assessed period.

The previous committee also noted that the heavy investment into platforms should be reconsidered. This point has not been well responded during the assessed period. The team has stated that 60% FTE was dedicated to platforms; yet the task and time distributions among team members and between platforms and team research topics remain unclear.

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

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maitres de conférences et assimilés	2
Directeurs de recherche et assimilés	0
Chargés de recherche et assimilés	1
Personnels d'appui à la recherche	6
Sous-total personnels permanents en activité	**9**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	3
Sous-total personnels non permanents en activité	**3**
Total personnels	**12**

EVALUATION

Overall assessment of the team

OGE is a team and also a transcriptomics/interactomics platform, with excellent number of support staff and very good financial resources. It has consequently an outstanding number of publications. The team also produces a very good number of high-quality publications at international standard. For the next years, the team proposes an interesting but too ambitious project.

Strengths and possibilities linked to the context

During this period, a CR INRAE has very courageously taken over the team leader responsibility after the departure of the former team leader. The team still has a significant size, particularly a good number of support staff. The team has trained 4 PhDs, and hosts currently another 3 PhD students. The funding of the team is very good: 3 ANR grants (2 coordinations) and several low-amount grants (1 H2020, 7 labex and 4 social/territorial projects), with a total of 2,597 k€ notified during the period.

During the assessed period, the team published 13 main research articles (signed at 1st or last author position) and contributed to 60 collaborative publications. One major finding of the team concerns the regulation by adenylates of the Arabidopsis plastidial thioredoxin through the binding of a CBS domain protein' (Plant Physiology, 2022). Another interesting result is that full-length transcriptome highlights the coordination of plastid transcript processing in Arabidopsis leaves (International Journal of Molecular Sciences, 2021). In situ transcriptomic and metabolomic studies unravelled the loss of photosynthesis in the leaves of mixotrophic plants exploiting fungi (Plant Journal, 2019). Also noteworthy is their collaborative contribution to the research article entitled 'An mTRAN-mRNA interaction mediates mitochondrial translation initiation in plants' recently published in Science (2023).

The team has a very good participation in organizing research/summer schools and international conferences.

Weaknesses and risks linked to the context

During the evaluated period, the OGE team suffered a big loss of staff with the departure of 1 DR (former leader of the team), 1 CR and 3 ITAs.

In spite of some articles published in good/high standard journals, the majority of publications of the OGE team are in specific topic journals with low-ranked levels.

Among the 60 articles resulted from collaborations, there is only one related to organelles (mitochondrial transcriptome, in this case). The visibility of the team on its own proper research topic is relatively low. It also reflects some lack of integrative connection and synergy between the team proper research topic and platforms activities.

Analysis of the team's trajectory

After the departure of the former team leader, the team has been led by a CR since 2022. Albeit the recruitment of an IE in December 2023, the team size was significantly reduced. In the next mandate, the team plans to develop in parallel the platforms (POPS and InterAtome) and the team proper project. The maintaining of POPS appears as highly demanded by INRAE. Developing epi-transcriptomics and micro-transcriptomics (single cell/nucleus and spatial transcriptomics) in POPS sounds very interesting and relevant. The scientific project of the team aiming to understand how plastid gene expression regulates plant response to stress includes a broad range of sub-projects.

RECOMMENDATIONS TO THE TEAM

The achievements in raising external fundings and number of articles are very good. Keep on active in this way! Nevertheless, the team is recommended to set publication policies: try to reduce the number of publications in low-ranked and/or grey journals (Frontiers, MDPI); make efforts to further improve to publish in high quality journals.

The scientific project of the team should be more/(re)-thought out. In view of the departure of one associate professor in 2025, the team size will be reduced to 1.5 FTE. This further reinforces the need to focus the scientific project. Integration and synergy should be best explored for the two parts of team activities (platforms and scientific project). The team has a very good number of support staff: a clear policy in the team management is necessary. Responsibilities, duties and work pipelines should be properly defined for each member of the team.

Team 11: Réseaux génomiques (Gnet)

Name of the supervisor: Ms Marie-Laure Martin

THEMES OF THE TEAM

The GNet team works at the intersection of statistics, bioinformatics, and biology. They develop methods to better understand gene activity and function, manage the analytical aspects of a transcriptomics platform, and lead or support data analytics in collaboration with biologists.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The previous committee recommended to increase the number of last-author papers in bioinformatics and computational biology journals, to improve recognition by bio-collaborators to secure lead positions in projects and publications, and to increase both the number of grants and PhD candidates. The committee also advised the team to shift focus from incremental improvements of established methods to pursuing more innovative and impactful research on emerging topics and techniques.

In response, the team increased its publication output, trained more PhD candidates, and secured several lead positions. They also critically reflected on and justified their approach to methods development.

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

Catégories de personnel	Effectifs
Professeurs et assimilés	1
Maitres de conférences et assimilés	1
Directeurs de recherche et assimilés	2
Chargés de recherche et assimilés	0
Personnels d'appui à la recherche	4
Sous-total personnels permanents en activité	**8**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	2
Sous-total personnels non permanents en activité	**2**
Total personnels	**10**

EVALUATION

Overall assessment of the team

The activity of the GNet team was rated very good to excellent. The team financial resources during the evaluated period were good to very good and its scientific production was very good to excellent. GNet also implemented significant translational activity. A new professor strengthens the team expertise, while emerging work in changepoint detection and protein interaction prediction positions them well to address key challenges in omics-data integration and plant biology.

Strengths and possibilities linked to the context

The GNet team has made significant progress, increasing the number of its publications up to 76, including 11 articles delivered by the team. Out of 24 methodological papers, team members are first, last or corresponding

author in 15. Additionally, 20 publications arose from supervised computational analyses, with some evolving into collaborations, and 32 stemmed from transcriptomics platform data (3.2/FTE/year; 1.9/FTE/year without 32 platform papers). The team endorsed leadership for articles in excellent applied mathematics journals such as Journal of the American Statistical Association, BMC Bioinformatics, Plant Methods, Nucleic Acids Research Genomics & Bioinformatics, and had key contributions to publications in excellent plant biology journals (Journal of Experimental Botany, Plant Journal). Funding raised over the period (678 k€; 28, 3k€/FTE/year) was relatively low compared to teams performing experimental research, but very good for the typical needs of computational sciences.

The GNet team is able to consolidate its strengths and address new opportunities. The recruitment of a new professor and the addition of two more HDR scientists increase the team capacity to provide methodological input and contribute to ongoing projects. Established expertise in network analysis and changepoint detection offers a basis for further methodological developments in omics-data integration and plant biology. The team has a strong capacity for methodological innovation related to the analysis of global gene expression, protein-protein interaction networks, and regulatory genetic elements. They developed tools for both experts and non-experts, making advanced bioinformatics accessible to a broader audience.

The team access to datasets via the POPS platform supports both independent and collaborative research. Focusing on these collaborations and continuing to refine methodological approaches will help the team maintains its role as a contributor to omics research while ensuring relevance to broader scientific goals.

Activity of the team is remarkable for its integration of statistical rigor with biological insights. Contributions as partners in several Carnot Plant2Pro projects serves to anchor theoretical developments into practical challenges in biology.

Weaknesses and risks linked to the context

The GNet team has made notable progress in improving authorship positions and providing input to collaborative projects. However, challenges remain due to a high workload of routine analytical tasks and standard analyses. While these activities are important for maintaining collaborations and supporting the transcriptomics platform, they may limit the team ability to focus on innovative research and higher-impact initiatives.
The team has a strong involvement in the local and national bioinformatics communities but does not develop explicit strategies for broader adoption of the methods they develop and their long-term maintenance/update.

Analysis of the team's trajectory

The GNet team is advancing through a balanced focus on methodological development and applied research. Their work on plant thermosensing under elevated atmospheric CO2, supported by a novel dataset with 22 replicates, integrates biological insights with methods development. Planned methodological efforts, such as changepoint detection and multilevel network construction, enhance the capacity of the team to address complex datasets.

Framing their research within the context of climate change strengthens its relevance, while their interdisciplinary approach positions them to contribute significantly to understanding plant resilience in changing environments.

RECOMMENDATIONS TO THE TEAM

The GNet team should continue to strengthen the publication record, continuously ensuring broad recognition of individual contributions. Targeting high-profile projects that showcase the team developed tools and methods can further enhance visibility and impact. Such projects should emphasize the innovative application of their computational approaches, particularly in areas like plant thermosensing and omics-data integration. Strengthening connections with local groups and offering analytical input could allow the team to make more targeted contributions to ongoing projects while also benefiting from shared expertise. Building on these interactions could enhance both the team and the local group research outcomes. More collaborative, multi-institutional studies could amplify the impact of their research and diversify perspectives. Community engagement, strategies for the widespread adoption and long-term maintenance of original methods (e.g. funding, communication, broad collaborations) should be considered to promote their adoption beyond direct collaborators.

For the transcriptomics platform, the team may benefit from focusing on complex and biologically significant transcriptome analyses rather than routine tasks that are increasingly accessible to many groups. Ensuring strong integration of all group members and strategic task prioritization is essential for the team continued success. Prioritizing projects that leverage the team unique expertise and advanced pipelines will allow for more meaningful contributions and maintain the platform relevance within the research community.

Team 12: Symbiosis and Immunity (SYMUNITY)

Name of the supervisor: Mr Pascal Ratet

THEMES OF THE TEAM

The team focuses on beneficial plant-microbe interactions in legumes primarily and in range of other plant species. Crosstalks with plant immune responses and development are a favored line of investigation. The team has expanded its range of model organisms to diverse bacterial species and plants (including Medicago, Pisum, Lotus, Brachypodium, Vicia).

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

The previous evaluation recommended to carefully prioritize projects to avoid dispersion. Judging from the research output, projects on beneficial interactions with cereals were set a lower priority or different timing, which allowed significant achievements on the symbiosis-development interplay and the natural diversity of legume-microbe interactions.

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

Catégories de personnel	Effectifs
Professeurs et assimilés	1
Maitres de conférences et assimilés	1
Directeurs de recherche et assimilés	1
Chargés de recherche et assimilés	0
Personnels d'appui à la recherche	3
Sous-total personnels permanents en activité	**6**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Personnels d'appui non permanents	0
Post-doctorants	0
Doctorants	2
Sous-total personnels non permanents en activité	**2**
Total personnels	**8**

EVALUATION

Overall assessment of the team

The SYMUNITY team has had a very good to excellent research output on the diversity of legume-microbe interactions, with a very good level of funding. Outreach and partnership remained limited. The team will be discontinued end 2025 with the retirement of the team leader. With one exception, the team members elected new teams in the institute to develop new projects.

Strengths and possibilities linked to the context

The team staff and focus had changed significantly at the beginning of the previous mandate. Relative to the size of the team, the research assistant support and the number of students/non-permanent support is good. The team remained active and productive mostly on the legume-microbe part of its project. This resulted in 27 publications (1.7/FTE researcher/year) with 15 as leader team over the period, including articles in excellent plant biology journals (The New Phytologist, Plant Physiology).

Highlights from the past period were the discovery of roles for NOOT-like regulators of nodule development in plant aerial development, the control of soil microbe lifestyles (symbiosis-endophytism-pathogenicity) by plants and the diversity of plant-beneficial microbe interactions. The interplay between symbiosis and immunity is a competitive field but the expertise of the team, its strength in microbiology and the tight collaborations they developed resulted in very original contributions.

The team has a strong investment in teaching and training, all previous PhD students published with the team (most as first authors).

Funding was very good, ensured mostly by small grants but in relatively high number (16 in total for 1192 k€), supporting a significant number of non-permanent staff (16 plus trainees) over the period.

The tight collaborative network, including with some former team members, allows the team diversifying the portfolio of expertise and projects of the team.

Weaknesses and risks linked to the context

Several important funding sources were acquired recently to work on cereals by a researcher who left the team. Consequently, less efforts were put on research on cereals, yet a few advances were achieved. The team covers a relatively broad range of questions and models despite a relatively limited staff to supervise projects (incl. two with significant teaching duties). During the visit of the committee, the projects of all but one team member were presented that will result in the strengthening of other teams of the institute. The proposed projects were very relevant to the staff expertise and the needs of the institute.

The team has an excellent reputation nationally but had limited interactions at the international level during the past period.

Analysis of the team's trajectory

With the retirement of the group leader at the end of 2025, the team will not be renewed, and the research topic will be discontinued. The team therefore has only one year left to complete ongoing projects. A priority list of the projects to complete and assigned staff has been presented during the visit of the committee. Four out of five remaining personnel elected new teams and new projects at the institute. Several interesting research lines have been initiated and the strong positioning of the team on the symbiosis-defense interplay and diversity of plant-microbe interactions should allow to keep good momentum until the remaining staff move to new projects.

RECOMMENDATIONS TO THE TEAM

With the team end approaching very fast, the committee strongly suggests establishing a priority list of projects to complete before end 2025 and focus efforts on the most promising and immediate deliverables. The committee also recommends preparing a transition plan to ensure that all staff finds a new team matching with their personal and scientific ambition. Such plans were presented during the committee's visit and appeared very relevant.

CONDUCT OF THE INTERVIEWS

Dates

Start: January 13, 2025 at 9:00 am

End: January 14, 2025 at 5:00 pm

Interview conducted on-site

INTERVIEW SCHEDULE

January 12, 2025

19h30 Closed meeting and dinner (Committee + Hcéres Scientific Advisor)

January 13, 2025

08h45 Welcome of the committee

09h00 - 12h50 Open sessions

09h00 – 09h15 Introduction (Hcéres Scientific Advisor) and Presentation of the committee

9h15-10h35 The IPS2 unit: presentation and self-evaluation (40 min presentation, 40 min questions/discussion)

10h35 Break

10h50-11h20 Team SILEG « Signaling pathways controlling legume root system development » (15 min presentation + 15 min discussion)

11h20-11h50 Team REGARN « Regulatory RNAs in root plasticity » (15 min presentation + 15 min discussion)

11h50-12h20 ChromD Team « Chromosome Dynamics » 15 min presentation + 15 min discussion)

12h20-12h55 Team FloCad « Flower and Carpel Development » (17 min presentation + 18 min discussion)

12h55- 14h00 Lunch

14h00-16h00 Open sessions

14h00-14h30 TeamQ-Lab « Quantitative Genomics and Epigenomics » (15 min presentation + 15 min discussion)

14h30-15h00 Team CCARS « Climate Change & Redox Signalling » (15 min presentation + 15 min discussion)

15h00-15h30 Team STRESS « Stress signalling » 15 min presentation + 15 min discussion)

15h30-16h05 Team SIREMETAB « Metaboaction » (17 min presentation + 18 min discussion)

16h05-16h30 Break (closed meeting of the committee + Hcéres Scientific advisor)

16h30-18h00 Open sessions

16h30-17h00 Team SYMUNITY "Symbiosis and Immunity" (15 min presentation + 15 min discussion)

17h00-17h30 Team GDYNPATH « Genome Dynamics and Pathogen Resistance » (15 min presentation + 15 min discussion)

17h30-18h05 Team OGE « Organellar Genome Expression » (17 min presentation + 18 min discussion)

18h05-18h35 Team GNet « Genomic Networks » (15 min presentation + 15 min discussion)

18h35-18h45 New team leaders

18h45 -19h00 Closed meeting of the committee + Hcéres Scientific Advisor

20h00 Dinner (committee + Hcéres Scientific advisor)

January 14, 2025

9h00- 13h00 Restricted sessions

9h00-9h40 Discussion of the committee with the scientists (DR, Pr, CR, MCF, IR) in the absence of the unit's direction)

9h40-10h20 Discussion of the committee with the permanent support personnel (T, AI, IE) in French, and in the absence of the unit's direction)

10h20-11h00 Discussion of the committee with the non-permanent staff (Ph.D, post-docs, fixed-term contracts) in the absence of the unit's direction)

11h00-11h15 Break (closed meeting of the committee + Hcéres Scientific advisor)

11h15-11h55 Discussion of the committee with the governing bodies 'in the absence of the unit's direction)

11h55-12h35 Discussion of the committee with the unit's direction

12h35-13h45 Lunch (closed)

14h00-17h00 Closed meeting of the committee

17h00 End of the visit

GENERAL OBSERVATIONS OF THE SUPERVISORS

Université Paris Cité

Le Président

Paris, le 24 février 2025

HCERES
2 rue Albert Einstein
75013 Paris

Objet : Retour de l'Université Paris Cité sur le rapport d'évaluation de l'unité **DER-PUR260024983 – IPS2**

Madame, Monsieur,

L'Université Paris Cité (UPCité) a pris connaissance du rapport d'évaluation de l'Unité de Recherche IPS2 – Institut des sciences des plantes de Paris Saclay.

Ce rapport a été lu avec attention par la vice-doyenne recherche et le doyen de la Faculté des Sciences d'UPCité, par notre vice-présidente recherche et par moi-même.

Je remercie le comité pour la qualité de son évaluation et vous indique ne pas avoir d'observation de portée générale à apporter.

Je vous prie d'agréer, Madame, Monsieur, l'expression de ma considération distinguée.

Édouard Kaminski

Présidence

Référence
Pr/DGDRIVE/2025

Affaire suivie par
Marine MADANI - DGDRIVE

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Sciences
Université Paris Cité

Référence
MC/NE/VD/2025-072

Faculté des Sciences
Université Paris Cité
5 rue Thomas Mann
75013 Paris

Objet : Dossier DER-PUR260024983 - Évaluation HCERES de l'UMR 9213 IPS2 – Retour Tutelle Université Paris Cité

Chères et Chers Collègues,

Nous souhaitons par ce courrier remercier les membres du comité de visite pour le temps qu'ils ont consacré à l'évaluation de l'unité IPS2, ainsi que pour leur écoute et le travail considérable qu'ils ont accompli.

La Faculté des Sciences est fière de compter l'IPS2 parmi ses unités de recherche et rappelle la grande qualité de la recherche menée par tous les membres du laboratoire.

Après lecture du rapport provisoire d'évaluation de l'UMR 9213 IPS2, la Faculté des Sciences n'a pas de remarque de portée générale.

En vous priant, chères et chers collègues, d'accepter nos chaleureuses salutations.

Maximilien CAZAYOUS
Doyen
Faculté des Sciences
Université Paris Cité

Nathalie EISENBAUM
Vice-Doyenne recherche
Faculté des Sciences
Université Paris Cité

**DIRECTION DE LA RECHERCHE,
ET DES RELATIONS INTERNATIONALES**

1ère Vice-présidente de la Recherche
Christelle MONVILLE

2nd Vice-président de la Recherche
Guillaume TIFFON

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Courriel : carole.troussier@univ-evry.fr

Evry, le 25 Février 2025

Rapport d'évaluation HCERES
DER-PUR260024983 - IPS2
Institut des sciences des plantes de Paris Saclay

Madame, Monsieur, Cher.e.s collègues,

Nous avons pris connaissance avec le plus grand intérêt du rapport détaillé du comité d'experts HCERES concernant l'activité du Laboratoire IPS2 (Institut des sciences des plantes de Paris-Saclay) dans le cadre de la campagne d'évaluation 2019-2023 vague E.

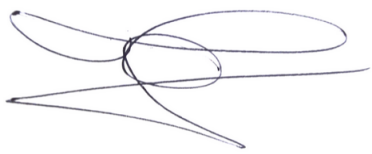
En tant que Vice-présidents Recherche de l'Université d'Évry Val d'Essonne, nous confirmons par la présente ne pas avoir d'observations d'ordre général à formuler à l'égard du rapport d'évaluation DER-PUR260024983 - IPS2 - Institut des sciences des plantes de Paris Saclay.

En vous priant d'agréer, Madame, Monsieur, cher.es collègues, l'assurance de nos salutations les plus distinguées.

1ère Vice-présidente de la Recherche

Christelle MONVILLE

2nd Vice-président de la Recherche



Guillaume TIFFON

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