Evaluation of Research

EVALUATION REPORT ON THE UNIT

LPCV - Laboratoire de Physiologie Cellulaire et Végétale

UNDER THE SUPERVISION OF INSTITUTIONS AND RESEARCH BODIES:

Université Grenoble Alpes - UGA

Commissariat à l'énergie atomique et aux énergies alternatives - CEA

Centre national de la recherche scientifique - CNRS

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

EVALUATION CAMPAIGN 2025-2026
GROUP A

Report published on November, 28 2025

High Council for the evaluation of research and higher education

On behalf of the committee of experts:

Danièle Werck, Chairperson of the committee

For Hcéres:

Coralie Chevallier, President

In accordance with articles R. 114-15 and R. 114-10 of the Research Code, evaluation reports drawn up by the committees of experts are signed by the chairpersons of these committees and countersigned by the president of Hcéres.

To facilitate the reading of the document, the terms used in this report to designate functions, occupations or responsibilities (expert, researcher, teacher researcher, professor, lecturer, engineer, technician, director, doctoral student, etc.) are generic and gender neutral.

This report is the outcome of an evaluation by a committee of experts the composition of which is specified below. The assessments it contains are an expression of the independent and collegial deliberation of the committee. The data within it are the certified accurate data extracted from the application forms submitted by the supervising bodies on behalf of the unit.

This version of the report is public under Decree no. 2021-1537 dated 29 November 2021. Sections of the report considered confidential, and responses to points of attention from supervisors are not included in it.

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UNIT CHARACTERISATION

- Name: Laboratoire de Physiologie Cellulaire et Végétale
- Acronym: LPCV
- Label and number: UMR 5168 CNRS, CEA, Univ. Grenoble Alpes; UMR 1417 INRAE
- Number of teams: 9
- Composition of the executive team: Mr Eric Maréchal (director), Ms Juliette Jouhet (deputy director) and Mr Laurent Blanchoin (deputy director)

SCIENTIFIC PANELS OF THE UNIT

SVE Sciences du vivant et environnement
SVE2 Productions végétales et animales (agronomie), biologie végétale et animale, biotechnologie et ingénierie des biosystèmes

THEMES OF THE UNIT

The Laboratoire de Physiologie Cellulaire Végétale (LPCV) joint research unit (UMR) aims at deciphering the functional organization of the eukaryotic cells, with focus on the plant cells, using an integrative approach spanning multiple scales. To this end, it uses a broad range of model organisms, from non-photosynthetic (yeast, human), to primary (plants, green algae) and secondary (diatoms, haptophytes) photosynthetic endosymbionts. The Unit is structured around three main thematic axes (Photosynthesis and metabolism, Morphogenesis and development and Response and adaptation to a changing abiotic environment (e.g. alpine)) and three technological priorities (Integrative structural biology, Multi-omic computational biology and Multi-scale imaging).

HISTORIC AND GEOGRAPHICAL LOCATION OF THE UNIT

LPCV is affiliated to CNRS (scientific sections 23, 24 and 29), CEA, UGA (Université de Grenoble Alpes) and INRAE (Division Biologie et Amélioration des Plantes, BAP). The CEA Department for Fundamental Research (DRF) is the main supervising body. LPCV was created in 1974 by Roland Douce, initially counting four scientists with focus on plant metabolism and cell compartmentation. Since then, its size and scope considerably expanded under the leadership of five successive directors to reach a staff of 110. They encompass multiple eukaryotic cell models, while building on its initial strengths in biochemistry, structural biology and cell biology.

The LPCV is primarily hosted by the CEA and located on the West Campus of Grenoble (distributed on 4 buildings: C2, C3, 40.20 and 42). Part of its Cytomorpholab team was located at Hôpital Saint-Louis in Paris until 2023 and then moved to the Institute Pierre Gilles de Gennes, still in Paris.

UNIT RESEARCH ENVIRONMENT

Together with the Institut de Biologie Structurale (IBS), LPCV forms the Département de Biologie Intégrée (DBSCI) of the IRIG (Institut de Recherche Interdisciplinaire, encompassing 10 institutes pooled into 5 departments). Intellectual property and industrial partnerships of LPCV are managed mainly by IRIG, that also provides a frame for transversal collaborations between its institutes, including shared cutting-edge equipments.

Located on the West Campus of Grenoble, LPCV has strong ties with other laboratories in the field of Plant Sciences: CERMAV (Centre Recherche sur les Macromolécules Végétales), LECA (Laboratoire d'Ecologie Alpine), and the Jardin du Lautaret (alpine plant research station). These interactions are mediated through IDEX UGA cross-disciplinary research programs (Glyco@Alps, Origin of Life, defiCO2) and joint teaching programs. At the UGA level, the LPCV also benefits from the Institute of Advanced Sciences (IAB) for collaborations in cell biology and of TIMS (Techniques de l'Ingénierie Médicale et de la Complexité) for support in mathematical modelling.

Beyond UGA, LPCV strongly benefits from European large-scale instruments located in Grenoble and providing a unique technological environment, like the ERSF (European Synchrotron Radiation Facility) and the ILL (Institute Laue Langevin), which are, respectively, critical for their studies in structural biology and membrane biophysics.
At the national level, LPCV initiated the two labex GRAL1 and 2 (Grenoble Alliance for Integrated Structural Cell Biology), renewed in 2018 for another 10 years within the frame of the Ecole Universitaire de Recherche CBH (Chemistry, Biology, Health), a graduate school that LPCV also contributed to found. These labex programs provide important funding in addition to PhD and Master fellowships. Since 2023, LPCV is involved in the National Strategy of FRANCE 2030 through three PEPR (Programmes et équipements prioritaires de recherche) coordinated by INRAE: BBEST/Bioproduction, SVA/Sélection variétale and AgroEcoNum/Agroécolgie et Numérique.

LPCV translational activities are supported by the Institut Carnot 3BCAR driven by INRAE (for the Lipid Team), AXELERA (a regional cluster for chemical and environmental sector), proof of concept funds from CEA or INRAE, strategic industrial partnerships with TotalEnergies and Fermentalg (via BPI France), and opening of its technological platforms to private actors.

UNIT WORKFORCE: IN PHYSICAL PEOPLE AS OF 31/12/2024

Catégories de personnel	Effectifs
Professeurs et assimilés	1
Maitres de conférences et assimilés	3
Directeurs de recherche et assimilés	10
Chargés de recherche et assimilés	12
Cadre scientifique CEA	10
Personnels d'appui à la recherche	15
Non cadre scientifique CEA	2
Non cadre administratif CEA	2
Sous-total personnels permanents en activité	**55**
Enseignants-chercheurs et chercheurs non permanents et assimilés	7
Cadre scientifique CEA non permanent	2
Personnels non permanents d'appui à la recherche	11
Non cadre scientifique CEA non permanent	2
Doctorants	32
Sous-total personnels non permanents en activité	**54**
Total personnels	**109**

BREAKDOWN OF THE UNIT'S PERMANENT STAFF BY EMPLOYER: IN PHYSICAL PEOPLE AS OF 31/12/2024. NON-SUPERVISING EMPLOYERS ARE GROUPED ON THE HEADING "OTHERS".

Nom de l'employeur	EC	C	PAR
UGA	4	0	0
CEA	0	10	4
CNRS	0	17	11
INRAE	0	5	4
Total général	**4**	**32**	**19**

GLOBAL ASSESSMENT

The LPCV UMR aims at deciphering the functional organization of the eukaryotic cells, with focus on the plant cells, developing an integrative approach that spans multiple scales. To this end, it uses a broad range of model organisms, from non-photosynthetic (yeast, human) to primary (plants, green algae) and secondary (diatoms, haptophytes) photosynthetic endosymbionts. The Unit is structured around three main thematic axes (Photosynthesis and metabolism, Morphogenesis and development and Response and adaptation to a changing abiotic environment (e.g. alpine)) and three technological priorities (Integrative structural biology, Multi-omic computational biology and Multi-scale imaging).

The scientific objectives, organization and resources of LPCV are excellent. It has original, well defined and structured objectives exploiting the complementarity of the capacities present in the Unit and its local context and fitting well the objectives of its supervising bodies. To be particularly pinpointed, are some topics for which LPCV maintains leadership like cell architecture and reconstituted cytoskeleton, regulation of flower development, lipid metabolism and cold adaptation particularly in snow environments, marine algae organelle-organelle, liquid-liquid phase separation in thermosensing and symbiotic interactions related to bioenergetics. The Unit benefits from strong institutional support (CEA, CNRS, INRAE, University Grenoble Alpes), major competitive grants (5 ERC, 1 ANR 2030 Biology and Health), high-quality platforms, world-class local ecosystem and proactive recruitment, fostering innovation through industrial partnerships. Clear governance and integration ensure excellent functioning. Yet, reliance on external funding (only 15% arise from the institutions), limited technical staff, and administrative strain remain points of concern.

Overall, LPCV's commitment in research and its international visibility are excellent. The unit published high-quality articles, some in broad audience journals (2 in Science in correspondence, 3 in Nature, 1 in Cell), and develops both national and international collaborations. LPCV members have given many invited presentations in conferences and invited seminars. The Unit benefits from institutional and competitive sustained funding, which supports a variety of successful projects and technical platforms. This, combined with the lab's positive reputation, has attracted a steady influx of talented tenured scientists, as well as PhD and post-doctoral candidates. The LPCV complies with the principles of scientific integrity, ethics and open science. That said, there is a disequilibrium between teams who attempt high-risk projects and search for industrial funding and those who don't, that in the current instability for long-term funding would appear to be a weakness for the institute.

Remarkably, the LPCV shows excellent integration of its research into society, with strong links to cultural, scientific, and educational institutions. Its outreach is marked by the outstanding visibility of some teams (Lipid, Flo-re, Cytomorpholab and Photosymbiosis) which are impressively active in media, exhibitions and even in the development of artistic projects. The Unit is also very good in term of academic–industrial partnerships, active technology transfer, attention to societal and environmental priorities with some teams (Photosynthesis, Lipid, Metalstress) having an excellent involvement in these aspects. Nonetheless, the Unit could enhance its outreach and visibility by strengthening its presence on social networks and by establishing a more structured and centralized organization of its outreach activities. In addition, the industrial funding very significant and important for the Unit mostly rely on a single team and single partner which is a fragility and a concern for the future.

The trajectory of LPCV for the next term is excellent and very promising. Building on solid scientific backgrounds, strong visibility, and already secured funding, new original projects are taking shape, expected to maintain excellent scientific output and significant breakthroughs. Due to the move of a large part of the staff to new buildings, some projects might suffer from delay. This should be later compensated by increased operational efficiency. Despite this partial reorganization, it can be noted that a geographic dispersion on the Grenoble campus will (unfortunately) still persist.

DETAILS OF THE EVALUATION OF THE UNIT

A - CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

As previously recommended, all teams maintained the scientific output of the unit with the same enthusiasm and energy.

To improve internal communication, the unit organized “science for dummies” sessions, team retreats, an annual poster day and celebrated the 50th anniversary of the lab.

The suggestion to include a technician in the Scientific Council was not strictly followed since questions related to technical platforms and shared resources are discussed in a dedicated working group. To take this suggestion

into account, questions related to the recruitment of technical staff are discussed during semestral meetings held between the Direction and technical staff.

It was suggested to encourage PhD students and post-docs to attend international meetings and to strengthen their role (and that of technical staff) in the team's life. To comply with this, each team committed to offering the opportunity to students and some technical staff to attend international meetings. Since 2019, non-permanent staff members have met with the direction twice a year to express questions related to their roles. An LPCV Alumni association was created, and a grant of 4 500 euros was allocated for a "bourse Roland Douce" entirely managed by the Alumni association.

The points of attention regarding policies of the different institutions, development of basic research with private funding and support to small teams were properly addressed.

IRIG support staff improved common policies for training, safety and cybersecurity. Yet the different information systems used by the supervising bodies remain a limitation when dealing with recruitments, finances and missions.

The unit considers that private funding in no way limits the development of basic science and is, in consequence, driving forward with challenging questions, providing at the same time additional funds for buying large equipment and building renovation.

To improve the poor condition of the buildings, with the support of the CEA and IRIG DRF, a general administrator was engaged in the renovation of the C3 building for a move scheduled in 2027. Yet funding for the move per se (200 to 250 k€) is still not secured.

Attention has been called to the agreement of all teams on the definition of LPCV strategic axes, particularly with the creation of new teams and the risk of dispersion. The strategic axes have been unifying during the last period, strengthening or opening scientific lines (like new model organisms) and critical fields of expertise like bioinformatics, imaging, FIB-SEM, or Cryo-EM.

The opening of two positions was recommended: a professorship in Plant Physiology and an additional member of the administrative support. UGA support allowed the promotion of an assistant Professor, and a new Assistant Professor position is now open. An administrative position was opened by INRAE in 2023, but the recruitment failed after one year. It remains a priority.

B - EVALUATION AREAS

EVALUATION AREA 1: THE UNIT'S SCIENTIFIC OBJECTIVES, ORGANIZATION AND RESOURCES

Assessment of the unit's scientific objectives, organization and resources

The Unit has original, well-defined objectives exploiting its internal synergistic capacities and the local context. The organization and resources are excellent. It benefits from strong institutional support, major competitive grants (5 ERC, 1 ANR 2030 Biology and Health), high-quality platforms, unique local world-class ecosystem and proactive recruitment, fostering innovation through industrial partnerships. Clear governance and integration ensure excellent functioning. Yet, reliance on external funding, limited technical staff, and administrative strain remain points of concern.

1/ The unit has set itself relevant scientific objectives and is organized accordingly.

2/ The unit has resources adapted to its scientific objectives, profile of activities and research environment and mobilizes them.

3/ The unit has premises, equipment and technical skills adapted to its scientific policy and research objects.

4/ The unit's practices comply with the rules and guidelines set by its supervisory bodies in terms of human resources management, safety, environment and data protection as well as scientific assets.

Context-related strengths and opportunities for the four references above

The scientific objectives of LPCV are original, ambitious, and mobilize well its internal complementary expertise and the local world-class ecosystem. Three thematic axes and 3 technological challenges (mentioned above) provide adequate inter-team structuration and a synergistic and unifying framework. The objectives perfectly match the priorities of its supervising bodies, The full support of these supervising bodies is well demonstrated by the award of CNRS Bronze and Silver medals, recruitments, support for improving LPCV facilities and equipment, numerous project fundings.

The LPCV has the technical capacity to approach biological problems at all scales from the molecule to the whole organisms. It benefits from robust technical expertise and adaptable organization. In addition to shared services, LPCV runs six technical facilities (plant cell cultivation, µalgal cultivation, microalgal molecular engineering, ionomics, plant tissue and organ imaging, eukaryotic protein production systems) and two technological platforms (µLife imaging platform and LIPANG lipidomic platform with IBiSA label since 2024). During the evaluated term, LPCV reinforced its platform dedicated to growth and manipulation of a range of Eukaryotic cells, from microalgae to angiosperms, to address all relevant questions (e.g. evolution, endosymbiosis) at all scales from molecule to whole organism. In this regard, one major strength is LPCV's ability to investigate most subcellular compartments.

LPCV benefits from world-class facilities located in Grenoble such as the European Synchrotron Facility, which strengthens its capacity in advanced structural analysis. Among many other shared facilities, IBS provides FIB-SEM (Focused Ion Beam Scanning Electron Microscopy) and NMR (Nuclear Magnetic Resonance) complementing the microLife platform. The localization of the CYTOMORPHOLAB team in the Institut Pierre Gilles de Gennes in Paris, enables complementary studies with stem cell models in close connection with clinical facilities. CEA's involvement in the relocation of part of LPCV to a new building will significantly improve the working environment. The design of this new facility has been supervised by the incoming director, ensuring alignment with the Unit's scientific needs.

Although CEA ceased its contribution to the unit's operating expenses in 2020, support by CNRS, INRAE and UGA allowed LPCV to increase its recurrent funding, which is now stable and to maintain its recruitment capacity. Over the reporting period, the LPCV's average annual operational budget, excluding salaries, was approximately 3 M€, of which 15% was recurrent. Most of the Unit's resources thus relied on competitive funding. Notably, the Unit has secured five prestigious ERC grants: Matador (2027-2019) Proof of Concept grant, ICEBERG (2018-2023) and SymbiOCEAN (2023-2028) Consolidator grants, and AAA (2017-2022) and ChloroMito (2020-2025) Advanced grants. In addition, all teams have obtained ANR contracts (32 in total, 20 coordinated), for a total of about 700 K€/year for the unit, demonstrating the feasibility and quality of projects across all teams. To be mentioned also a very significant contribution from the Gordon & Moore foundation (713 k€) and two HPSP projects in coordination. In addition, the unit benefits from strong and long-lasting ties with private partners resulting in a support of about 5 M€ during the period.

The number of LPCV personnel remained stable compared to the previous period: 32 permanent researchers, engineer-researchers and teaching-researchers and 19 permanent support staff. To face the current decline in stable recruitment opportunities, LPCV has implemented a proactive policy. This initiative was supported by all governing bodies and met success. Since 2019, LPCV has attracted (i) 5 young permanent researchers and two senior scientists and (ii) 8 PAR have been recruited or appointed to LPCV. Most notably, the CNRS support enabled the recruitment of two ATIP-Avenir teams, thereby strengthening the Unit's staff and showing the attractiveness of LPCV.

Regarding management, LPCV has been successfully reorganized over the past five years to support its research objectives and provide a dynamic, stable and attractive environment. This reorganization is highlighted for example, by the creation of the University of Grenoble Alpes IDEX (IDEX UGA). The unit has implemented several initiatives to enhance the quality of experimental design, optimize operations, and improve data storage and analysis. Technical platforms have established defined procedures made available through shared files. Compliance with the Nagoya Protocol for culture collections and awareness of scientific integrity (OFIS) are prioritized. Additionally, LPCV promotes open science, although cost considerations are taken into account. All documents are made available on HAL (Hyper Articles en Ligne), ensuring wide accessibility and adherence to open science principles.

In addition, the Unit's practices fully comply with the rules and guidelines set by the supervisory bodies in terms of human resources management, safety, environment and data protection as well as scientific assets. A Sustainable Research Working Group was created, and initial actions (reduced travel, recycling) reflect growing integration of environmental concerns into operations and project design. LPCV benefits from a clear multi-institutional human resources framework. It successfully aligns procedures (e.g. career progression) across CNRS, INRAE, UGA and CEA despite differing statuses (EPST/EPIC). Career progression is successful across categories and promotion rates are often 10 to 33%, above national averages. An external Scientific Advisory Board (SAB) reviews the Unit's organization and provides recommendations every 5–6 years.

Context-related weaknesses and risks for the four references above

LPCV covers a wide range of research topics: yeast and human stem cells, plants, green algae, diatoms, haptophytes. Organising effective interactions between different topics may be difficult to coordinate and create added value.

Some LPCV research activities rely heavily on interactions with LCBM (Chemistry and Biology of Metals Laboratory) and SyMMES (Molecular Systems and Nanometals for Energy and Health Laboratory) which might become a fragility in the future.

The Unit's consolidated budget has experienced an overall decrease, primarily attributable to a reduction in funding from competitive grants, research contracts, and external partnerships. In contrast, core institutional funding has remained relatively stable, with a slight decrease in the CNRS support, offset by increased contributions from INRAE and UGA. The recent demand by CEA for LPCV to contribute to IT management, utilities, and waste disposal costs without a corresponding increase in basic institutional funding compromises the sustainability of the unit's budget.

In addition, the strong reliance on external funding sources introduces significant year-to-year variability and is a challenge for long-term financial planning (up to three years). Some contracts, particularly those granted by the ERC, come with specific restrictions that prevent the pooling of funds. The ability of LPCV teams to consistently secure significant funding through competitive calls remains a major factor in the laboratory's attractiveness and success, but the continuation of this funding cannot be foreseen. Given the anticipated decline in the funding of national programmatic research in the coming years, this dependency is an important issue for the Unit's sustainability and strategic development.

LPCV's activities were so far distributed across four buildings. New laboratory facilities will soon be available (2027), which will reduce this dispersion, but this new organization will still leave 3 teams (Cytomorpholab, Photosynthesis and Photosymbiosis) and the microLife platform at a significant distance on the campus and out of the renewed C3 building. The planned move from C2 to C3 building will transiently slow down the research activities of teams currently based in C2. More importantly, some funds are still missing for transfer into new buildings.

Maintaining high-technology platforms in biological imaging and lipidomics presents several challenges. A key weakness lies in the difficulty of retaining highly trained personnel essential for maintaining advanced protocols and providing technical support to users. Equipment maintenance and technical operations rely on a limited pool of permanent technicians and engineers whose time is shared across 9 research teams, the platforms and common services. The technician-to-researcher ratio currently ranges from 0.06 (0.13 projected in 2025) to 1 depending on the team, which is clearly insufficient and too heterogeneous. In French academic laboratories, a ratio around 0.5 PAR per researcher is generally considered a solid baseline to sustain productivity.

In a context of reduced governmental support for permanent technical staff recruitment, LPCV increasingly relies on ANR project funding (also expected to decrease) to hire technicians and engineers on fixed-term contracts, while recruiting fewer postdoctoral researchers on de-risked projects. While pragmatic in the short term, this approach may hinder long-term innovation and raises concerns about how the unit will continue to foster curiosity-driven research alongside targeted project-based activities.

The sustainability of the platforms is also threatened by the high costs of equipment upkeep and upgrades, especially in a context where core funding from institutes is declining. These factors risk undermining the long-term performance, accessibility, and innovation potential of the platforms.

Another significant concern is the stability in the number of permanent researchers, where recruits merely balance retirements, leading to no net growth in this critical area. A drop in positions for lecturers, which could impact the laboratory's ability to continue its strong links with UGA. The upcoming opening of a new lecturer position in 2025 is a positive step, but the current reduction poses a risk to the laboratory's educational and research capabilities.

The LPCV staff is involved in many management activities and scientific initiatives, which is excellent but time-consuming.

Another area of concern is data management (DM) and IT. DM and IT processes still face challenges with storage capacity, interoperability, and long-term data security. Moreover, growing data volumes and reliance on external software create vulnerabilities in DM and sustainability.

The committee did not find any specific mention regarding inclusion of persons with disabilities.

EVALUATION AREA 2: THE UNIT'S SCIENTIFIC RESULTS, IMPACT AND ATTRACTIVENESS

Assessment of the unit's scientific results, impact and attractiveness

Overall, LPCV's commitment in research and its international visibility are excellent. The unit published high-quality articles. LPCV members have given many invited presentations in conferences. Sustained funding supports many successful projects and technical platforms. This, combined with the lab's positive reputation, attracted a steady influx of talented students and tenured scientists. That said, the disequilibrium between teams who attempt high-risk projects and search for industrial funding and those who do not could be a weakness given the current instability for long-term funding.

1/ The unit is recognized for its scientific achievements that meet quality criteria.

2/ The research activities of the unit result in quality scientific production.

3/ The unit participates in the coordination and management of its community.

4/ The unit's scientific production respects the principles of scientific integrity, ethics and open science. It complies with the guidelines applicable in this field.

Context-related strengths and opportunities for the four references above

LPCV has established a commendable scientific reputation and has made notable contributions to European research in the fields of cytoskeleton, flower development, lipid metabolism and photosynthesis.

LPCV has an excellent publication record, with 345 articles (1.7 articles/FTE/year) from 2019 to 2024, including 290 research articles, 28 reviews, 25 book chapters, and 2 scientific book editions. This record includes articles in prestigious journals such as 3 in Nature, 2 in Science, 1 in Cell. Notably, 37% of these articles were published in the best journals of their field. 151 of these articles (33%) were led by LPCV researchers. Additionally, 43 publications resulted from collaborations between LPCV teams. Three patents were filed during the term (among them, one with two teams and SNCF).

From 2019 to 2024, LPCV scientists received over 110 invitations to give seminars and oral presentations, including 97 conference invitations. Additionally, LPCV PhD students have given 80 oral presentations, showcasing the active involvement of young researchers. The Unit has attracted 66 PhD students, reflecting its appeal. LPCV researchers were awarded three international distinctions (two elected EMBO members and one elected EMBO young investigator member), four national prizes (notably two CNRS silver medals), and twelve junior prizes at conferences. LPCV teams participated in organizing committees of seventeen conferences over the past six years (three as main organizers). They have served on various committees and advisory boards for CoNRS, CNRS, INRAE, and UGA, and have acted as reviewers and editors for major scientific journals (Mol Plant, Mol Biol Cell, J Biol Chem).
LPCV demonstrates a strong and attractive staff hosting policy, marked by the successful recruitment of high-caliber researchers and support staff. Since 2019, LPCV attracted five young permanent researchers through highly competitive selection processes. Additionally, two senior scientists joined the unit in 2022 and 2024, respectively. Thanks to a long-term partnership, LPCV hosted two engineers of TotalEnergies until 2022. In the past six years, LPCV has recruited or appointed eight technicians and engineers, and hosted fifteen invited and guest researchers.

Noteworthy, LPCV participates in local and national scientific structures (e.g. of the Groupement de Recherche (GDR) « Plant Epigenetic Mechanisms » and of the labex GRAL, an 'Excellence initiative' PIA structure). As a result, more than half of the teams received funding for projects at the interface between structural and cellular biology. Unit members are strongly involved in the management of their supervising bodies (e.g. direction of the INRAE BAP department, CoNRS) and structuration of their main actions (three INRAE-coordinated PEPR).

The LPCV has established itself as an attractive research unit through its success in competitive calls for projects. Nationally, LPCV teams are awarded between 650 and 750 k€ annually through the ANR program and associated France 2030 PEPR projects. Remarkably, all LPCV teams have succeeded in obtaining ANR contracts. LPCV also secured international grants of high prestige and competitiveness (see above). Early career scientists also obtained competitive grants, such as the CNRS ATIP Avenir, CNRS Momentum, HFSP, and ERC Starting Grants. This success among younger researchers demonstrates the overall attractiveness of the unit for emerging scientific talents. Overall, LPCV teams are awarded approximately 2.5 to 3 million€ annually, attesting their relentless efforts in applying for national and international calls and developing industrial partnerships.

LPCV maintains strong ties with the Institute of Structural Biology (IBS). Together, they form the Department of Structural, Cellular, and Integrated Biology (DBSCI). The transverse axes of "Integrative Structural Biology" and "Multi-omic Computational Biology" are coordinated between LPCV and IBS. LPCV focuses more on genomics, large-scale gene expression, transcription, and epigenetics, while IBS emphasizes structural biology, computational science, and engineering. This complementary focus allows for a robust and interdisciplinary approach to research. A significant contributor to LPCV's appeal is the µLife platform, which offers advanced imaging technologies such as Live patterning (dynamics of cell processes), Traction Force Microscopy, Cryo-electron Microscopy (Cryo-EM), Focused Ion Beam Scanning Electron Microscopy (FIB-SEM), and 3D subcellular imaging. The impact of this platform is evident, with 15 articles published by LPCV through its use. Additionally, the Lipidomics "Lipang platform" supports many projects related to the characterization of algal and plant lipids. Over the past 6 years, it received an average of 20 projects per year, with 90% being academic and 10% from industry. Of these projects, 50% are from LPCV, 5% from GRAL (excluding LPCV), 20% at the national level, and 25% at the international level. This diverse project portfolio highlights the platform's broad appeal and utility. The Lipang platform has co-signed 33 publications, demonstrating its significant contribution to research outputs. The platform trains approximately per year 2 master's students, three PhD students, and two contract researchers. This commitment to training further enhances the attractiveness of LPCV, as it provides valuable hands-on experience with cutting-edge technologies.

LPCV members comply with the principles of scientific integrity, ethics and open science. For instance, electronic laboratory notebooks were massively adopted by the members of the Unit; technical platforms comply with procedures of data storage and genetic resources comply with the Nagoya protocols, HAL is used routinely. A seminar was held in 2020 to raise awareness of scientific integrity. The Unit supports publications in open access journals whenever possible, despite the cost.

Context-related weaknesses and risks for the four references above

The stability of the budgetary resources in the coming years remains a very important point of vigilance (3 to 5 years of visibility). 85% of the resources arise from grants, contracts and partnerships, while only 15% arise from the institutions.

While the number of permanent positions has remained stable (due to new positions - mobility and retirements), there has been a marked decrease in positions for lecturers.

LPCV teams are implicated in the organization of national and international conferences, but only a few of them are held in Grenoble and led by LPCV researchers.

EVALUATION AREA 3: INCLUSION OF RESEARCH ACTIVITIES IN SOCIETY

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

LPCV shows excellent integration of its research into society. Its outreach is marked by the outstanding visibility of teams Lipid, Flo-re, Cytomorpholab and Photosymbiosis. The Unit is also very good in term of academic–industrial partnerships, active technology transfer, attention to societal and environmental priorities with teams Photosynthesis, Lipid, and Metalstress having an excellent involvement in these aspects. Yet, the presence of the Unit in social networks may be strengthened and outreach activities could be more structured.

1/ The unit stands out for the quality of its interactions with the cultural, and socioeconomic world.

2/ The unit develops products and services for the cultural, socioeconomic world.

3/ The unit shares its knowledge with the general public and participates in social debates.

Context-related strengths and opportunities for the three references above

The unit has established solid partnerships with cultural, scientific, and educational institutions (e.g., CEA-Maison Minatec, Casemate CCSTI Grenoble, Muséum de Grenoble and Echosciences as local network of café des sciences). It is highly engaged in science communication through TV documentaries (e.g. for France 3 and France 5), radio programs (e.g. for Europe 1 and France Inter), press articles (e.g. for the New York Times and Pour la Science), conferences, exhibitions and artistic collaborations or the development of a virtual reality application "PlanktonQuest", freely downloadable. This wide range of formats reaches varied audiences and enhances the unit's societal presence.

LPCV has developed strong academic–industrial collaborations. Since 2019, 5018 k€ has been obtained to support the translation of knowledge into applications, including BPI TRANS'ALG (1881 k€, 2023-2026), TOTAL 2 and 3 and TOTAL OPTIMALG (overall budget of 2703 k€, 2023-2028) and St Gobain CYANOGYPSE (102k€, 224-2028). The unit is involved in Institut Carnot 3BCAR (Bioenergy, Biomolecules, Biomaterials) and has links with the AXELERA competitiveness cluster. It leverages grants, project labeling, and support platforms such as LIPANG to develop and transfer technologies. Long-term strategic partnerships with SME such as Fermentalg and major industrial players like TotalEnergies further enhance opportunities for sustainable growth and impact. Total private funding to the unit amounts to more than 5 M€, which represents approximately 20% of the total unit's income over the examined period.

Technology transfer and research valorization are highly developed and actively pursued. The unit has developed products and services with industry (e.g., TotalEnergies, Fermentalg, Arkema, Saint-Gobain), LPCV also secured intellectual property (three patents were filed between 2019 and 2024 and LPCV has an IP portfolio of more than twenty active patents) and through the projects of the CytoMorpholab team was involved in the emergence of the CYTOO spinoff.

The nomination of some PIs as representatives for sustainability, gender equality, and regulatory issues ensures that research strategies align with societal expectations. Flagship projects (e.g., AlgAdvance) explicitly address these concerns, creating opportunities to position the unit as a responsible actor.

LPCV translates actively its scientific production into various pedagogical materials including notably one scientific book for students and researchers, two books for a large public including "Les Clés du Champs", eight articles cited in Wikipedia pages, one subject for the French Baccalauréat, three review articles dedicated to university students in Trends series, eight to ten interventions per year in school, from preschool to high school level, and one TV documentary. LPCV also participates in public debates on topics such as plant domestication, including the putative use of genome editing. This strengthens its reputation as a trusted scientific voice.

Context-related weaknesses and risks for the three references above

The strong involvement of LPCV in outreach activities can place a significant burden on researchers, potentially impacting their core scientific activities. Furthermore, the contribution to societal debates currently relies largely on individual initiatives rather than a coordinated, unit-wide strategy, which may lead to missed opportunities for broader impact and visibility. In this respect, it can be noted that the outreach activities of LPCV will be reduced by the recent retirement of its most active members in NGO-related societal debate.

Although the Unit is engaged with traditional media (radio and television), its visibility on social media platforms is limited or absent. In the long term, this could negatively impact its attractiveness to younger generations and reduce its capacity to engage effectively with a wider public audience.

Academic-industrial funding is very significant and important for the unit, but relies on very few (mainly a single) teams and essentially on a single private partner.

ANALYSIS OF THE UNIT'S TRAJECTORY

Overall, the trajectory of LPCV is excellent.

During the evaluated period, the Unit's Knowledge of eukaryotic cell organization and its multidisciplinary approaches have allowed LPCV to address complex biological questions and to reach its objectives. The unit has continued to build and/or consolidate local, national, collaborations, networks, facilities (including unique platforms like lipidomics and imaging) and projects. This ensured successful scientific outcomes, as well as the recruitment of excellent permanent and non-permanent staff. Strong and long-lasting industrial partnerships were consolidated. It translated into an excellent to outstanding scientific output, good recruitments and excellent support from all supervising bodies and funding agencies. Some delays resulted from the departure of a young group leader for Sweden and from the failed recruitment of a badly needed administrative staff member. Yet another new young group (PHOTOSYMBIOSIS) leader was successfully installed, adding complementary expertise and topics to the unit. A CEA Lab Manager was recruited to consolidate the CYTOMORPHOLAB group and coordinate the two team sites (Paris and Grenoble).

Thanks to an exceptional scientific ecosystem and the complementarity of its teams and tools, LPCV is currently an international leader in its field. Some of its industrial collaboration reaches beyond the Unit itself and these were extended to the whole INRAE. Although the academic staff of the Unit is small in size, it successfully implemented an international Master's Program with the University of Milan. Largely due to two groups and one of its members, the LPCV is one of the most visible plant Units in the media and broad audience platforms.

For the next period, the LPCV will be managed by a new director (a woman) and one deputy-director (instead of three), but is planning to give increased responsibility to the group leaders, which sounds positive.

It will keep the same scientific priorities, focusing on the functional organisation of the Eukaryotic cells, mainly photosynthetic cells, across multiple scales, from molecules to organisms. These priorities align very well with those of its supervising bodies and with national priorities. The Unit's projects will be supported by a labex (GARL2), 3 PEPR (B-BEST, AgroEconum and Sélection Végétale Avancée) and an excellence Chair 2030 (Biology and Health Sensation). Its main Scientific axes will be four, with the three prior ones continuing (Photosynthesis and Metabolism, Morphogenesis and Development and Response and Adaptation to a Changing environment) and a new one emerging and defined as Evolution of Biological Processes. This will allow the LPCV to integrate new questions resulting from the study of an extended set of models representative of the tree of life.

On the technological side, the Unit faces three main challenges. The first (Integrative Structural Biology) is unchanged but addresses novel questions like phase and cell organization, and cell architecture. The second (Data-driven Discovery: Learning from Omics and Imaging) merges two prior ones at the analytic and bioinformatic levels to address the biological objectives with the support of two recent recruitments and new priorities on 3D imaging and AI-based analysis. The third technological challenge (Emerging Model Organisms) is meant to feed the new scientific axis 4.

The Chlorogenesis team will close due to the retirement of its leader, and other teams will have new team-leaders. These changes well reflect the recent evolution and new capacities within LPCV as well as the new trends in the scientific community at large. The Unit is still ready to further adapt to the most recent developments to stay ahead of the race for the next five years. To this end, LPCV will implement a dedicated seminar series on new avenues in science and promote better access for young scientists to the most prestigious international conferences. Key expertise, such as biochemistry or cell morphogenesis, will be prioritized and consolidated when required. Already planned outreach actions are expected to maintain high visibility by the public, whether through schools, media, museums or broader cultural world. The still modest in size (not in dynamism) teaching staff will continue to increase thanks to the recruitment of an assistant professor in 2025. The LPCV takes appropriate measures to keep producing FAIR science and to store and manage its steadily increasing flow of data.

The long-planned move of some dispersed teams and platform (Plant facilities), so far working in shabby buildings, to renovated facilities should be effective in 2027. The other lab spaces will also be renovated by the CEA. This comes after the gathering of the LIPANG platform into a renovated space in 2024. Such essential structural improvements will significantly improve overall working conditions in the Unit. Appropriate measures were also taken to reduce its environmental impact.

Yet, on the downside, the expenses required to support the lab move and purchase of office furniture are currently charged to the Unit, which cannot cover such expenses (the direction of the LPCV is actively seeking support). In addition, there are still some serious concerns regarding the retirement of permanent staff (4 researchers (including a very visible team leader) and one member of support personnel. The current or foreseen lack of support staff (e.g. in the LIPIDS team) is worrisome. There is also a concern related to the funding required to hire excellent post-docs that could constitute a fishpond for the recruitment of new permanent staff and

future team leaders, and the lack of visibility on the recurrent and contractual funding of the Unit's functioning and research. Yet, the solution to such problems depends more on the supervising and funding bodies (not to say National and European governance) than on the unit. The LPCV was, so far, been well supported, but the current context is preoccupying for the future.

TEAM'S TRAJECTORIES

PHOTOSYNTHESIS
The team Photosynthesis project is very good to excellent and continues to be based on the use of molecular and cellular biology approaches to understand the response of model and non-model phototrophs to a changing environment. This realistic project aligns very well with LPCV priorities. It capitalizes on the strengths of the team members. including impressive skills in cutting-edge techniques, mostly different forms of microscopy: FIB-SEM, confocal single cell and expansion microscopy. These techniques will make it attractive for national and international collaborations. Yet solid funding remains to be acquired to support the projects.

LIPID
The team plans to pursue its excellent work on lipid homeostasis, transport and adaptation to environmental changes (in particular polar and high elevation temperature) in photosynthetic organisms. The same priorities will be maintained to address evolutionary and physiological questions at different scales. In addition to the models already investigated, new models will be introduced, in particular a member of the charophytes (Closterium) to better address evolutionary questions. Further efforts will be invested in technological development for lipid imaging at the tissue and cell level, and single-cell monitoring of gene expression. The team will also seek to develop new approaches to induce non-GMO genetic variability in algae. Projects are solid, relevant, set on strong bases and well-framed. Competitive funding has been secured until 2028. The team is currently discussing novel industrial partnerships.

METALSTRESS
The very good trajectory of the team's future, which is structured around three main axes, i.e. to continue the investigation of uranium toxicity in plants, building on a PhD work to advance studies on nickel homeostasis and toxicity, and to develop a new line of research on metal tolerance in metal-tolerant microalgae. These axes are well aligned with the team's expertise and position it effectively addresses key scientific challenges. They are also appropriately calibrated with respect to the team's size and available manpower. National and international collaborations are relevant and strategic, and funding has been secured (HOMONIME and FunhyCoela projects funded at the ANR AAPG2025 call) for the majority of the planned objectives.

CHROMDEV
The excellent research trajectory of the team capitalizes on recent advances and is organized around two complementary axes: 1) elucidating the role of PEP-PAP complexes in nucleus-chloroplast coordination during photomorphogenesis, and 2) deciphering chromatin-mediated switches controlling organogenesis. These projects are supported by ANR funding through a dedicated PhD fellowship. This focused approach is designed to uncover novel, robust yet flexible regulatory pathways governing developmental transitions. The project scope is tailored to the team size, expertise, and workload, while ANR grants and strategic collaborations ensure both scientific excellence and feasibility. This will certainly position the team as an expert in identifying innovative mechanisms underpinning plant developmental plasticity.

STRUCDEV
The team has developed well-considered and realistic plans for its future research, considering its current size and recent achievements. The trajectory is therefore assessed as excellent. The strategy is structured around two main axes: (i) investigating the interplay between transcription factor oligomerization and the phenomenon of liquid–liquid phase separation (LLPS), and (ii) advancing the structure–function analysis of MADS transcription factors from an evolutionary developmental (evo-devo) perspective. The team will continue to integrate molecular to whole-plant approaches, which remains one of its core strengths. The planned integration of AI tools, particularly for structural prediction, holds promising potential. The three current ANR projects run to 2026, and very significant additional funding (about 1.1 M€) was acquired in 2025, which guarantees an excellent start for these projects.

FLO_RE
FLO_RE benefits from a strong and still increasing permanent staff (a new half-time engineer) and an extremely solid scientific background to keep successfully developing its research with a still strong focus on the regulators of flower development and their evolution in the green lineage. This provides ample possibilities of new exciting developments given the possibility to exploit tools that recently became available. Prioritizing Marchantia as a model for flower-devoid plants was an excellent starting choice, but indeed, it would still be interesting to add (in coordination with the LIPID team) a charophyte model to the toolbox. Significant funding (INRAE, ANR) has already been obtained to support the next steps of the project. In addition, a competitive candidate has been identified for recruitment as a new permanent researcher and ERC starting grant application. The FLO-RE

trajectory is thus excellent, and an outstanding scientific output can still be expected from the team for the next term.

CYTOMORPHOLAB
Cytomorpholab is expected to keep on an outstanding track. The team's projects focus on reconstituting a dynamic cytoskeleton capable of sensing, polarizing, and moving—key cellular properties. Using actin and microtubule networks, they aim to create the first artificial cell that can polarize (supported by ANR 2030 Sensation). Indeed, building an artificial cell has become a major international challenge, aiming to recreate life-like functions from minimal components. The recent results obtained put the team in an excellent position to face and win this challenge. The team benefited from plentiful funding during the evaluated term, but with only one ANR project ongoing until 2026 and probably some remaining ERC funds, new support is needed to make this ambitious project realistic. There is little doubt that the team will be able to find it.

PHOTOSYMBIOSIS
Team Photosymbiosis is on an excellent to outstanding trajectory. Their next challenge is to move from an explorative and descriptive level to a more mechanistic understanding of photosymbioses. They plan to develop more imaging and molecular tools and approaches. Based on the ongoing scientific collaborations and grants (recent success in the Human Frontier Science program call, 2026-2029) this looks very promising. But based on the small size of the team (2 permanent members) they will have to recruit at least one researcher or research engineer in order to fulfil these plans.

CHLOROGENESIS
One of two permanent researchers recently retired (April 2024), and the last (and team leader) will retire ~1 year after the end of the present contract. Accordingly, the Chlorogenesis team activities will be completed in December 2026. At this point, the two remaining team members are in discussions to join another team of the LPCV for the beginning of the next Hcéres contract (Jan. 2027). The team's two PhD students will submit their theses before the end of 2025. Hence, the team's trajectory is well organised. The research endeavours of the team will be consolidated by articles and other outputs. The trajectory of the team to its closure is thus very well set.

RECOMMENDATIONS TO THE UNIT

RECOMMENDATIONS REGARDING THE EVALUATION AREA 1: SCIENTIFIC OBJECTIVES, ORGANIZATION AND RESOURCES OF THE UNIT

The committee recommends that LPCV diversifies its funding sources to be less reliant on competitive calls. All teams are encouraged to apply for all types of fundings, local, national and international. More teams should seek for private resources that, although very significant, currently rely on only few of them.

Given LPCV's equipment, intensive workflows and its ambition to operate with industry-level efficiency for collaboration with private partners, improving the technician-to-researcher ratio is a critical need. In addition, the administration service needs at least two additional members. Recruiting non-permanent personnel to maintain platform activities is clearly not a long-term solution. Stabilizing the existing support staff is essential to prevent further erosion of expertise.

The Unit is encouraged to maintain a proactive policy of young researcher recruitment. Teaching staff could be further increased.

The C2 to C3 building transition, while beneficial in the long term, represents a key point of vigilance to minimize negative impacts on scientific productivity and staff well-being. After the relocation, with several teams remaining outside the new C3 building, the Unit must further reinforce global cohesion to ensure effective integration.

Measures regarding the inclusion of disabled persons should be planned.

Although a collective reflection on data management was initiated in 2024 at the IRIG level, this process needs to be accelerated. Robust data management practices and reliable server infrastructure are essential for supporting high-quality research.

RECOMMENDATIONS REGARDING THE EVALUATION AREA 2: THE UNIT'S SCIENTIFIC RESULTS, IMPACT AND ATTRACTIVENESS

While LPCV has a good record of interdisciplinarity, cross-team projects between genomics, epigenetics, lipidomics and structural biology, it could be further strengthened to generate more well respected integrative research papers.

To raise the Unit's visibility, LPCV researchers could be encouraged to lead more multi-institutional articles, going beyond co-authorship.

To stand out from larger institutes, we recommend that 1-2 key research areas be identified where LPCV is an undisputed international reference. The unique strengths of LPCV in epigenetics, algal and plant lipidomics, algae biotechnology, and imaging platforms should be highlighted in all communications and funding applications.

Leadership in conference organization would reinforce the visibility of Grenoble as a plant biology hub in Europe.

To attract more junior researchers, LPCV's unique environment could be more widely advertised in strategic areas such as computational biology and synthetic biology. Similarly, co-supervising, Erasmus and other short-term training programs for international PhD and post-doc exchange should be further sought to keep LPCV attractive for young researchers.

Continuing to reinforce the strategic alliances with IBS and within GRAL, projects led by LPCV could capitalize on the strengths of LPCV and the shared infrastructure of the DBSCI (Département de Biologie Structurale et Cellulaire Intégrée of the IRIG).

RECOMMENDATIONS REGARDING EVALUATION AREA 3: INCLUSION OF RESEARCH ACTIVITIES IN SOCIETY

The committee notes the absence of a clearly defined strategy outlining precise actions proving the societal relevance of its research over the next period. A more detailed roadmap would strengthen the Unit's position and clarify its ambitions in this regard. The committee found limited evidence of how the Unit plans to enhance collaborations with the private sector. Concrete actions aimed at maintaining and expanding industrial partnerships should be defined. Industrial partnerships might be expanded beyond energy and green chemistry, for instance going towards agriculture, climate-smart crops and other biotechnology applications. Material targeted at policymakers could also be designed to increase LPCV impact.

Increasing the Unit's visibility on social networks could be effective in reaching broader audiences, amplify its scientific outreach and attract young generations into science.

A clear communication strategy, capitalizing on the excellent work already done in the domains of open science and ethical research (e-lab books, HAL, Nagoya, seminars, etc.) could be developed to increase this element of LPCV's attractivity.

Increased participation of young permanent and non-permanent staff in outreach efforts could be encouraged. Without limiting individual initiatives, the creation of a dedicated and structured group responsible for coordinating the Unit's outreach and science communication activities could enhance coherence and long-term impact in this area.

TEAM-BY-TEAM ANALYSIS

Team 1: Photosynthesis (Light-Photosynthesis & Metabolism)

Name of the supervisors: Mr Gilles Curien and Mr Giovanni Finazzi

THEMES OF THE TEAM

The team studies energy conversion in photosynthetic organisms and the adaptation of energy metabolism to environmental fluctuations, from molecular to cellular levels. Key topics include light harvesting, photoprotection, and the dynamics of protein networks in chloroplasts and mitochondria. Using oceanic algae and crop plants, the team integrates physiology, structural biology, and metabolism to explore organelle adaptation and improve photosynthetic efficiency. They also develop tools in photosynthetic analysis, molecular biology, and proteomics.

CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

The previous recommendations were split into 2 sections.

1. On scientific production and activities. Considering the size of the team, its scientific production is already outstanding and can hardly be improved. Public outreach activities on subjects related to microalgae (diversity, ecological importance, applications) can be intensified.

In the present evaluation, the team was involved in multiple events aimed at outreach to the general public in a fun and informative way; these include "Tribulations Savantes" and the hosting of middle school interns over the past 5 years as well as participation in the Fête de la science and in the LPCV Open Days.

2. On scientific strategy and projects. It is difficult to add, remove or modify anything to this ambitious and interdisciplinary project. One can suggest that it is possible to better exploit the discoveries on the control and plasticity of photosynthesis at the whole cell level by exploring their possible implications for biotechnological improvements in the context of large-scale cultures of microalgae.

The team is in collaboration with Total Energies, including a recent co-financed thesis project with the Lipid team and a joint project, Formix, with CEA Cadarache. The team has been involved in 2 EU projects on increasing biomass through manipulation of Photosynthesis: Gain4Crpos and Plankt-on.

TEAM WORKFORCE: IN PHYSICAL PEOPLE AS OF 31/12/2024

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maitres de conférences et assimilés	1
Directeurs de recherche et assimilés	1
Chargés de recherche et assimilés	2
Cadre scientifique CEA	1
Personnels d'appui à la recherche	1
Non cadre scientifique CEA	1
Cadre administratif CEA	0
Non cadre administratif CEA	0
Sous-total personnels permanents en activité	**7**
Enseignants-chercheurs et chercheurs non permanents et assimilés	1
Cadre scientifique CEA non permanent	1
Personnels non permanents d'appui à la recherche	0
Non cadre scientifique CEA non permanent	0
Cadre administratif CEA non permanent	0

Non cadre administratif CEA non permanent	0
Post-doctorants	0
Doctorants	2
Sous-total personnels non permanents en activité	**4**
Total personnels	**11**

EVALUATION OF THE TEAM

Overall assessment of the team

The team is very good to excellent, with an original and excellent project, and very good scientific output both in quantity and quality. The team has excellent funding. The team is known as a leader in the field of photosynthesis. The future dynamic will depend on the new leadership of the team and their ability to develop a unified vision.

Context-related strengths and opportunities

The team has an original and prominent position in the field of photosynthesis. They describe their approach as "Next Generation Physiology" combining analysis of in vivo phenotyping, metabolomics/modeling and molecular/structural techniques. Each of the researchers is a specialist in a different theoretical/technical domain enhancing this synergy and placing them at the cutting edge. The team's project is relevant locally and within the unit dynamic. The team regularly publishes with other LPCV teams: Lipid (13 co-publications), Photosymbiosis (7 co-publications) and Metal-stress (1 publication).

The scientific production is excellent qualitatively and quantitatively with 36 research articles, 2 reviews and 2 book chapters (1.85 article/FTE/year) and 8 signed by PhD students and 14 with other LPCV teams. The team benefits international visibility in the following areas with 8 first and last author publications: (1) photoprotection and its relation to UV sensing through new molecular targets (Proc Natl Acad Sci USA 2025); (2) regulation of thylakoid and envelope transporters and their effects on photosynthetic fluxes and cellular energetics (New Phytol, 2022). Major discoveries showing how mitochondria and chloroplasts interact physically and bioenergetically in a vast range of marine algae, as well as a host of new marine symbiotic interactions illustrate the team's originality (Nat Commun and Proc Natl Acad Sci 2021). The team has numerous collaborations on the regulation of photosynthetic electron fluxes (9 articles). Novel algal metabolisms were characterized (New Phytol, 2021, Plant Physiol, 2022) and the team contributed new tools in this domain including metabolic models and databases (C R Biol 2021, Quant Plant Biol 2024) and new techniques (Cell Rep Methods 2024).

The team's visibility is very good, shown by 22 oral communications, 9 of which were invited and abroad.

The team benefited from high attractiveness with a new CEA recruitment and doubled its size since the last evaluation, mainly due to many PhD students, post-doctoral and fixed-term contracts (18).

Funding has been excellent with more than 3 M€ (139 k€/FTE/year) obtained through 3 projects supported by ANR (1 as partner, MOMIX and PHOTO-DYN and DIM as partner), 1 CNRS momentum, 3 European contracts including an ERC advanced. The collaborative EU projects (GAIN4Crops, PLANK-TON and Marie Curie Fellowship) have given the team visibility through conception of new tools that will be used by the community or open new collaborations.

Outreach is improving. Team members co-organized 2 international conferences (SFPhi 2025, Paris and Structural Proteomics, Utrecht). The team was involved in multiple events for the public and middle school internships. Some members were involved in national and international reviewing and policy making through Hcéres evaluation and "Chargée de Mission" for UGA. In addition to the MCF, team members teach a total of 150 h/year.

Context-related weaknesses and risks

During the last period, the team was led by senior researchers and was handed over to the junior scientists in 2025. This transition may affect lab function and visibility due to the higher incoming administrative workload.

Operation of platforms and equipment suffer from constant loss of specialized technical expertise in Cryo-Electron Tomography including 3D image analysis. This is also true for spectroscopy expertise and photosynthetic measurements.

ANALYSIS OF THE TEAM'S TRAJECTORY

The team project is still based on the use of molecular and cellular biology approaches to understand the response of model and non-model phototrophs to a changing environment, and the use of an integrative approach spanning multiple scales and techniques. These are all key to LPCV scientific priorities. The project is realistic in that it capitalises on the strengths of each of the active team members. The team has established tools and impressive skills in cutting-edge techniques, mostly different forms of microscopy: FIB-SEM, confocal single cell and expansion microscopy. These techniques will make it attractive for national and international collaborations. Generous funding has been secured before and during the current evaluation period, which extends in terms of overheads beyond 2025. Yet solid steps remain to be taken to acquire really secure funding for the upcoming period.

A new researcher has recently been recruited after completing a Marie Skłodowska-Curie Fellowship in the team. He will add a new dimension through the advanced structural proteomics techniques for which he is a renowned specialist. He will now co-lead the team, providing a new vision for its future. The team plans to capitalise on new investments in expansion microscopy and structural proteomics to concentrate efforts and reduce costs. The trajectory of the team is thus considered to be very good to excellent.

RECOMMENDATIONS TO THE TEAM

With continued energy from the group leaders, the dynamic and interactions of the last six years should be pursued. The team researchers must continue to maintain visibility at the national and international level to form collaborations. A combined portfolio of projects of both low and high risk is recommended to support their publishing dynamic.

Overall, the generous EU funding to this group since its formation has not made application for new grants a pressing necessity for the current term. New funding has now to be secured. Industrial and national funding should be considered as means to support academic and private collaboration within more applied science projects, with still an eye on inclusion in EU calls and consortia.

Technical support and new recruitments will be fundamental for the coming years to keep the original and strong technical know-how of the team and to allow young researchers to still take an active part in the lab and to be creative. Targeted support recruitment should be envisaged. The maintenance and future of the recently acquired confocal microscope also needs to be discussed, as does the upkeep costs of the ChloroKB web application.

The team needs to find a way to develop a unified vision for the lab that can be used to express the unity of the team's research strategy in a convincing manner.

Team 2: Lipid (Biogenesis, Dynamics and Homeostasis of Membrane Lipids)

Name of the supervisors: Ms Juliette Jouhet and Mr Eric Maréchal

THEMES OF THE TEAM

LIPID is dedicated to an in depth study the glycerolipid metabolic components, lipid trafficking and dynamics in plants, diatoms, and eukaryotes harbouring plastids originating from primary or secondary endosymbiosis. The team uses a multidisciplinary approach combining biochemistry, cell biology, and mathematics. Genetic and genomic tools are also used to link molecular to organismal functions. The research conducted is both comprehensive and model driven.

The team is backed by the platform LIPANG dedicated to lipid analysis.

CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

The team was advised to maintain overlap and complementarity between the individual PI projects and to maintain the team dynamism. This is the case for the evaluated term with 5 common publications.

The combination of focused and exploratory projects was well maintained, as well as strong partnership with industry that provides essential funding and visibility. Yet the team still relies on external funding for technical support, and this is an issue that needs to be solved.

TEAM WORKFORCE: IN PHYSICAL PEOPLE AS OF 31/12/2024

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maitres de conférences et assimilés	0
Directeurs de recherche et assimilés	2
Chargés de recherche et assimilés	4
Cadre scientifique CEA	2
Personnels d'appui à la recherche	2
Non cadre scientifique CEA	0
Cadre administratif CEA	0
Non cadre administratif CEA	0
Sous-total personnels permanents en activité	**10**
Enseignants-chercheurs et chercheurs non permanents et assimilés	1
Cadre scientifique CEA non permanent	0
Personnels non permanents d'appui à la recherche	2
Non cadre scientifique CEA non permanent	2
Cadre administratif CEA non permanent	0
Non cadre administratif CEA non permanent	0
Post-doctorants	0
Doctorants	8
Sous-total personnels non permanents en activité	**13**
Total personnels	**23**

EVALUATION OF THE TEAM

Overall assessment of the team

The team is overall excellent to outstanding. Its excellent project is focused and original. Scientific production is qualitatively and quantitatively excellent. Some highly visible articles on snow algae led to an exceptional outreach and coverage by national and international media. This work also inspired cultural projects. National and private fundings are excellent. The team demonstrates an excellent commitment to translational activities as shown by a patent still further exploited and long-term partnerships with industrial actors. International funding could be better exploited.

Context-related strengths and opportunities

The objectives which focus on secondary endosymbiotes and adaptation to cold climates are original and excellent. They position the team at the forefront of their field. This team of researchers combines complementary competencies and benefits from a strong ecosystem within LPCV, through partnerships on the Grenoble site and from national and international collaborations.

During the evaluated period, the team published 66 primary articles, 15 reviews, 11 book chapters and 3 books (2.4 publications/FTE/year). For 55% of the primary articles, team members were in a leading position. About 16% were co-signed by a PhD student, 15% by other LPCV teams. Articles in correspondence were published in excellent and sometimes outstanding international journals: e.g. 2 Nat Commun, 1 Plant Cell, 1 Curr Biol, 1 New Phytol, 2 Proc Natl Acad Sci USA, 2 J Exp Bot, 1 Plant Physiol. Likewise, the review articles were published in highly respected journals or books. One of the most advertised accomplishments is the elucidation of the response to oligotrophic conditions and thermal variations for the snow alga Sanguina nivaloides, the main contributor to alpine red snow blooms (Nat Commun, 2023). But the team also pursued the characterization of lipid regulation, transport, and inter-organelle fluxes in Arabidopsis and investigated the membrane lipid synthesis pathways and lipid storage mechanisms in secondary endosymbionts. A good example is the characterization of the multigenic family of 3 MGDG (monogalactosyldiacylglycerol) synthases in the diatom Phaeodactylum tricornutum, some in response to stress (Plant Cell 2024).

LIPID is highly visible in its field. One team member is the chief editor for one of the sections of Frontiers in Plant Science. The team organised two International Symposia on Plant Lipids, one online during Covid time, the second in Grenoble. Team members gave 19 invited presentations of which 10 abroad in national and international congresses, and 11 seminars (of which 4 were abroad).

The team has been very successful in fundraising (total 7156 k€, i.e. 183 k€/FTE/year). This includes seven ANR contracts, of which four are as coordinator and the Algadvance PEPR. At the international level, LIPID also coordinated the HFSP project. A large proportion of its budget (67%) arises from industrial projects funded either by BPI-France (Fermentalg, Soprema, Arkema), or the Institut Carnot and six directly by private partners (five TotalEnergies and one Saint-Gobain). TotalEnergies assigned two engineers in the team.

The resulting translational activity raises original questions and feeds excellent fundamental research, while resulting in valuable applications: a patent published in 2024 protects the accumulation of oil in a diatom mutant, currently tested in upscaling trials as an oleaginous strain for industry (via PEPR).

Lipidomic analyses central to these projects are carried out at the LIPANG platform, renovated and upgraded by the FEDER fund to allow for local, industrial and international collaborative projects. This platform developed by the LIPID team, is now independent since 2024 and obtained the IBISA label; one of the LIPID team members remains its scientific director. It is run by one PAR CNRS 0.8 FTE and one PAR CEA 0.5 FTE.

LIPID deployed exceptional outreach activity, including secondary school sessions, semi-professional teaching, and atelier fêtes de la science by Master students. large public conferences by the PIs, press releases, and a YouTube video. The ALPAGA project benefited from large media coverage, including national and international press, radio, television (most significantly a 51-minute documentary on snow algae by ARTE) and internet media. The team was also involved in a visual art exhibition entitled "Bloom" (2023), and in the creation of a contemporary opera by the Opera of Lyon entitled "Le sang des glaciers" (2024-2025).

Context-related weaknesses and risks

The team is the most at risk from a staffing point of view, as it has the lowest technician-to-researcher ratio (0,9 support personnel for seven researchers at the end of 2024), thus showing a severe deficit of technical support staff even though the ratio was increased to 1.4 in 2025.

LIPID has no teaching personnel despite its large size and no personnel with bioinformatic competence.

Most team members endorse time-consuming collective responsibilities as Unit's director, responsible of the setup of new facilities, CNRS or INRAE administration.

Despite excellent international visibility, the team raised modest international funding, especially from Europe.

The team very strongly relies on its industrial partners and on their scientific policy.

ANALYSIS OF THE TEAM'S TRAJECTORY

The team is planning to pursue its work on lipid homeostasis, transport and adaptation to environmental changes (in particular polar and high elevation temperature) in photosynthetic organisms, from algae to the classic model plants (Arabidopsis) including primary and secondary endosymbionts. Based on the recent excellent results and the potential of local collaborations (Alps), the same priorities will be maintained to address evolutionary and physiological questions at different scales. In addition to the models already investigated like P. tricornutum and O. tauri, new models will be introduced, in particular a member of the charophytes (Closterium) to better address evolutionary questions. Further efforts will be invested in technological development for lipid imaging at the tissue and cellular level, and single-cell monitoring of gene expression. The team will also seek to develop new approaches to induce non-GMO genetic variability in algae. The team keeps open for novel industrial partnerships keeping within its scientific interest.

The projects are solid, relevant, set on strong bases and well framed. Funding is secured untill2026, 2027 or 2028 for some of them (via the ARN projects PicoFRLIRT, Alpaga, DIM, Ephemer, and CONTROL and the HFSP project Trappedindice) at the submission of the report. The team obviously keeps very pro-active in fund raising and seeing for private patnerships. This should make the next years successful.

RECOMMENDATIONS TO THE TEAM

The team needs to find the levers to obtain additional technical support. This is now even more necessary with the increasing involvement of the team in research administration. The team is also encouraged to recruit teaching personnel and staff with bioinformatic expertise, that is essential for handling multiomic datasets and for most of the projects announced.

The team is encouraged to further reinforce its involvement in internationally funded projects, in particular exploiting its European collaborations and EC funding agencies (but indeed HFSP is also an excellent and convenient funding source).

It is also advised to maintain the complementarity and synergy between the projects led by individual PIs to preserve the group dynamism. The strong publication output should be sustained, with continued efforts to publish in well respected journals.

The team collaborations with the private sector constitute an essential financial resource that should be further encouraged and developed, when possible extended to additional partners to limit the risk associated with a strong reliance on single one.

Team 3: MetalStress (Plants, Stress & Metals)

Name of the supervisor: Mr Stéphane Ravanel

THEMES OF THE TEAM

The MetalStress team focuses on deciphering the cellular and molecular mechanisms underlying responses to non-essential trace elements, using a range of photosynthetic organisms including plants and microalgae.

CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

The previous committee recommended expanding the team's international visibility and increasing the number of publications in multidisciplinary journals. While some progress has been made, these objectives have not been fully achieved, and the recommendations remain relevant. The committee also advised strengthening the team workforce. Several staff changes have occurred during the evaluated period, making it difficult to achieve this goal. However, the recruitment of a new INRAE researcher in 2022 has helped to offset the retirement of the prior leader. The team was, in addition, reinforced by the addition of a non-permanent staff member, thus maintaining a stable core team.

Finally, the recommendation to adopt a more focused scientific strategy has been effectively addressed during the period under review.

TEAM WORKFORCE: IN PHYSICAL PEOPLE AS OF 31/12/2024

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maitres de conférences et assimilés	0
Directeurs de recherche et assimilés	2
Chargés de recherche et assimilés	1
Cadre scientifique CEA	1
Personnels d'appui à la recherche	1
Non cadre scientifique CEA	0
Cadre administratif CEA	0
Non cadre administratif CEA	0
Sous-total personnels permanents en activité	**5**
Enseignants-chercheurs et chercheurs non permanents et assimilés	1
Cadre scientifique CEA non permanent	0
Personnels non permanents d'appui à la recherche	1
Non cadre scientifique CEA non permanent	0
Cadre administratif CEA non permanent	0
Non cadre administratif CEA non permanent	0
Post-doctorants	0
Doctorants	2
Sous-total personnels non permanents en activité	**4**
Total personnels	**9**

EVALUATION OF THE TEAM

Overall assessment of the team

Overall, the METALSTRESS team is rated as good to very good. The team's scientific production is assessed as very good in terms of quality and quantity. The team has internationally recognized expertise in metal-related stress, supported by the award of several national grants. Their capacity to attract funding is good and the lack of international funding remains an area for improvement. It is also the case for outreach activities and collaboration with private-sector R&D, considered to be good.

Context-related strengths and opportunities

For several years, the METALSTRESS team has been developing an original research program aimed at deciphering the molecular mechanisms underlying uranium toxicity in plants and microorganisms. Their approach combines investigations across multiple levels of biological organization, from molecules to organs, and relies on a wide range of advanced techniques, including structural biology and metalloproteomics.

The team made some significant achievements, particularly in the field of uranium toxicology, with the publication of 23 peer-reviewed articles (1.3 articles/FTE/year). Thirteen of these articles were published with team members as leading authors (ex: J Hazard Mater, Environ Exp Bot, Plant Physiol Biochem, Plant Cell Environ), including six with PhD students as first authors, underscoring the strong involvement of early-career researchers. In addition, around 20% of the publications (6 out of 23) were co-signed with other LPCV teams, reflecting the team's integration and collaborative spirit within the unit.

Their work has substantially advanced current knowledge on uranium uptake and toxicity in plant roots, as well as on the molecular mechanisms underlying plant and microalgae responses to uranium stress. Notably, in Sarthou et al. (J Hazard Mat 2022), they identified for the first time a Ca^{2+}-permeable cation channel capable of mediating uranium uptake in Arabidopsis roots, thereby opening new perspectives for phytoremediation strategies. In parallel, their research on microalgae (Beaulier et al., Sci Total Environ 2024) identified Coelastrella sp. PCV as a promising microalga candidate for the remediation of uranium-polluted waters, with the additional advantage that its accumulation of lipid droplets offers opportunities for potential biomass valorization.

Building on this expertise and supported by a good dissemination record (6 invited talks and 13 oral communications at international congresses), the team has recently broadened its scope to encompass the soil–microorganism–plant continuum in contaminated wetlands, thereby adding a more applied dimension to their research.

The team has also demonstrated a good capacity to attract competitive funding, raising more than €1.5 million (55 k€/FTE/year) from national and European research agencies as project coordinator (ANR projects DEMONIACO, GreenU and Tatootink, and the Radonorm EU H2020 project**).**

Despite the absence of teacher-researchers in the permanent staff, the team's contribution to teaching activities is noteworthy, and likely explains its strong attractiveness to students and early-career scientists.

In addition, the team manages the ionome platform, which is a valuable asset for expanding national and international collaborations, strengthening interactions with the private sector, and increasing opportunities to secure international funding.

Context-related weaknesses and risks

Currently, the ionome platform is managed by a single assistant engineer who also participates in the team projects. The absence of a dedicated team researcher/engineer to run the platform constitutes a major challenge for the future development of the team and represents a clear risk for the sustainability of both the METALSTRESS team and the platform.

In addition, at present, there are limited interactions with the synchrotron radiation facilities, although such collaborations could offer valuable opportunities to address their upcoming scientific questions.

Overall, the outreach activities of the team are limited, with only three events reported during the evaluation period (CEA project for middle school students, participation in a TV show, and a science career forum). In addition, the team's scientific projects are mainly focused on hyperaccumulator plant models. This restricts the translational opportunities and dimension of their research. Apart from a single joint project with an industrial partner on weed control using electromagnetic radiation, interactions with the private sector and the wider translation of results into agriculture and related industries remain limited.

ANALYSIS OF THE TEAM'S TRAJECTORY

The team upcoming trajectory is assessed as very good and structured around three main axes: further investigating uranium fate in plants, building on PhD work to advance studies on nickel homeostasis and toxicity, and developing a new line of research on metal tolerance in metal-tolerant microalgae. These axes are well aligned with the team expertise and position it effectively to address key scientific challenges. They are also appropriately calibrated with respect to the team's size and available manpower. National and international collaborations are relevant and strategic, and funding has been secured (HOMONIME and FunhyCoela projects funded at the ANR AAPG2025 call) for most of the planned objectives.

RECOMMENDATIONS TO THE TEAM

The team works on a topic that is a recognized global challenge to agriculture, and has the skills, knowledge, and potential to be world-leading in this area. The team is encouraged to continue to consolidate its considerable research efforts by publication in international journals and by presentations at national and international conferences. While so far, the team's publication output was strong, its visibility should be further enhanced by targeting journals with broader, multidisciplinary audiences.

It is important to strengthen efforts to lead and participate in EU and other internationally funded projects, especially in the context of increasing national budget constraints.

The team could further strengthen its competitiveness by developing stronger collaborations with synchrotron facilities (SOLEIL, ESRF), which would provide access to cutting-edge techniques at both the organ and molecular levels, thereby helping them remain at the forefront in an increasingly competitive international context.

Given the high societal relevance of the research conducted by the METALSTRESS team, there is also an opportunity to enhance its involvement in outreach activities targeting the general public.

Team 4: ChromDev (Chromatin Dynamics and Developmental Transitions)

Name of the supervisor: Ms Christel Carles

THEMES OF THE TEAM

The ChromDev team aims to unravel the molecular mechanisms underlying plant morphogenesis. Adopting an integrative approach that spans from the atomic to the whole-plant level, their research focuses on two main developmental processes using *Arabidopsis thaliana* and *Sinapis alba* as models: photomorphogenesis and chloroplast biogenesis, as well as organogenesis processes, including the transition to flowering. These two developmental processes involve deep reprogramming events characterized by gene expression changes involving cellular and nuclear dynamics controlled by mechanisms that are studied in the team.

CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

As the team was established in 2018, the previous evaluation focused primarily on recommendations regarding its scientific strategy for the period under review. The main recommendation concerned the need to clarify the chloroplast biogenesis project and its connection to the chromatin dynamics research.

In the current report, the team has partially addressed this point. While efforts to integrate both themes were evident in the written report, the two research areas still appear largely independent, beyond the use of shared methodologies. Therefore, this recommendation remains valid.

The committee had also encouraged the team to strengthen interactions with other groups within LPCV. This has been effectively implemented, notably through strong collaborations with the STRUCDEV and FLO_RE teams, resulting in joint projects and co-authored publications.

TEAM WORKFORCE: IN PHYSICAL PEOPLE AS OF 31/12/2024

Catégories de personnel	Effectifs
Professeurs et assimilés	1
Maitres de conférences et assimilés	1
Directeurs de recherche et assimilés	0
Chargés de recherche et assimilés	2
Cadre scientifique CEA	0
Personnels d'appui à la recherche	1
Non cadre scientifique CEA	0
Cadre administratif CEA	0
Non cadre administratif CEA	0
Sous-total personnels permanents en activité	**5**
Enseignants-chercheurs et chercheurs non permanents et assimilés	1
Cadre scientifique CEA non permanent	0
Personnels non permanents d'appui à la recherche	1
Non cadre scientifique CEA non permanent	0
Cadre administratif CEA non permanent	0
Non cadre administratif CEA non permanent	0
Post-doctorants	0
Doctorants	1
Sous-total personnels non permanents en activité	**3**
Total personnels	**8**

EVALUATION OF THE TEAM

Overall assessment of the team

The global assessment of CHROMDEV is considered as very good. More precisely, the activities of CHROMDEV in terms of scientific project and production quality are good to very good. Its scientific production is very good quantitatively. The team successfully developed an integrative cellular and structural biology strategy, leading to publications in well respected journals. This approach also proved good in securing competitive national funding. Outreach activities are considered as good but collaborations with private-sector R&D remain poor and further progress could be made in this area.

Context-related strengths and opportunities

The Chromdev team has developed strong expertise in the niche area of developmental transitions.

Its scientific production is good quantitatively (0.66 article/FTE/year) and very good qualitatively (New Phytologist and EMBO Journal as leader) with 12 peer-reviewed articles among which 8 in leading position, plus 2 manuscripts in revision one in Nature Communications and the other in Nature Plants. The publications also include 5 reviews, and 2 book chapters. Especially, they identified an epigenetic control mediated by the H3K27 mark on plant flowering time and lignin composition of the stem (New Phytologist 2023) and also identified a new role for the nucleo-plastidic PAP8 protein in coupling chloroplast formation and photomorphogenesis (EMBO Journal 2020).

Team members have demonstrated a strong international visibility through 23 oral communications, including 12 invited presentations. The Chromdev team is also well integrated into collaborative networks, working with other groups in the Unit (Flo-RE and StructDev), as well as with national partners (IBMP Strasbourg, Institut Curie, and Université Clermont-Ferrand) and international collaborators (Israel and Germany).

Chromdev has secured several national research contracts (4 ANR projects, 1 CEA DRF project, and 2 labex projects) for a total of more than 1.3 M€ (70 k€/FTE/year), reflecting a good capacity to attract competitive funding.

In addition to its scientific contributions, Chromdev was actively involved in teaching, through the engagement of one assistant professor and a professor, and plays a federating role in research activities at CNRS, UGA and INRAE. A PI is the deputy director of the "Chemistry, Biology and Health" pole of UGA. A PI coordinates the "chromatin dynamics" theme of the GDR "Plant Epigenetic Mechanisms" led by CNRS. In addition, a team member was involved in the definition of flagships at the origin of the PEPR SVA (INRAE) and in the design of modules for a connected distributed infrastructure.

The team is furthermore committed to outreach activities, as illustrated by the organization of a photographic exhibition at Grenoble train station in the framework of the REWIRE PRC ANR project.

Context-related weaknesses and risks

From a staffing perspective, the team faces certain risks. The technician-to-researcher ratio (1:4) is low and may limit the team operational capacity, especially given the strong involvement of the team members in teaching and administration. Furthermore, collective responsibilities are largely endorsed by a single team member, which in the long term could put her under excessive pressure and compromise the team ability to sustain its high scientific standards.

While the team has been successful in attracting national grants and enjoys good international visibility, it still lacks funding at the international level, particularly from European programs.

In addition, research activities remain strongly focused on Arabidopsis, which limits the translational potential of the work. Finally, outreach activities are modest, with only limited initiatives beyond the Art-Science exhibition organized in Grenoble within the framework of an ANR project

ANALYSIS OF THE TEAM'S TRAJECTORY

*T*he team research trajectory capitalizes on recent advances and is organized around two complementary axes: 1) elucidating the role of PEP-PAP complexes in nucleus-chloroplast coordination during photomorphogenesis, and 2) deciphering chromatin-mediated switches controlling organogenesis. These projects are supported by ANR funding running until 2027 or 2028 and, for the chromatin axis, by a dedicated PhD fellowship. This focused approach is designed to uncover novel, robust yet flexible regulatory pathways governing developmental transitions. The project scope is tailored to the team size, expertise, and workload, while their funding strategy combining ANR grants and strategic collaborations ensures both scientific excellence and feasibility. This will certainly position the team as an expert in identifying innovative mechanisms underpinning plant developmental plasticity. The overall trajectory is therefore assessed as excellent.

RECOMMENDATIONS TO THE TEAM

The team is encouraged to intensify its engagement in EU and internationally funded projects, particularly given the current context of national budget constraints. An additional model with more translational relevance could be considered.

Strengthening collaborations with synchrotron and cryo-EM facilities would further enhance access to state-of-the-art technologies, reinforcing its international competitiveness.

Additionally, the team should sustain its commitment to teaching and outreach, which are integral to its mission. To optimize efficiency and ensure long-term sustainability and impact, a more balanced distribution of collective responsibilities among permanent staff could be considered.

Team 5: StrucDev (Integrated Structural Biology and Plant Development)

Name of the supervisor: Ms Chloé Zubieta

THEMES OF THE TEAM

The team aims to understand the molecular mechanisms underlying the transcriptional complexes formation, recognition and how they are triggering developmental programs depending on the cellular environment. The team uses a combination of structural biology, biochemistry, biophysics and reverse genetic approaches to tackle this goal focusing on temperature sensing and flower development.

CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

The previous committee made several recommendations concerning the team size, including the need to attract new members and address the lack of technical support. These recommendations have been successfully addressed: the team recruited a new CNRS research scientist and a CNRS IE, doubling the permanent staff number.

The committee also encouraged the team to continue publishing in well respected journals, which has been successfully implemented, as evidenced by several recent publications in well respected and broad-audience journals.

Furthermore, recommendations aimed at strengthening collaborations both within and beyond the Unit have been fully met.

TEAM WORKFORCE: IN PHYSICAL PEOPLE AS OF 31/12/2024

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maitres de conférences et assimilés	0
Directeurs de recherche et assimilés	1
Chargés de recherche et assimilés	1
Cadre scientifique CEA	1
Personnels d'appui à la recherche	1
Non cadre scientifique CEA	0
Cadre administratif CEA	0
Non cadre administratif CEA	0
Sous-total personnels permanents en activité	**4**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Cadre scientifique CEA non permanent	0
Personnels non permanents d'appui à la recherche	0
Non cadre scientifique CEA non permanent	0
Cadre administratif CEA non permanent	0
Non cadre administratif CEA non permanent	0
Post-doctorants	0
Doctorants	3
Sous-total personnels non permanents en activité	**3**
Total personnels	**7**

EVALUATION OF THE TEAM

Overall assessment of the team

Overall, the STRUCDEV team is considered very good. Its scientific output is excellent quantitatively and qualitatively, with major contributions in thermosensing and flower development. The team is fair to good at attracting funding, but mainly through national sources. Outreach is considered as very good while interaction with industry, which includes one patent, is very good and could be further developed.

Context-related strengths and opportunities

The scientific output of STRUCDEV was excellent with 30 publications (1.7 articles/FTE/year) of which 10 in leading position (two in Proc Nat Acad Sci, three in Mol Plant, one in JoVE, one in Comput Struct Biotechnol J, one in Nucleic Acids Res and one in Curr Opin Plant Biol). Moreover, the team achieved a good dissemination record, with six invited lectures at congresses (one abroad), five invited seminars (two abroad), and three oral communications at congresses (one abroad), reflecting both national and international recognition.

During the evaluation period, the team made major contributions to the description of the EVENING COMPLEX as a thermosensor, demonstrating that its DNA-binding activity varies with temperature (Proc Natl Acad Sci USA 2020 and 2023; Nature, 2020). This finding significantly advances our understanding of how plants perceive environmental cues. Building on this, the team is now exploring the role of liquid–liquid phase separation that is an emerging and understudied mechanism in plants with strong potential for future discoveries. In parallel, their work on MADS complexes uncovered a plant-specific mechanism requiring heterotetramerization of MADS transcription factors to control floral determinacy and organ identity (Nucleic Acids Res, 2020; Nat Commun, 2021; Plant Cell 2024). This study also highlighted the importance of complementing in vitro approaches with in planta experiments to gain biologically relevant insights.

The team benefited from good funding, mainly from ANR (3 funded projects during the term – PROSPERO, TERFING, TEMPSENS, one as coordinator) and PhD fellowship.

Finally, the team maintained strong collaborations with the European Photon and Neutron Science Campus, notably with the ESRF, where one of its members serves as the local contact for the BioSAXS beamline.

Context-related weaknesses and risks

The team conducts highly focused fundamental research and has successfully secured national funding, including ANR projects and PhD fellowships through Grenoble labex. However, the total funding over the period was modest slightly more than 700 k€ from ANR contracts (average 39 k€/FTE/y). The growing uncertainty surrounding national funding opportunities may limit their future development, as European-level funding has not yet been pursued.

In addition, in spite of a patent filed during the term, the team's translational activity and interactions with the private sector remain limited. Similarly, their involvement in public outreach is modest, although this represents a valuable opportunity to strengthen their impact and visibility.

Finally, authorship practices within the team mostly place the team leader as last author, while project leaders are listed as first authors. On the long-term, this may limit the visibility and career progression of researchers.

ANALYSIS OF THE TEAM'S TRAJECTORY

The team has developed well-considered and realistic plans for its future research, considering its current size and recent achievements. The trajectory is therefore assessed as excellent. The strategy is structured around two main axes: (i) investigating the interplay between transcription factor oligomerization and the phenomenon of liquid–liquid phase separation (LLPS), and (ii) advancing the structure–function analysis of MADS transcription factors from an evolutionary developmental (evo-devo) perspective. The team will continue to integrate molecular to whole-plant approaches, which remains one of its core strengths. A notable aspect of their future direction is the planned integration of AI tools, particularly for structural prediction, which holds promising potential. The three current ANR projects run to 2026 and very significant additional funding (about 1.1 M€) was acquired in 2025 via 3 ANR grants (Steffie, PHEAT and Utopia) and 2 PhD fellowships which guarantees an

excellent start for these projects. The committee fully supports the team initiative to submit ERC proposals to further secure the team's projects.

RECOMMENDATIONS TO THE TEAM

The team is encouraged to maintain its strong publication dynamic and continue targeting well respected research journals. In future evaluations, a clearer presentation of each team member contribution to the various aspects of the project would be helpful.

The interactions with European neutron and photoncampus are highly valuable and could be further strengthened, as they help the team maintain its technical and scientific edge in its research area.

To support the team's goal of attracting more postdoctoral researchers, applying for European funding, particularly through MSCA fellowship, is recommended, as is lecturing in foreign laboratories and international meetings.

Strengthening collaborations with private sector, possibly via introducing an additional plant (crop) model, as well as increasing involvement in public outreach activities, would also enhance the team visibility and societal impact. Participation in national or international science communication events, such as Fête de la Science or Fascination of Plants Day, could serve as valuable opportunities in this regard.

Finally, the team is also encouraged to adopt more flexible authorship practices that recognize scientific leadership, for example by allowing project leaders to appear as last authors when appropriate, in order to support their career development and scientific recognition.

Team 6: Flo_RE (Floral Regulators: Function, Structure and Evolution)

Name of the supervisors: Mr François Parcy and Ms Gabrielle Tichtinsky

THEMES OF THE TEAM

FLO_RE studies the mode of action and evolution of the transcriptional regulators of the floral development and auxin-response using integrated structural biology (structure/function relationships). The team also exploits its tools and bioinformatic resources for meta-analyses of larger sets of transcription factors and database creation/maintenance. Its models are Arabidopsis, Cauliflower and Marchantia.

CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

The team pursues its policy to recruit new staff bringing new competences.

Concerning the recommended addition of a new model representative of early plant evolution, Marchantia has been chosen rather than a charophyte since easier to handle and more appropriate for an ongoing collaborative project. Adding a charophyte model is still considered.

The dynamic aspects of protein/DNA recognition will be tackled in an upcoming ANR project via single molecule tracking.

TEAM WORKFORCE: IN PHYSICAL PEOPLE AS OF 31/12/2024

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maitres de conférences et assimilés	1
Directeurs de recherche et assimilés	2
Chargés de recherche et assimilés	0
Cadre scientifique CEA	1
Personnels d'appui à la recherche	2
Non cadre scientifique CEA	0
Cadre administratif CEA	0
Non cadre administratif CEA	0
Sous-total personnels permanents en activité	**6**
Enseignants-chercheurs et chercheurs non permanents et assimilés	0
Cadre scientifique CEA non permanent	0
Personnels non permanents d'appui à la recherche	2
Non cadre scientifique CEA non permanent	0
Cadre administratif CEA non permanent	0
Non cadre administratif CEA non permanent	0
Post-doctorants	0
Doctorants	4
Sous-total personnels non permanents en activité	**6**
Total personnels	**12**

EVALUATION OF THE TEAM

Overall assessment of the team

The FLO_RE team is excellent to exceptional. It is outstanding for the quality of its scientific production and outreach activity with an exceptional visibility of its leader in all types of media. The production of FLO_RE is excellent from a quantitative point of view and its funding is very good, essentially national and local. The team has only opportunistic interactions with economic partners and still some margin for progression for international funding, attractivity, as well as translational activity.

Context-related strengths and opportunities

The team's work is based on a strong background, properly focused, well exploiting its local ecosystem, original for its structural and evolutionary aspects, well-structured and structuring for the community. Scientifically, FLO_RE is a world leader in its field.

FLO_RE benefits from good to very good funding, mainly from ANR (five funded projects, all coordinated by the team (CHOMAUXI, FLOPINET, AGRODIV, TRANSINET, UBIFLOR). All submitted projects were funded. FLO_RE also signed one GRAAL-labex contract, and a funding from PEPR. Total funding over the period was 1750 k€ (average 83 K€/FTE/y).

The scientific output of FLO_RE is outstanding qualitatively and excellent quantitatively. The team published 43 articles including two book chapters and eight reviews (i.e. two articles/FTE/year), of which 23 (46%) in lead position (of which two in Science, three in Mol Plant, one Nat Commun, one Proc Nat Acad Sci USA, two Trends Plant Sci, one Curr Opin Plant Biol, one PLOS Genetics, one Plant Cell, two New Phytol). Five (8%) were co-signed with other LPCV teams and sixteen (37%) by PhD students. A major contribution is the elucidation of the mode of action of the master regulator LEAFY highlighting its interaction with the F-Box protein UFO (UNUSUAL FLORAL ORGANS) to form an unexpected transcriptional complex regulating flower development (Nature Plants 2023). Another breakthrough is the unravelling of the perturbations in the floral developmental programs leading to fractal forms and unusual structures of cauliflower and Romanesco cabbage (Science 2021). In addition, the team made important contributions to the development of tools for the functional characterization of plant transcription factors, their structure-based classification and the curation of plant transcription factors databases (such as JASPAR).

FLO_RE has a very good visibility attested by thirteen invited talks in congresses (six abroad) and sixteen invited seminars (of which four abroad). It can be noted that these numbers, especially invitations abroad, are restricted by the choice of the team members to avoid plane travel. Yet the team regularly contributes to the organization of the Workshop on the Molecular Mechanisms controlling Flower Development and the APIS meeting (Annual Planta International Symposium).

Despite a focus on basic science, the team generated applications, as shown by the use of the self-assembly properties of the Gingko biloba LEAFY protein to generate a new honeycomb nanostructure expected to be useful for biocatalysis, biosensor or nanoelectronics (FR and WO patents).

A very charismatic team leader maintains an outstanding outreach activity. He published two books dedicated to the general public, one generating a widely and internationally broadcasted documentary ("L'abominable mystère des fleurs", 2022). In addition, he gave 17 radio interviews, produced 33 interviews/articles for large audience journals and 5 videos, gave 20 large audience conferences. Several actions were designed to reach highschool students.

Noteworthy, for ethical reasons, the team made strong choices of sobriety in terms of funding and travel, as well as of outreach maximization. Its members strived to reach an optimal output within this frame, with great success.

Context-related weaknesses and risks

FLO_RE is a very successful fundraiser at the national level but did not obtain international funding during the period (since it does not seem to seek any).

The team has some difficulties to recruit good post-docs and despite its excellence does not seem to attract spontaneous foreign post-doc applications. This might be explained by the very ambitious scientific objectives of the team that make it difficult for post-docs (usually recruited for two years) to get work published in visible position. In addition, the avoidance of distant travel and conferences abroad do not provide a suitable ground for attraction of potential candidates. Nor do the CEA current administrative rules.

The team is totally focused on fundamental science and does not really question potential applications of its research (except upon specific demand from former staff members).

ANALYSIS OF THE TEAM'S TRAJECTORY

FLO_RE benefits from a strong and still increasing permanent staff (new half-time engineer) and extremely solid scientific background to keep successfully developing its research with still strong focus on the regulators of flower development and their evolution in the green lineage. This provides many opportunities of new exciting developments, given the possibility to exploit tools that recently became available (Cryo-EM, protein complexes modelling, AI for mining genomic information).

Prioritizing Marchantia as a model for flower-devoid plants in a first step was an excellent choice, but indeed, it would still be interesting to add (in coordination with the LIPID team) a charophyte model to the toolbox.

Significant funding (1 INRAE and 1 ANR grants) has been already obtained to support the next steps of the project. In addition, a competitive candidate has been identified for recruitment as new permanent researcher and ERC starting grant application.

The FLO-RE trajectory is thus excellent, and an outstanding scientific output can still be expected from the team for the next term.

RECOMMENDATIONS TO THE TEAM

Presence at international meetings is usually the best opportunity for direct personal discussions and a key opportunity to trigger applications of foreign post-docs. This can be considered to ponder the choice to participate (or not) to distant international conferences.

Fund-raising is indeed very time-consuming, but extending fundraising to the international and initiate international projects can be an excellent starting point for future post-doc recruitments. Note that the HFSP program provides excellent funding with minimal reporting work. It could be a good back-up in case of decrease of national resources. Note also that if this would occur, a team member would be a very competitive candidate for an ERC advanced application.

It is indeed important to set priorities to keep efficient; yet considering potential applications sometimes can feed fundamental research with new and exciting ideas, and additional flexible resources.

Team 7: CytoMorphoLab (Physics of Cytoskeleton & Morphogenesis)

Name of the supervisor: Mr Laurent Blanchoin and Mr Manuel Théry

THEMES OF THE TEAM

CytoMorphoLab conducts fundamental research on cytoskeletal architecture, with a particular focus on the actin filament network. The central goal is to understand how the actin network, which spontaneously assembles at the cell periphery, senses and adapts to external cues. The team investigates the range of architectures that can emerge within this network, while analyzing how renewal dynamics and mechanical constraints shape cell morphology, govern motility, and mediate the cell physico-chemical integration into its environment.

The team is physically split on two sites, one in Grenoble located at the IRIG site (CEA), and the other in Paris located at the ESPCI site within the Pierre-Gilles de Gennes Institute.

CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

In the previous report, the team was ranked excellent. The difficulties stemmed from the split in different locations and from the bad shape of the Grenoble building. In 2025, the IRIG board and CEA approved the relocation of the Grenoble team from building C2 to a renovated aisle in C3 and a move planned for 2027. Meanwhile, part of the CytomorphoLab team, previously based at Hôpital Saint-Louis in Paris for stem cell studies, has been hosted at Institut Pierre Gilles de Gennes since 2024.

TEAM WORKFORCE: IN PHYSICAL PEOPLE AS OF 31/12/2024

Catégories de personnel	Effectifs
Professeurs et assimilés	0
Maitres de conférences et assimilés	0
Directeurs de recherche et assimilés	1
Chargés de recherche et assimilés	1
Cadre scientifique CEA	4
Personnels d'appui à la recherche	2
Non cadre scientifique CEA	0
Cadre administratif CEA	0
Non cadre administratif CEA	0
Sous-total personnels permanents en activité	**8**
Enseignants-chercheurs et chercheurs non permanents et assimilés	1
Cadre scientifique CEA non permanent	1
Personnels non permanents d'appui à la recherche	1
Non cadre scientifique CEA non permanent	0
Cadre administratif CEA non permanent	0
Non cadre administratif CEA non permanent	0
Post-doctorants	0
Doctorants	6
Sous-total personnels non permanents en activité	**9**
Total personnels	**17**

EVALUATION OF THE TEAM

Overall assessment of the team

The CYTOMORPHOLAB team is considered overall outstanding. The team is a leader in the field of cytoskeleton studies. Its excellent project is focused and original and received exceptional national and International funding. With this support, the team generated an outstanding scientific production, both qualitatively and quantitatively, which led to an exceptional outreach and wide coverage. The team also strongly contributes to define the national scientific strategy. Yet it keeps strictly focused on fundamental science.

Context-related strengths and opportunities

The team CytoMorpholab is a world leader in the field of cell architecture and reconstituted cytoskeleton system in vitro. The team builds a composite of actin filaments and microtubules in dynamic steady state, where actin drives inward flow and microtubules self-organize into radial or polarized patterns via opposing motors. Their interaction will allow switching in response to stimuli, leading to the first artificial cell with a responsive cytoskeleton and revealing how adhesion controls robustness or sensitivity in polarization.

They published 49 peer-reviewed research articles (average 1.9 articles/FTE/year) of excellent to outstanding quality (Proc Natl Acad Sci USA, Nat Cell Biol, J Cell Sci, EMBO J, Curr Biol, …) including 32 on which they appeared as corresponding authors. CytoMorpholab supervised 7 PhD students with 11 publications where they are co-authors. The study published in Curr Biol (2024) uncovers how dynamic actin networks share limited cellular resources. Using a reconstituted system, the authors show that protein turnover enables coexistence between strong and weak networks. However, under stronger competition, turnover alone cannot prevent resource imbalance. This leads to the dominance of stronger networks, highlighting competition strength as a key factor in cellular adaptation. The team also showed that microtubules act as mechano-responsive elements in living cells Nat Mater (2023). Under compressive stress, they deform, reduce dynamics, and become stabilized through CLASP2-dependent mechanisms. This stabilization supports cell migration in confined environments, underscoring the role of microtubules in cellular mechano-responses.

The team obtained very prestigious grants, namely 3 ERC grants (MATADOR, ICEBERG, AAA 3.3 M€); 1 prestigious national grant ANR 2030 Biology and Health, €2.0M), 1 ANR JCJC (*SCALING 256 k€*) and 4 ANRs PRCE (Chirality, MicRON, *MOVING, SHARP*), and an INCA project all as coordinators, that secure the future. They also obtained an industrial contract with Clarins (35 k€), which results in a total funding of 4583 k€ i.e 918 k€/FTE/year. Moreover, they recently recruited two new permanent staff members: a CNRS CRCN and a CEA Engineer.

Two team members have been elected EMBO Members in 2019 and 2021. Another member has been awarded the l'Oréal Unesco prize for Women in Science, in 2023. The team leader has received the Silver Medal of the CNRS in 2019, distinguishing researchers for the originality, quality, and significance of their work, recognized both nationally and internationally.

The team CytoMorpholab has actively engaged in outreach, including media appearances on France Culture and La Recherche and artistic-scientific collaborations such as the Lilu Lichtfestival Luzern. Upcoming highlights include the major exhibition "Living Architecture" at the Musée d'Orsay, followed by two special events in 2026 on the theme of scaling in living systems.

Context-related weaknesses and risks

There is a structural imbalance between Grenoble and Paris in terms of permanent positions, combined with a lack of in-house expertise in artificial intelligence (AI).

ANALYSIS OF THE TEAM'S TRAJECTORY

Cytomorpholab is expected to keep on an outstanding track. The team's projects focus on reconstituting a dynamic cytoskeleton capable of sensing, polarizing, and moving—key cellular properties. Using actin and microtubule networks, they aim to create the first artificial cell that can polarize (supported by ANR 2030 Sensation). Indeed, building an artificial cell has become a major international challenge, aiming to recreate life-like functions from minimal components. The recent results obtained put the team in an excellent position to face and win this challenge. The team benefited from plethoric funding during the evaluated term but, with

only one ANR project ongoing until 2026 and probably some remaining ERC funds, it now has to find new support to make this ambitious project realistic. There is little doubt that it will be able to find it.

RECOMMENDATIONS TO THE TEAM

The team is commended for its strong engagement in internationally funded projects and is encouraged to further expand these initiatives as well as its outreach activities aimed at the general public.

The team's impressive publication record demonstrates its scientific excellence, further targeting well respected journals will strengthen its international standing. Maintaining the fruitful overlap and complementarity between the individual PI's projects will continue to sustain the team's remarkable dynamism.

Developing collaborations with private-sector partners represents an exciting opportunity to increase the team's resources, broaden the team's visibility and reinforce its societal impact.

A co-supervised PhD student would be an option to develop AI in the team in collaboration with a group where this expertise exists.

Team 8: Photosymbiosis (Photosymbiosis)

Name of the supervisor: Mr Johan Decelle

THEMES OF THE TEAM

The team uses advanced subcellular imaging to study planktonic symbioses, focusing on how host organisms remodel algal cells for photosynthetic sugars. This includes changes in sugar transport, cell cycle and mitochondrial networks. The research spans 3 axes: sugar metabolism and carbon export, morphogenesis of internalised algae or kleptoplasts, and algal adaptation before and after symbiosis. Combining 3D imaging, structural biology, and transcriptomics, the team develops new planktonic models through strong national and international collaborations, fieldwork, and outreach.

CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

The team was created in 2020 with ATIP funding (CNRS) and was not evaluated previously by Hcéres.

TEAM WORKFORCE: IN PHYSICAL PEOPLE AS OF 31/12/2024

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
Cadre scientifique CEA	0
Personnels d'appui à la recherche	1
Non cadre scientifique CEA	0
Cadre administratif CEA	0
Non cadre administratif CEA	0
Sous-total personnels permanents en activité	**2**
Enseignants-chercheurs et chercheurs non permanents et assimilés	2
Cadre scientifique CEA non permanent	0
Personnels non permanents d'appui à la recherche	4
Non cadre scientifique CEA non permanent	0
Cadre administratif CEA non permanent	0
Non cadre administratif CEA non permanent	0
Post-doctorants	0
Doctorants	2
Sous-total personnels non permanents en activité	**8**
Total personnels	**10**

EVALUATION OF THE TEAM

Overall assessment of the team

Overall, the PHOTOSYMBIOSIS team is considered as excellent, on an outstanding track. Its funding is exceptional and scientific output excellent to outstanding. Outreach activities are excellent. Based on the team size of 2 permanent members, they appear to do superhuman job at managing the team from the funding, scientific, outreach and collaborative side. The team currently has no interaction with economic partners and shows limited translational activity. Recruiting additional researchers could help strengthen these aspects.

Context-related strengths and opportunities

The team uses state of the art structural biology and 3D imaging techniques alongside transcriptomics to develop new planktonic models and to understand various levels of planktonic symbioses. This is a timely area in line with increased interest in biodiversity and recently emerged high resolution 3D imaging tools. The team's work is very novel and original, it requires mastering new models and a pipeline of descriptive and highly informative techniques.

The team has an outstanding publication record for the period (3.7 articles/FTE/Year) with 9 publications as either first or last author (two articles in ISME J, 3 in Curr Biol, 1 in Plant Cell Physio, 1 in Environ Microbiol, one in Trends Cell Biol and one article in Proc Natl Acad Sci USA). The team discovered that a symbiosis leads to drastic changes to the organization of the algal cell taken up by the host, where the host "farms" the algal cells for its photosynthesis derived sugars resulting in a remodelling of sugar transporters and mitochondrial networks (Proc Natl Acad Sci USA 2021). Moreover, the team members have co-authored 13 other publications for the period in excellent international journals.

Based on the number, extent and diversity of collaborations, the team has excellent visibility. The team leader had 13 invitations to international conferences, universities or institutes since 2019. In 2024, he was awarded with the Bronze Medal of CNRS and elected as EMBO Young Investigator Program. The team leader is a coordinator of the TREC expedition led by EMBL to study organisms in the environment all over Europe. Numerous collaborations across Europe and the USA have been developed in microscopy and AI-assisted image analysis in the framework of AtlaSymbio project (Univ of Dusseldorf, Cambridge University, Standford University).

The team uses technical facilities and platforms in Grenoble (IRIG and IBS), it has strong collaborative ties within LPCV: two articles with the Photosynthesis team (Nature Commun 2021 and Proc Nat Acad Sci USA 2021, last author); Lipid team (Curr Biol 2019, first author) and Metal Stress (Environ Microbiol 2021). The team leader is responsible for the scientific animation at LPCV.

The team has shown an exceptional ability to attract funding with 3702 k€ obtained in six years (average 617 k€/FTE/year), including prestigious ERC and Moore grants. Thanks to this funding and its publication record, the team has attracted six post-docs and two PhD students over the past five years, which is an outstanding achievement for a small team.

Another major achievement has been an outreach project, PlanktoQuest (presented regularly nationally and internationally since 2023). It is a virtual animation available as a free app using fully immersive 3D imagery of oceanic algae. Team members, both permanent and non-permanent, are encouraged to teach at the university with a total number of 83 h/year on average.

Context-related weaknesses and risks

The team leader admits that his energies can be dispersed by the variety of his tasks and projects and would like to commit more time to supervising the team's research projects. His most recent publications, eight as co-author, and two first and last author papers for the team (New Phytol and Curr Biol) clearly show that the team so far did not suffer from its success. However, dispersion of energy could become a long-term problem if there are no new recruitments, specifically a second CR to bear the load of supervision and project management, as well as some of the administrative duties in the long term.

For the moment, a translational scientific strategy has not been outlined in the future research plans by the team.

ANALYSIS OF THE TEAM'S TRAJECTORY

The team's trajectory is excellent, with an outstanding prospect. Photosymbiosis will continue to capitalise on its success in original research, creation of new models in photosymbioses, continued outreach for biodiversity and formation of students and post-doctoral researchers. The team see the need to change the focus from descriptive towards the molecular mechanisms of symbiosis and will adopt new techniques, specifically in the understanding of sugar transport with a new group of collaborators. The team is mainly composed of non-permanent staff which may not change dramatically during the next term. Given its small size (2 permanent members), the team should recruit at least one researcher or research engineer to fulfil these plans. The project is supported with adequate financial resources, notably through the coordination of the ERC project SymbiOCEAN (2023–2028, €2.2M).

RECOMMENDATIONS TO THE TEAM

The team is encouraged to consider a strategy of translating their findings into organisms of biotechnological significance.

The committee also recommends avoiding dispersion of energies and concentrate some efforts on recruitment of a permanent scientist to reinforce the remarkable success of the team.

Team 9: Chlorogenesis (Chloroplast Proteome Dynamics and Biogenesis)

Name of the supervisor: Mr Norbert Rolland

THEMES OF THE TEAM

This team studies the mechanism by which photosynthetic organisms adapt to rapid changes in adverse environmental conditions, particularly the adaptation in metabolism that facilitates rapid and effective responses. With the increased understanding of the chloroplast protein dynamics, the aim is to design novel strategies maintaining high yield under environmental conditions that affect food safety. Thus, the team research focus on the chloroplast proteome dynamics, in order to decipher the molecular mechanisms that control the targeting of proteins imported into plastids through alternative pathways (vesicular trafficking and localized translation).

CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

The main recommendation of the previous report was that the team should try to expand and increase in size. However, despite efforts, this proved to be impossible.

TEAM WORKFORCE: IN PHYSICAL PEOPLE AS OF 31/12/2024

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

EVALUATION OF THE TEAM

Overall assessment of the team

The team is rated very good to excellent. Their projects have been historically excellent for their originality and focus. The team has had a strong scientific output both in quantity and quality and an outstanding outreach activity in support of the acceptance of genome-edited plants. However, there could be more original research papers led by team members. This team continues to have worldwide recognition for the groundbreaking work undertaken over several decades. However, the self-evaluation report strongly focuses on the more historical successes rather than recent findings.

Context-related strengths and opportunities

This well-established team has a long history of exceptional research achievements and world-leading science, as well as an excellent record in science communication and interactions with society.

The team's work is based on the sound hypothesis that the dynamics of subcellular (and sub-organellar) proteomes are essential for optimal adjustment of the chloroplast functioning and thus of plant adaptation to environmental constraints. The activities of the team have built on the firm foundations of past successes, and they continue to make progress in documenting the chloroplast proteome, with a particular focus on the activities of the chloroplast envelope proteins. It continues to have worldwide recognition for the groundbreaking work that has been undertaken over several decades.

The outputs of the team are very good. They have published 12 primary articles, 3 reviews, 1 book, and 4 book chapters (average 2 articles/FTE/year). Recently, the identification of a calmodulin isoform that controls the subcellular location of two "non-canonical" chloroplast proteins is a significant finding (J Biol Chem 2019). The fact that two members of the team have been invited to write reviews for well respected journals (Mol Cell Proteom, J Exp Bot) bears testimony to the recognition of the strong record of scientific success of this team.

The team has presented over 40 oral communications (many invited) and 6 posters. There is a strong focus on reviews and more general articles in the areas of science communication, particularly regarding genetically modified organisms and gene editing, that are tailored to a wider audience. The efforts of this team have provided a useful platform for the discussion of the health and safety aspects of these technologies, together with the challenges for European agriculture (Nat Biotech 2019 and 2022; Frontiers Bioeng Biotechnol 2020; Plant Biotechnol J 2021).

The team has been very successful in attracting funding. There are 2 ANR contracts (1 ongoing as coordinator); 2 H2020 projects (1 CSA and 1 COST); 1 INRA BAP/ANR labex GRAL grant, with a total funding of 693 k€ over the reporting period (average 116 k€/FTE/year). Team participation in the EU Crop booster project has been fundamental in facilitating the significant achievements in science communication. Overall, the team has been highly successful in its outreach activities, as evidenced by the significant number of first-author publications in news-related media and journals in the area of genetically modified plants.

Context-related weaknesses and risks

There could be more primary publications where team members are the first or last author.
The team has diminished in size, with the 2024 retirement of a researcher and close retirement of the team leader. Hence, the team may be less motivated because it will soon disband.

ANALYSIS OF THE TEAM'S TRAJECTORY

As stated above, one of two permanent researchers recently retired (April 2024) and the last (and team leader) will retire ~1 year after the end of the present contract. Accordingly, the Chlorogenesis team activities will be completed in Dec. 2026. At this point, the two remaining team members are in discussions to join another team of the LPCV for the beginning of the next Hcéres contract (Jan. 2027). The team's two PhD students will submit their theses before the end of 2025. Hence, the team's trajectory is well organised. The research endeavors of the team will be consolidated by publication and other outputs.

RECOMMENDATIONS TO THE TEAM

The panel was encouraged by the new data that was presented during the interviews, which should lead to several excellent publications. We encourage the team to consolidate this excellent work by publications within the coming months. We trust that the team members will carry their extensive knowledge, skills and experience into other teams.

CONDUCT OF THE INTERVIEWS

DATES

Beginning: September 25, 2025, 08h30

Ending: September 26, 2025, 18h00

Interview conducted: remotely

PROGRAMME OF THE INTERVIEWS

Thursday, September 25th, 2025

Open sessions

08h15-08h30	Welcome of the evaluation committee members and presentation of the evaluation by the Hcéres scientific advisor
08h30-09h30	General presentation of LPCV (30 min presentation + 30 min discussion)
09h30-10h00	Team Photosynthesis (15 min presentation + 15 min discussion)
10h00-10h20	Team Chlorogenesis (10 min presentation + 10 min discussion)
10h35-11h15	Team Lipid (20 min presentation + 20 min discussion)
11h15-11h45	Team Metalstress (15 min presentation + 15 min discussion)
11h45-12h15	Team ChromDev (15 min presentation + 15 min discussion)
12h15-13h00	**Closed meeting** (Committee + Hcéres Scientific Advisor)
14h00-15h50	**Open sessions**
14h00-14h20	Team StrucDev (10 min presentation + 10 min discussion)
14h20-14h50	Team Flo-Re (15 min presentation + 15 min discussion)
14h50-15h30	Team Cytomorpholab (20 min presentation + 20 min discussion)
15h30-15h50	Team Photosymbiosis (10 min presentation + 10 min discussion)
15h50-17h30	**Closed meeting**, (Committee + Hcéres Scientific Advisor): first debriefing of the pre-report

Friday, September 26th, 2025

Restricted sessions

08h30-09h30	Meeting with Researchers
09h30-10h00	Meeting with Technicians, Engineers and Administrative Staff (permanent + contract)
10h00-10h30	Meeting with PhD students and Post-docs
10h45-11h15	Meeting with the governing bodies: Université Grenoble-Alpes, CNRS, CEA and INRA
11h15-11h45	Meeting with Team Leaders
11h45-12h45	Meeting with LPCV direction and team leaders
14h00-17h00	**Closed meeting** (committee members + Hcéres Scientific Advisor); consolidated report discussion
17h00	**End of the visit**

GENERAL OBSERVATIONS OF THE SUPERVISORS

Saint-Martin-d'Hères, le 25 Novembre 2025

OBSERVATIONS DE PORTEE GENERALE SUR LE RAPPORT D'EVALUATION

Unité de Recherche LPCV

L'Université Grenoble Alpes n'a pas d'observations de portée générale à formuler

Le Vice-président recherche
de l'Université Grenoble Alpes,
Philippe Roux

Université Grenoble Alpes - +33 (0)4 57 42 21 42
N° SIRET 130 021 397 000 18
www.univ-grenoble-alpes.fr

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19 rue Poissonnière
75002 Paris, France
+33 1 89 97 44 00