

EVALUATION REPORT OF THE UNIT

MEPHI - Microbes Évolution Phylogénie et Infections

UNDER THE SUPERVISION OF THE
FOLLOWING ESTABLISHMENTS AND
ORGANISMS:

Aix-Marseille Université - AMU

Institut de recherche pour le développement -
IRD

EVALUATION CAMPAIGN 2022-2023
GROUP C

Report published on April, 04 2024



In the name of the expert committee :

Alain Filloux, chairman of the committee

For the Hcéres :

Stéphane Le Bouler, acting president

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

NOTE TO THE READER

This report is the result of the unit's evaluation by the expert committee, the composition of which is specified below. The experts have been chosen by Hcéres on the basis of their expertise in the activities to be evaluated, the scientific disciplines involved and the research topics concerned. The expert committee is a group of peers, with no ties or conflicts of interest, set up ad hoc to assess the activity and output of a research group over a defined period. It does not have the power of inspection, nor does it have judicial or disciplinary authority.

This document is based on a self-evaluation document drawn up by the group being evaluated, according to a template defined by Hcéres. It is drawn up following meetings and discussions between Hcéres experts and members of the unit (see attached programme). The numbers in this report are the certified exact data extracted from the deposited files by the supervising body on behalf of the unit.

The appreciations it contains are the expression of the independent and collegial deliberation of this committee. The committee used a gradient of qualifiers, which are, in descending order: "exceptional, excellent, very good, good, and honourable".

MEMBERS OF THE EXPERT COMMITTEE

Chairperson:

Mr Alain Filloux, Nanyang Technological/University, Singapore

Mr Vincent Cattoir, CHU Rennes (representative of CNU)

Ms Claire Cherbuy, Inrae, Jouy-en-Josas (supporting personnel)

Ms Francesca Chiodi, Karolinska Institutet, Sweden

Experts:

Mr Erick Denamur, Université Paris Diderot - Paris 7

Mr Patrick Linder, Emeritus Professor, Switzerland (vice-chairman)

Mr Olivier Panaud, Université de Perpignan Via Domitia (representative of CSS IRD)

HCÉRES REPRESENTATIVE

Ms Muriel Mercier-Bonin

CHARACTERISATION OF THE UNIT

- Name: Microbes Evolution Phylogeny and Infections
- Acronym: MEPHI
- Label and number: UMR D-258
- Number of teams: 8
- Composition of the executive team: Mr Jean-Christophe Lagier

SCIENTIFIC PANELS OF THE UNIT

SVE Sciences du vivant et environnement
SVE4 Immunité, infection et immunothérapie

THEMES OF THE UNIT

MEPHI focus is on human (and animal-one health) health research and infectious diseases.

There are clear areas that are very much the identity of MEPHI like the culturomics approach to identify novel pathogens as well as looking at paleomicrobiology and thus the evolution of pathogens and diseases. The investigation of novel pathogens has also been considered during the Covid-19 pandemic.

Another area is microbiota (bacteria but not only, e.g. viruses and archae), including digestive microbiota (south countries) but not only (e.g. vaginosis and periodontal diseases). The aspect of microbiota is also largely integrated in a broader understanding of host-pathogen interactions, and how this may impact control and progression of infectious diseases.

Antimicrobial resistance and control of infectious disease in hospitals are also flagged research area, the latter benefiting from the connection with "Assistance Publique - Hôpitaux de Marseille" (AP-HM) and the original set up of the "Institut Hospitalo-Universitaire Méditerranée Infection" (IHU-MI) including care unit rooms.

The approaches are supported by advanced technologies and platforms available within the IHU-MI, including a table top electron microscope.

The approaches are for most discovery- and description-oriented, rather than in-depth mechanisms or hypothesis-driven.

They include a strong potential for translational research and diagnosis.

Overall, a fairly broad coverage from the eight teams within MEPHI of all aspects of infectious diseases including microbiota, discovery of ancient and new pathogens, immunobiology of host-pathogen crosstalk: from the single-cell to the clinic, human, animal and environmental megaviromes within microbiota, antimicrobial agents and resistance, cardiovascular infections, evolutionary biology, and innovative approaches to understanding and controlling contagions in hospitals.

HISTORIC AND GEOGRAPHICAL LOCATION OF THE UNIT

MEPHI is an UMR that was created in 2018 (director Pr Michel Drancourt and subsequently from 2019 Jean-Christophe Lagier) and has resulted from the split of URMITE (director Pr Didier Raoult) in two entities (the other entity is VITROME, director Pr Philippe Parola). The present and proposed next directors for MEPHI are Jean-Christophe Lagier and Bernard La Scola, respectively.

URMITE had in the past received tutelary support from AMU, IRD, CNRS and Inserm, while MEPHI is now only supported by AMU and IRD, since Inserm did not participate in the initial creation and CNRS withdrew in 2019. MEPHI is also a partner for "Assistance Publique - Hôpitaux de Marseille", AP-HM.

MEPHI premises are entirely located in the IH-MI (IHU-MI foundation, director Didier Raoult until August 2022 and Pierre-Édouard Fournier since then) building on the Faculty of Medicine campus (La Timone-Marseille). These premises host all eight MEPHI teams and the associated platforms. It also hosts the three other units, VITROME, UVE and SESSTIM.

The IHU-MI building represents 1700 m² of research laboratory space while 640 m² is dedicated to the technical platforms. The building also has 75 rooms for hospitalization and care units.

MEPHI also has a tight international engagement and partnership with countries in the south, notably Africa, through cooperation with IRD.

RESEARCH ENVIRONMENT OF THE UNIT

In recent years, research in MEPHI has mainly been conducted within the unit, thanks to research infrastructures and strong support from IHU-MI, although there are clearly collaborations with other laboratories from local institutes, e.g. CIML or CRCM. **[added by Hcéres: Investigations have revealed a highly problematic working environment (harassment).]**

MEPHI is initially part of IdEx A*Midex University foundation, which was the project presented by Aix-Marseille Université and its partners (CNRS, Inserm, IRD, CEA, AP-HM, Sciences-Po Aix, Centrale Marseille). The A*Midex University foundation was confirmed in 2016 and has adopted a new strategic roadmap in 2021 for the period 2021-2024.

MEPHI through its scientific output helped supporting the ANR grant for IHUs (2020-2025).

MEPHI is bound to the "École Doctorale" ED62 for training of PhD students.

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

Permanent personnel in active employment	
Professors and associate professors	24
Lecturers and associate lecturers	14
Senior scientists (Directeur de recherche, DR) and associates	4
Scientists (Chargé de recherche, CR) and associates	2
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnels (PAR)	24
Subtotal permanent personnels in active employment	68
Non-permanent teachers-researchers, researchers and associates	11
Non-permanent research supporting personnels (PAR)	7
Post-docs	2
PhD Students	73
Subtotal non-permanent personnels	93
Total	161

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

Employer	EC	C	PAR
Aix-Marseille Université	38	0	7
CHU Marseille	0	0	16
CNRS	0	4	1
EPST	0	2	0
Total	38	6	24

UNIT BUDGET

Recurrent budget excluding wage bill allocated by parent institutions (total over 6 years)	659
Own resources obtained from regional calls for projects (total over 6 years of sums obtained from AAP idex, i-site, CPER, territorial authorities, etc.)	5
Own resources obtained from national calls for projects (total over 6 years of sums obtained on AAP ONR, PIA, ANR, FRM, INCa, etc.)	1 186
Own resources obtained from international call for projects (total over 6 years of sums obtained)	732
Own resources issued from the valorisation, transfer and industrial collaboration (total over 6 years of sums obtained through contracts, patents, service activities, services, etc.)	0
Total in euros (k€)	2 582

GLOBAL ASSESSMENT

The MEPHI unit has formally emerged in 2018 from the split of the URMITE UMR in MEPHI and VITROME. This transition has not impacted the research activities within the now eight teams of MEPHI. VITROME has encapsulated most of the research around vector-borne diseases, while MEPHI kept a broader scope on the evolution/phylogeny of infectious diseases.

Both units, as well as UVE and SESSTIM, are hosted in the remarkable and very convenient infrastructure of the IHU-MI building on the campus of "Marseille-La Timone". This is an exceptional material working conditions at facilitates scientific production through the availability of well-maintained platforms for sequencing, bioinformatics, proteomics, microscopy or culturomics.

The unit benefits of important funding support from IHU-MI (platforms, PhD studentships, technical staff etc.) as well as from the region. The unit has also notable success in external funding, including ANR-supported or H2020-supported projects in connection with African countries. However, there is no ERC grant or other international prestigious grants.

There seems to be a perceptible fragility in the links with the classic French institutions, considering the absence of Inserm, CNRS and minimal and questionable future perspective between MEPHI and IRD. The major support of MEPHI thus remains AMU, together with IHU-MI. This would be largely sufficient from an operational perspective, but the position of MEPHI within the national and international portfolio will suffer from a too locally oriented visibility.

The research direction taken by MEPHI remains focussed on emerging pathogens and evolution of infectious diseases, notably through an original culturomics approach. The research is clinic- and diagnostic-oriented, with the aim of translating findings into therapeutic approaches hence the links with industries and the creation of start-ups. The role of MEPHI in SARS-CoV-2 surveillance and diagnostics has been huge during the Covid-19 pandemic and has taken a substantial amount of time/involvement from many of the teams.

The systematic and descriptive approaches taken by several teams in the unit has resulted in an impressive number of publications, which goes beyond expectations. **[added by Hcéres: This raises questions about the conditions for such massive production of knowledge and about the measures taken to guarantee its quality. Doubts about a number of recent publications should be taken into account, either because they have been given a "warning" by the publishers, or because they pose problems for "ethical reasons" or "illegitimate publications". According to Retraction Watch database, a total of 57 articles are the subject of an expression of concern by the editors, while three articles have been retracted. Assessments of "ethical concerns" and "illegitimate publishing" have been published in peer-reviewed scientific journals (Locher C et al. Publication by association: how the covid-19 pandemic has shown relationships between authors and editorial board members in the field of infectious diseases. BMJ Evidence-Based Medicine, 2021 - 111670; Frank F et al. Raising concerns on questionable ethics approvals - a case study of 456 trials from the Institut Hospitalo-Universitaire Méditerranée infection. Research Integrity and Peer Review, 2023; 8 :9). A recently published study involving the unit has been criticized by the ANSM for breaches of the legal framework that led to the acquisition of the data. It is therefore impossible to ignore this context, which has raised doubts about the ethical compliance with which certain studies were conducted, and about the consequences for the accuracy and value of the conclusions reached.]**

The unit is mainly visible through a few of the PIs and some of them have or will retire shortly putting some uncertainty on the future plan. The visit reveals that the current director Jean-Christophe Lagier is no longer candidate to lead the unit and that the deputy director Michel Drancourt will retire. Bernard La Scola is proposed as the next director and Oleg Mediannikov (IRD) as the deputy director, while the number of teams is brought from 8 to 5. This is a challenging time. One would need a careful monitoring regarding how the organizational chart falls into place and the new management demonstrates a new and forward looking strategy. Indeed, during the pandemic MEPHI leading researchers have been engaged in public disagreements and fierce controversies, involving media, authorities and the general public. This attitude, in many occasions, resulted in negative publicity thus questioning the scientific positions and managerial decisions of the previous IHU director. For the sake of the staff, it would be important to improve the scientific practices and the overall divisive communication strategy in order to start restoring the image of the unit.

Overall, the unit has delivered on many of the objectives such as surveillance for emerging diseases, new pathogens or antimicrobial resistance spread. There is still an element of risk that this research approach may not deliver on more conceptual findings, which are expected as makers of scientific excellence.

DETAILED EVALUATION OF THE UNIT

A - CONSIDERATION OF THE RECOMMENDATIONS IN THE PREVIOUS REPORT

Several weaknesses have been flagged in the previous evaluation which have only partly been addressed during this evaluation period.

Overall, the responses are rather direct and mostly considering internal decision from the management of the unit rather than an attempt to capitalise on what were appropriate and constructive remarks. Below is a summary of the main previous recommendations (*italicized*) and the comments of this committee on whether and how they have been considered.

Recommendation 1 in the previous report: MEPHI has clear capacity to publish high ranked papers, but these are a small proportion of the output. The focus should be on high quality publications rather than high volume of low ranked papers:

The number of papers published is indisputably exceptionally high, but one would rather want to see an increased proportion of very high impact papers. This is at least not reflected in the list of top papers presented by individual teams, since reviews, high impact paper preceding 2018, short notes, or non-leadership papers cannot be counted as very high impact papers.

Recommendation 2 in the previous report: The experts committee recommends to apply for EU grants, which are important potential sources of funding and provide an opportunity for the internationalization of the unit as they tend to work as an attractor for students from other European countries.

The answer as for the lack of European grants indicates that MEPHI has participated in several of these notably H2020-funded MicAfrica and MISTRAL, but it is unclear whether MEPHI is the coordinator in all of these grants, or simply the lead for one workpackage. MISTRAL involves research to correlate gut microbiota and HIV/AIDS relationship and is a large consortium. As for MicAfrica the main role of MEPHI is largely shotgun metagenomic of gut microbiomes. Overall, there are no ERC.

Recommendation 3 in the previous report: The unit is attractive at the national level (recruitment of permanent researchers by means of internal mobility or external recruitment). Attractiveness outside France (and outside the Infectiopole Sud network) may be improved. International visibility by presentations at main conferences in the field may also be improved.

The lack of participation to international conferences is indeed, as in many other places, due to the Covid-19 restriction. Yet the answer suggests that it is anyhow on purpose that MEPHI's staff does not travel to limit carbon print. This is a fair statement but that might be mitigated by the fact that early career scientists need to network and find opportunities to secure positions elsewhere. Moreover, it would help to bring more visibility to MEPHI and prevent its international (except south countries) isolation.

The preference to recruit internally is also biased and one should be prepared to be much more open to attract new talents who were not trained within MEPHI.

Recommendation 4 in the previous report: There should be improvement in recruitment of students from Europe. Similarly, the response to the lack of foreign post docs and PhDs is biased to the selection of individuals from the south countries and French speaking regions, which does not justify the exclusion of staff from other countries and thus the mis-opportunities of increasing mixed cultures and skills.

Recommendation 5 in the previous report: Progress should be made to improve gender balance at leadership level.

The gender balance was disrupted by the withdrawal of the CNRS and the departure of one female researcher in 2019.

Recommendation 6 in the previous report: The experts committee recommends to be vigilant on the PhD/HDR ratio. The organization of regular thesis committees with external reviewers should be enforced.

The ratio PhD/HDR looks too high even at an average of >3 thesis/HDR, considering that this is an average and some PIs still far exceed their supervision quota.

B – EVALUATION AREAS

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

Assessment on the unit's resources

The unit has excellent resources notably through the IHU-MI foundation and very good income from external funding.

Assessment on the scientific objectives of the unit

The broader objective of the unit to be a task force in the study and control of infectious diseases is excellent but deserves to go beyond the current descriptive approach.

Assessment on the functioning of the unit

The organisation of the unit has the potential to be excellent but is impacted by internal/external disagreements/controversies on how it operates, as well as by bias towards recruitment or communication strategy.

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

Strengths and possibilities linked to the context

MEPHI benefits of an extremely favourable material working conditions being hosted entirely in the new building of the IHU-MI, which also includes technical platforms, an infectious disease unit as well as administrative offices and teaching space. This connectivity and interface should reinforce multidisciplinary and translational research at the interface between basic science and clinically-oriented research.

The IHU-MI foundation not only hosts MEPHI but also other UMRs, namely VITROME, SESSTIM and UVE.

IHU-MI is also a source of funding to support special requests for equipment, technicians and doctoral studentships.

In addition to the IHU-MI infrastructure, MEPHI benefits from core funding provided by AMU and IRD. The average per year is 125 k€ and 30 k€, respectively (ratio 1/5). It is to be noted that staff is largely supported by AMU (overall salaries 3,700 k€) as compared to IRD (190 k€).

Weaknesses and risks linked to the context

The overall very comfortable environment of MEPHI is not necessarily reflected by the ability to secure large amount of external funding. Obviously, all teams have benefited from external grants over the years, and although this has been steadily increasing from 2018 to 2020 (250, 700, 900 k€), 2021 shows only 35 k€ in external income.

External funds are coming most essentially from ANR. This is noticeable but for the size of the unit the success is relatively modest since there are only two ANR grants reaching over 300 k€ of funding (Fungiplex and Farmresist). It is surprising considering that most of the staff are clinicians "*Hospitalo-Universitaire*", that there is little funding, other than two Covid-19-related, directly correlated to clinical research (PHRCs or "*Programme Hospitalier de Recherche Clinique*").

There are some European contracts (one from FP7, two from HORIZON, and one "*Consortium national et européen*") with only one H2020 supported grant where MEPHI has leadership (MISTRAL). There is no ERC.

Except for Fungiplex which started in 2021, most of external funding is ending in 2023 and there is no clear indication on the funding strategy or currently submitted grant applications.

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

Strengths and possibilities linked to the context

The scientific strategy of the unit is very clear although very broad on the investigation of infectious diseases at large.

MEPHI and VITROME (previous URMITE) are still connected through seminar series and scientific collaborations.

MEPHI's strategy could have represented a task force in responding to emergence of disease as exemplified by the response to the Covid-19 pandemic (PCR screening, one million tests, epidemiology data, clinical outcomes) and by excelling at characterizing novel pathogens, sequencing and surveillance. **[added by Hcéres: However, its clinical contributions have been notoriously controversial.]**

MEPHI also addresses some of the IRD objectives and notably through its engagement with countries in the south (Mali, Senegal, Niger). Notably MEPHI investigates health conditions associated with impact of malnutrition on microbiota (GDRI with UMR MIVEGEC and 15 other countries) or endemic diseases linked to mycobacterial species.

MEPHI has good interactions in the local context, notably with "*Région Sud*" (PACA) that is financing two PhD students as well as with local industries since nine Cifre students were hosted by MEPHI.

MEPHI was also very successful with start-ups creation in the past, and MediHandTrace, created in 2015 was sold to CHRYSTSEN France in 2019.

Weaknesses and risks linked to the context

The nature of MEPHI's work on infectious diseases obviously addresses very important societal challenges. However, direct impact on society or economy is not clearly stated.

The filing of sixteen patents is reported but there are only five deposited during the period (three in 2018 and two in 2019). Overall, the licensing status of all these previous patents is not clear.

There is only one start-up that has been created during the period (Techno-Jouvence in 2019 and with UMR VITROME). In comparison, many significant start-ups were created in previous years, for example with Pocrame in 2014, Culture Top in 2015, Gene & GreenTK in 2013 or Xegen in 2012.

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

Strengths and possibilities linked to the context

MEPHI organisation in terms of providing a "*Welcoming pack*", internal and safety regulation, prevention of bioinformatic breaches, etc. is documented in the report and in agreement with the corresponding charts. The unit welcomes and trains numerous staff and students coming from countries in the south.

The overall gender balance in the research unit is good (46 men and 36 women).

The NSB3 laboratory appears to be under strict regulation, and under the responsibility of a principal investigator as well as a safety assistant.

Weaknesses and risks linked to the context

Although the gender balance is overall good, women leadership in the unit is lacking. This was in the previous recommendations and has not yet been acted on.

The unit should be commended for its approach on reducing carbon print, but dissemination of work at international conferences is essential and cannot only be accounted for using virtual conferences or seminars.

Favouring French speaking post doc is laudable but could be seen as discriminatory and results in partial isolation from the international scientific community.

The functioning of the unit has been under a very authoritarian management when still embedded within the unit URMITE. Moreover, the presence of the previous URMITE director in the MEPHI unit has crystallised attention from the media and press. **[added by Hcéres: As well as numerous peer reviews during the Covid-19 pandemic. From its meeting with the technical staff, the committee learned that unit members experienced a painful feeling from the deteriorated public image of the unit, from the long lasting scrutiny of the media and from the ongoing administrative and legal actions initiated by French authorities in response to issues raised by the very authoritarian management (see above).]** The leadership of the current director is totally different and far softer. Yet the committee was not convinced that the current director could lead the unit outside of the current swirl, which is also indicated by his wish not to be reconducted for the next mandate for which the proposed director is Bernard La Scola.

EVALUATION AREA 2 : ATTRACTIVENESS

Assessment on the attractiveness of the unit

The unit has an excellent infrastructure to perform research, but the attractiveness is only very good considering a moderate level of international/major external funding (proportionally to the size of the unit) or recruitment of post-docs and staff outside Marseille or the south countries.

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

Strengths and possibilities linked to the context

Some unit members are members of learned societies, such as two members being fellows of the international society of antimicrobial chemotherapy, one person of the unit became a "*membre honoraire of the Institut Universitaire de France*", IUF, and one member was elected junior fellow of IUF.

The researchers of the unit participate as members or directors in scientific societies, mainly in France (e.g. FNSF - Associations – "*Fédération Nationale Solidarité Femmes*", "*Centres de compétences régionaux labellisés – mucoviscidose*", "*Centre de références hépatites virales*", "*Centre de Compétence des Cardiomyopathies*", "*Conseil Scientifique Société Française d'Allergologie*", and others), but also on the international level (e.g., ESCMID: European Society of Clinical Microbiology and Infectious Diseases, European Committee on Antimicrobial Susceptibility Testing (EUCAST), ISC: International Society of Chemotherapy for Infection and Cancer, and others).

Members of the unit participated in the organisation or organized conferences such as EuroValve (2018 Italy, 2019 Spain, 2020 and 2021 Belgium), 22nd and 23rd Evolutionary Biology meeting (2018 and 2019 France), 31th ICC and 4th GCCMID in 2019 (Dubai, United Arab Emirates).

Several members of the unit were or are, guest or special issues editors, some are associate editors and importantly two chief editors. One was for "*Human microbial genome*" (2018-2021) and the other for "*International Journal for Antimicrobial Agents*" since 2015, which has remarkably progressed in terms of notoriety under his leadership.

Weaknesses and risks linked to the context

Members of the unit do not often participate at international conferences, as by decision of the unit management, and their favoured/significant connections/destinations/collaborations seem to be most exclusively with the south countries. This is important in the context of infectious diseases but engaging more widely the international scientific community seems essential to guarantee larger visibility and attractiveness.

Furthermore, the participation of junior members at national and international conferences is extremely important for their education and career development, and not encouraging this will result in missed opportunities.

There are many interactions opportunities with the local institutes involved in microbiology, bacteria-host interactions or infectious diseases, some are mentioned like with CIML or CRCM, but they do not seem to be corresponding to major collaborative efforts.

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

Strengths and possibilities linked to the context

The lab attracts many PhD Students (174) mainly from French speaking areas of Europe and Africa but not from abroad. In many cases, funding sources are cited as "undefined". Others are quoted as CD ("*Contrat doctoral uniquement recherche*"; 15), CDE ("*Contrat doctoral avec activités complémentaires- e.g. enseignement*"; 1), ETR ("*Financement étranger*"; 18), Cifre ("*Convention industrielle de formation par la recherche*"; 9), COLLTERR ("*Collectivité* " 2), INDUSTRI ("*Contrat industriel*"; 2), and ATER ("*Attaché temporaire d'enseignement et de recherche*"; 1).

The IHU-MI foundation offers a state of the art infrastructure, including several platforms (PRIMMI – "*Plateformes de Recherche et d'Innovation Mutualisées Méditerranée Infection*"), such as microscopy, MALDI-TOF or genomics. Furthermore, the IHU-MI foundation directly allocates doctoral grants (annual call and likely many of the above PhD students might be recipient of such grant) and supports the development and maintenance of the technical platforms (European commission support).

The committee has been told that all new members of the unit are trained for safety and for deontology and scientific integrity, for which courses are available on Ametice [added by Hcéres: *[[22-23]-M1.S2.BS.Déontologie en santé et intégrité scientifique*] and through a MOOC, respectively. However, the committee was unable to assess the impact of this training on current research practices.]

Weaknesses and risks linked to the context

Judging from the report of auto-evaluation, the hosting policy is defined by the unit as excellent but this seems to be discordant with ongoing procedures led by French authorities. However, this goes beyond the prerogative of the Hcéres committee as the latter can only evaluate on the basis of the auto-evaluation report and interviews with staff.

The ratio of PhD students to mentors/HDRs is far too high to guarantee a continuous and adequate training, although there were no direct issues flagged in the committee meeting with the students present on the day of the interview. There are currently 56 research staff members of which 32 HDRs (total of 82 staff with technician and administrative personnel). The average is about three PhD/HDR, and this is an average while some PIs probably far exceed the supervision quota from AMU, which is likely 1.5 PhD/supervisor.

Despite apparent broad international collaborations, which is based on publications co-authorships and not necessarily on direct engagement with other institutions, the unit does not attract renowned researchers, even for short periods.

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

Strengths and possibilities linked to the context

The senior members of the unit have obtained several competitive grants, mainly on the national level and from collaborations with the South (Tunisia, Senegal, Egypt).

In particular, two ANR-supported projects were obtained in 2021 (Fungiplex (Co-I) – 355 k€ and parcourspreHospCovid19 (Co-I) – 74 k€), one in 2020 (ImmunoCovid (PI) – 60 k€) and one in 2018 (FarmResist (Co-I) – 354 k€). All other ANR-supported projects were obtained before the evaluation period.

The unit also has private contracts as leader: two contracts from the PHRC/RIPH program ("*recherche impliquant la personne humaine*" - total of 300 k€) and two from the "*institut universitaire de France*" (15 k€/an) but obtained in 2014 and 2017 so before the evaluation period.

One member of the unit also obtained a PIA-ANR-funded grant (RHU Lumière for 489 k€, obtained before the evaluation period in 2016 and which has ended in 2021).

There are European contracts and notably two from the H2020 program involving the south countries, MicAfrica (Co-I) for 170 k€ over 2021/2023 and MISTRAL (PI) started in 2019 for 730 k€. There is also an Infect-era grant within the framework program FP7 (Co-I) but obtained in 2016 and ended in 2019.

What seems to be the largest grant is a vast national consortium called EMERGEN – "*Surveillance pathogènes EMERgents via la GENomique microbienne*", started in 2021 and with about 2.8 M€. It is mainly about Covid-19 surveillance and variants identification.

Weaknesses and risks linked to the context

External funds are noticeable but according to the size of the unit, the success is relatively modest and the fact that most of the external funding is ending in 2023 may be worrying.

The unit obtained some European competitive grants but no ERC grants.

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

Strengths and possibilities linked to the context

The unit has access to many technical platforms, e.g. genomics and bioinformatics, mass spectrometry and chromatography, BSL3 culture lab, and table top electron microscopy. The unit is thus using these facilities and developing new techniques with success.

Weaknesses and risks linked to the context

The unit is not directly responsible for a technical platform. However, the bioinformatic platform is barely to be differentiated from Team 7, whose PI may then be seen as a platform manager rather than a team leader.

EVALUATION AREA 3 : SCIENTIFIC PRODUCTION

Assessment on the scientific production of the unit

Although the overall volume of scientific productions is overwhelming, its qualitative level, notably those of publications is very variable from good to very good, with few truly influential publications.

Doubts raised about a number of recent publications must be taken into account, either because they have been given a "warning" by the publishers, or because they raise problems for "ethical reasons" or "illegitimate publications". According to Retraction Watch database, a total of 57 articles are the subject of an expression of concern by the editors, while three articles have been retracted. A recently published study involving the unit has been criticized by the ANSM for breaches of the legal framework that led to the acquisition of the data.

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

Strengths and possibilities linked to the context

The quantitative level of publications of the unit is very high. In four years (2018-2021) the unit published 1,438 papers, which is 360 papers a year so basically one paper per day.

Most papers are as expected published in specialized journals in Microbiology (548) and Infectious diseases (467), which makes the visibility of the unit in this area undisputable.

The number of papers published is very good in any of the eight teams of the unit, which suggests strengths in all the research areas in which the unit is engaged.

There is a good number of books (4) that have been edited by members of the unit, notably on evolutionary biology (Team 7). There are also about 20 book chapters published by unit members and this time almost across all teams (1, 3, 4, 5 and 6).

Weaknesses and risks linked to the context

The quality of publications is very variable and truly influential publications, including in generalist journals, which will flag the greatest novelties in any field of research, are rare (particularly in the top selected papers for each team).

There are many papers that result from collaboration and co-authorship, which may dilute the core production of the unit's PIs.

Many papers are also posted in preprints depository, notably in the field of Covid-19, which should be considered cautiously until published in peer-reviewed journals. [**added by Hcéres:** Doubts about a number of

recent publications must be taken into account, either because they have been given a "warning" by the publishers, or because they pose problems for "ethical reasons" or "illegitimate publications".]

There are no reports from conference or congress listed, which does not correspond to the very high production of the unit and thus questioned the scientific dissemination strategy of the unit.

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

Strengths and possibilities linked to the context

The quantity of papers published by the unit goes well beyond the usual ratio of expected publications compared to the number of staff involved.

Weaknesses and risks linked to the context

Whereas the number of papers is high within each team, it is somehow clear that it is not equally spread across all PIs of the teams. It is also clear that the overall output is resulting from the very high productivity of some of the scientists in the unit, which may be daunting for some of the other PIs.

There are two teams (1 and 3) which represents about 95% (1,354) of the total number of publications (1,438). Team 1 in particular has 775 publications (almost one paper every two days over the period), which likely denotes the descriptive approach of the unit rather than in-depth understanding.

[added by Hcéres: *This very large number of articles raises questions about the research unit's publication strategy, which appears to be a race to publish rather than a search for a balance between the number of publications and the quality of these publications.*]

The policy of authorship is not entirely clear, since some PIs co-sign multiple publications throughout the unit, sometimes even as first author. In particular the previous director of URMITE is now a member of team 1 and appears as an author in numerous publications, which may raise the question of *authorship by duty*.

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

Strengths and possibilities linked to the context

The great majority of the papers published by MEPHI is in open journal papers (1,075 out of 1,473), which provides rapid access and visibility of the data published. Newcomers are introduced to publication rules: "As explained to all new arrivals, the laboratory's publication rules are based on those of the American Medical Association, AVIESAN and CNRS".

Weaknesses and risks linked to the context

Although not mentioned in the report of auto-evaluation, there are several ongoing inquiries from the French authorities and governmental bodies, which cast doubts on the overall integrity of procedures that have involved some of the unit's members. However, as stated earlier, scientific evaluation of the Hcéres committee is solely based on the unit auto-evaluation report.

EVALUATION AREA 4: CONTRIBUTION OF RESEARCH ACTIVITIES TO SOCIETY

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

The inclusion of the unit's research in society is very pronounced, notably considering the strong commitment during the Covid-19 pandemic, but it is dampened by poor communication strategies, which splits the opinion/position of the public, of the scientific community, of the stakeholders and governmental agencies.

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

Strengths and possibilities linked to the context

The unit has very strongly responded to the Covid-19 crisis notably through surveillance, sequencing and diagnostics. Diagnostic is not only Covid-19 but also Q fever and allergic aspergillosis for example. This also involves point of care diagnosis remote from medical laboratory.

The unit also provides recommendation on antibiotic resistance strategies (e.g. HAS, EUCAST) or management of endocarditis. The unit was also involved in the NGS protocol for SARS-CoV-2 variants detection. The unit also provides references for the care of highly contagious patients for the "Direction Générale de l'Offre des Soins" (DGOS).

Several PhD students are funded by non-academic partners (e.g. CEVA, Cifre, "Région Sud").

There are several existing collaborative projects with industrial partners including in the context of ANR projects (e.g. Fungiplex with Macroarray diagnostics or Flash Covid with Beckman Coulter) or thesis funding (Enovacam company, Amoeba Company, L'Occitane or BioSella).

There are existing contracts with companies with therapeutics objectives, such as ImCheck Therapeutics and Genoscience Pharma, and also contracts for the development of pro- and prebiotics (AMU and L'Occitane).

Weaknesses and risks linked to the context

Some teams (e.g. Team 1) in the unit have decided to no longer engage with pharmaceutical industry in human health, which considering the unit activity in infectious diseases does not make sense.

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

Strengths and possibilities linked to the context

The unit is active on filing patents (25) and engaging industrial/technological links (Hitachi and laptop microscopy).

The unit also created one start-up (Techno-Jouvence) and continued the participation in other start-ups PROCRAMÉ, Culture-Top, Biosqual, Arthrobac Pharma, Xegen Company, MediHandTrace (sold to CHRYSTSEN in 2019), GENE & GREEN TK.

Weaknesses and risks linked to the context

The nature of the work on infectious diseases in relation with industry raises the question of determining what could be published and what should be intellectually protected which may impact the immediate visible output of PhD students and a risk if they want to continue in post-doctoral research elsewhere.

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

Strengths and possibilities linked to the context

Some unit members participate constructively in influential debate on recommendation about various infectious disease-related questions under the authority of the Minister of Health and the "Haut Conseil de Santé Publique".

The unit communicates through the IHU-MI foundation YouTube channel about the various ground-breaking findings or scientific activities (e.g. faecal transplantation, Covid-19, plague and ancient microbes...).

Several members of the unit are also regularly invited to comment in local newspapers and TV channels but also nationally (TF1, France Info, RTL) and internationally (BBC, Le Temps suisse).

The unit (Team 2) organised a conference from plague to Covid-19 in 2020 in Marseille.

Members of the unit engage with schools, including the Declics operation, which connects scientists and high school pupils.

Weaknesses and risks linked to the context

The unit has widely been in the press and media during the Covid-19 pandemic and very often on controversial issues. This has resulted in an advertising [**added by Hcéres: which has been detrimental to the overall reputation of the unit and the institute**].

C – RECOMMENDATIONS TO THE UNIT

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

The unit should apply for more prestigious funding such as ERC. Furthermore, most of the staff are clinicians/"*Hospitalo-Universitaire*" and one can only recommend that the level and number of PHRC-funded grants be significantly increased. A long-term strategy with individual grants lasting more than three years would put the unit on very solid ground.

The leadership and management from the previous director of URMITE and of the IHU, Pr Didier Raoult, has raised number of questions, and set MEPHI and the IHU in troubled times during the pandemic. There are clear discrepancies on how this management was perceived from within MEPHI or from outside. The meetings with the research staff, technical staff and PhD/Post-docs have suggested that the atmosphere within the unit is good, although these meetings were poorly attended and not necessarily representative. It was clear from the technical staff (only five present out of 26) that there was a weariness about events from the last three years involving investigations from the government, IGAS ("*Inspection Générale des Affaires Sociales*") and ministry of education. Instead, the discussion with the representative of the various institutions (AMU, IRD, new IHU director) has flagged the fact that a change is needed to revert the negative perception. The IHU, and thus MEPHI, is losing connections with most of the scientific world beyond Marseille and that should be re-instated and re-invigorated. This is possible with the quality of the existing members, but it is needed that a new turn be taken, the past left behind and new blood brought in. Scientific directions such as the impact of hydroxychloroquine are still pursued despite widespread critics from peers. Outcome from a new cohort of 30,000 patients is expected to confirm previous claims. There is no doubt that in science trying is always good, but persisting can be dangerous.

The plan for the future project was presented during the interview. This is a good timing since many existing researchers will retire shortly, including the lead PI for team 2, a PI from team 3 currently deputy director for the doctoral school (ED62) or the lead PI of team 6.

The unit is redefined with five teams around culturomic, genomic, AMR, microbiota, and host pathogen-interactions. There is no plan for major new recruits and that should be encouraged including for example in immunology and genetics.

The current team 8 will stop at the end of the present contract as well as team 7. Philippe Levasseur (team 7) and thus the bioinformatic platform will move to VITROME. Although this expertise might still be available to MEPHI. It is important to guarantee that the extensive work of MEPHI in omics analysis will be feasible in this new context.

The proposed director is Bernard La Scola, while the proposed deputy director is Oleg Mediannikov. This should be clearly communicated to all parties involved (AMU, IHU and IRD) and should be totally transparent and supported from within the unit, which was not clearly the case.

Whereas MEPHI is firmly anchored with AMU, the future with IRD seems quite uncertain. The direction of MEPHI should provide guarantees on what their view on IRD research/priorities are and engage a constructive dialogue with the IRD direction. Several projects involved the collection of many samples from Africa but the unit should go beyond that and not only work in Africa but for Africa.

The ratio of >3 PhD/HDR is too high and although there were no complaints of students present at the meeting (but only five out of 26 were present) during the interview, this should be corrected.

Recommendations regarding the Evaluation Area 2: Attractiveness

It is obvious from the organigramme that there is an absence of gender parity at key positions with no women leading a team for example. This is partly addressed in the new organigramme with Laurence Camoin co-leading the new team 3 (host-pathogens interactions in cardiovascular infections) and Virginie Monnet-Corti co-leading the new team 2 on "oral microbiota", but it would be recommended to have plans in place to promote and recruit other women on key positions.

The policy of the unit to refrain from travelling is laudable from an ecological perspective, but has to be adapted to the needs for effective international contacts. Indeed, there should be a right balance to be found which would allow engagement of unit members in international conferences to promote/disseminate the work as well as encouraging networking of early career scientists to favour their professional trajectory.

The recruitment of international post-docs should be increased (only few and exclusively from south countries). Here also the re-engagement of the unit in more intense exchange-collaboration at the national level but also within Europe and the rest of the world is encouraged to prevent a risk of isolation.

Attractiveness is also linked to research excellence. Key examples of scientific outputs, which make the unit a place to be, should be better flagged. Listing publications could be impressive but understanding their scientific impact is even better. In particular the report of auto-evaluation was not illuminating high scientific outcomes and the selected publications not necessarily high profile. Simply referring to the lists and tables to demonstrate excellence can have shortcomings. In this respect the attitude of the unit members towards future evaluation committees should be taken more seriously and the whole unit should show interest in such event to demonstrate cohesion and enthusiasm for the project.

Recommendations regarding Evaluation Area 3: Scientific Production

The publication strategy seems to be guided by obtaining as many papers as possible. This is not the best approach for the unit to be commended for its scientific excellence. The overwhelming number of publications could be counterproductive as seen during the various presentations of the teams, which was mainly listing long series of papers without providing clear insights on what are the breakthroughs and most important publications. It takes time to bring observations to higher impact and this should be considered carefully. The lack of mechanistic approaches, the few in-depth studies, and the declared strategy of performing descriptive research, are not a strong indicator for attracting collaborations from renowned laboratories or institutions world-wide.

The above has already been flagged in previous evaluations but has not yet been considered. This race to publication could be linked to the mechanism of Sigaps points and the income it generates for institutions conducting medical research. Yet higher profile publications would certainly lead to higher level of external and high-profile funding.

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

The very tumultuous period of the Covid-19 pandemic with the many press releases and media interventions has overall not casted a bright light on the unit. This is something that should quickly left behind by taking clear and unambiguous scientific positions, avoid isolation and find new leadership.

The unit is doing an excellent work on creating start-ups and filing patents. Yet it becomes important that some of these patents be licensed.

TEAM-BY-TEAM ASSESSMENT

Team 1: Microbiota
 Name of the supervisor: Mr Jean-Christophe Lagier & Mr Oleg Mediannikov

THEMES OF THE TEAM

Team 1 is mainly interested in isolating, culturing and characterizing new microbial species, what the team denominates as culturomics. Through this identification of new microbial species, the team is also interested in developing improved methods for this aim, e.g. table top scanning electron microscopy, and in the analysis of the human microbiome. During the Covid-19 pandemic, the team also intensively studied SARS-CoV-2 and its effects on patients.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

Recommendation 1 in the previous report: It would be useful for the team to recognize that correct science eventually becomes mainstream science. A less adversarial approach to the rest of the scientific community would be useful, as it would both allow them to communicate their findings and vision more effectively and also improve on their own weaknesses.

No progress has been made concerning this point.

Recommendation 2 in the previous report: The team leader might delegate more PhD direction to senior scientists holding an HDR (7).

The team is now co-led by Oleg Mediannikov (IRD DR) and Jean-Christophe Lagier (APHM/AMU PU-PH in Infectious diseases). Didier Raoult is now Emeritus Professor. This should ameliorate the PhD students' supervision.

Recommendation 3 in the previous report: There is a large number of interesting discoveries, but an effort in deepening the understanding of the scientific and biological context, as mentioned as weakness in the previous report (Weaknesses: The downside of the "discovery approach" is that few new findings are followed up with more in-depth functional, computational or statistical analyses), is not apparent.

No progress has been made concerning this point.

WORKFORCE OF THE TEAM

Permanent personnel in active employment	
Professors and associate professors	4
Lecturer and associate lecturer	3
Senior scientist (Directeur de recherche, DR) and associate	1
Scientist (Chargé de recherche, CR) and associate	1
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	4
Subtotal permanent personnel in active employment	13
Non-permanent teacher-researchers, researchers and associates	4
Non-permanent research supporting personnel (PAR)	1
Post-docs	1
PhD Students	18
Subtotal non-permanent personnel	24

Total	37
--------------	-----------

EVALUATION

Overall assessment of the team

This team has published an unusually large number of articles. The publication strategy is essentially to produce as many articles as possible, regardless of quality. The impact of these publications according to the team's themes is therefore very heterogeneous. For example, those relating to the Covid19 are highly controversial and have given rise to several expressions of concern by noteworthy publishers and learned societies. Those relating to culturomics are more satisfactory. Communication activity on the Covid-19 was very intense but often inappropriate. The programme is very attractive to french-speaking PhD students.

Strengths and possibilities linked to the context

The strength of the team is the reactivity to clinical situations, e.g. analysis of the milk in breast feeding women in Africa, or the analysis of patients from the recent pandemic.

The team has a large publication record with a total of 775 publications from 2018-2021. Part of this large number is due to the co-authorship by the former director of IHU.

A clear asset of this team is the culturomics of so far unidentified or non-cultured bacteria, i.e. more than 750 new bacterial species identified. The team has successfully developed methods for this culturomics approach. The team has published overviews on culturomics in 2018 in Nature Review Microbiology and in 2020 in Clinical Microbiology Review. The culturomics approach, combined with metagenomics, is also an important aspect of a H2020-funded project, MISTRAL, of which Team 1 is part and which addresses the relationship between gut microbiota and HIV/AIDS.

A productive collaboration with Hitachi was established to develop the use of table-top electron microscopes (three available in the unit) for microbiological diagnostic.

Over the period 30 PhD students have secured their degree, several of them being co-supervised by PIs from other teams in the unit.

Weaknesses and risks linked to the context

The team has a very disperse research activity following different opportunities and no particular in-depth research project. This is spread across culturomics approach; microbiota in health and diseases; or One Health approach including microbiota, zoonosis and environment.

The number of publications is not an absolute criteria of quality as exemplified by the hydroxychloroquine mediatized topic (e.g. the huge number of citations is mainly due to controversial papers in International Journal for Antimicrobial Agents, a journal with an Editor-in-chief member of MEPHI).

The team was clearly suffering from lack of self-criticism, which is counterproductive for the recognition of the many interesting reports. Both in the text of the report of auto-evaluation and during oral presentation, the members of the team are presenting themselves as "among the world's leaders", but without convincing arguments for these assertions. Indeed, what has been presented to the committee was very general statements, rendering difficult to really know exactly what key achievements have been achieved.

The team has few post-docs (in fact 1), few invitations in prestigious congresses and lacks major external grants from ANR or ERC support.

RECOMMENDATIONS TO THE TEAM

For a national and international recognized visibility, it is necessary to focus on few important subjects chosen by the team and to deepen the insights.

Team 2: Discovery of ancient and new pathogens
Name of the supervisor: Mr Michel Drancourt

THEMES OF THE TEAM

Team 2 performs "curiosity driven" research to detect new pathogens potentially associated with human health. It uses established and new techniques to do so. Interestingly, it also combines humanity sciences (e.g. the analysis of ancient texts) to understand evolution of human diseases (particularly plague caused by *Yersinia pestis*). The field of analysis is very large ranging from skin microbiome analysis in Burkina Faso (Africa) to the search of Archaea or Nanoarchaea in human dental plaque from patients in Marseille.

Four research axes are followed by the team including paleomicrobiology, the identification of Archaea (and Nanoarchaea) in human liquids and body sites, the study of Mycobacteria, and the development of new tools or improving existing tools for diagnostic purposes. This activity is in collaboration with on-site start-up companies, e.g. Gene&GreenTech, POCRAMé and Culture- Top.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

Recommendation 1 in the previous report: To enhance its reputational profile, the team should consider organising an international meeting on an aspect of the team's research. They should consider strategies to attract students from Europe or English speaking countries. Such a very highly cited and highly publishing team should be able to attract the best students from abroad.

In 2020 the "Région Sud" organised a meeting "Méditerranée du Futur" with the subject: «1720-2020: De la peste au Covid-19, 300 ans de résistance aux pandémies en méditerranée», where the team and other members of the unit were involved. Nevertheless, this was probably not a scientific meeting as suggested by the previous recommendation, where scientists from all over the world presented their data in scientific sessions.

Recommendation 2 in the previous report: One might suggest that a website be created to promote the patented and, if any, licenced products.
Not addressed.

Recommendation 3 in the previous report: The experts committee recommends to ensure that students have support for issues other than related to research. The doctoral school stated that this is normally in place but is currently suspended. There should be a senior "contact" person whom the students are made aware of and who can be the first point of contact for issues with supervisors or other mentoring (non-academic research) problems.

According to the information obtained from the students, they do not have an external mentor.

Recommendation 4 in the previous report: The experts committee recommends to increase active international engagement.

Other than in the South, no international engagement occurred.

Recommendation 5 in the previous report: The experts committee recommends to consider extending the pipeline of new taxa detection and characterisation to include biology and disease association with groups in MEPHI or new invited groups to MEPHI or external collaborators. Consider discussions with appropriate teams with MEPHI and explore whether there is any value in starting a new project on the influence of the existing microbiome in the infection process of species being studied.

Internal collaborations do exist.

Recommendation 6 in the previous report: The palaeomicrobiology studies could be re-enforced by paleogenomic approach which could be strengthened by collaborations.

No paleogenomic approach was mentioned.

WORKFORCE OF THE TEAM

Permanent personnel in active employment	
Professors and associate professors	3
Lecturer and associate lecturer	2
Senior scientist (Directeur de recherche, DR) and associate	0
Scientist (Chargé de recherche, CR) and associate	0
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	7
Subtotal permanent personnel in active employment	12
Non-permanent teacher-researchers, researchers and associates	3
Non-permanent research supporting personnel (PAR)	0
Post-docs	0
PhD Students	17
Subtotal non-permanent personnel	20
Total	32

EVALUATION

Overall assessment of the team

The scientific production is very good. Inclusion in society is very good. Attractiveness is very good with a couple of external grants. The overall assessment is very good, although the research carried out by the team remains at a very descriptive level. Other than in the South, no international engagement occurred.

Strengths and possibilities linked to the context

The strength is clearly the curiosity that drives the research of team 2. The approaches are diverse and the inclusion of humanity sciences is interesting.

The team has a large publication output in a variety of different journals dealing with basic and clinical microbiology. It includes Scientific Reports, BMC Genomics, Anaerobes, and more clinically-oriented journals such as J. of Clinical Medicine, Clinical infectious diseases, American J. of Tropical Medicine & Hygiene, Clinical Microbiology and Infection.

The team published 199 articles (over 80 with members of the team as first or last author), of which 131 in collaboration with other groups of the unit. It also published or contributed to 23 reviews. PhD students from team 2 were part of 59 publications.

The research topic that aims to report new or so-far undetected microorganisms related to human health reveals interesting questions, e.g., the association and communication of *M. ulcerans* with fungi, the presence of Archaea in febrile patients. The team also successfully performed paleomicrobiology in isolating and identifying bacteria from ancient sources and developed new techniques, such as paleoserology to analyse ancient material (dental pulp).

Members of the team participated at a few occasions in the knowledge distribution to the large public, such as in the television and newspapers.

Weaknesses and risks linked to the context

The reported data remain descriptive and, although revealing interesting questions, remain without answer in the absence of further investigations that could bring important insights in human diseases.

The research is technology- and not hypothesis-driven. It does not follow a research axis other than "curiosity".

RECOMMENDATIONS TO THE TEAM

The team should decide when a reported finding is really important and then follow up the investigation to show whether or not the reported data are relevant for human diseases.

Team 3: Immunobiology of host-pathogen crosstalk: from single-cell to clinics
 Name of the supervisor: Mr Benoît Desnues & Ms Joana Vitte

THEMES OF THE TEAM

Team 3 is focused on different aspects of immunobiology of host-pathogen crosstalk. Notably, they study pathophysiology caused by intracellular bacteria with a tropism for myeloid cells causing infections linked to clinical conditions (*Coxiella burnetii* causing Q fever and *Tropheryma whipplei* causing Whipple's disease); this has been the major research topic of the team for two decades positioning them as world leader. The expertise of the team was utilized to study:

1. SARS-CoV-2 infection;
 2. Host-factors influencing susceptibility and evolution of infection also in the context of pregnancy;
 3. Interplay between allergies and host-microorganism interactions.
- Clinical specimens and murine models of infection are the basis for contributing to translational and basic knowledge.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

Several recommendations were provided to Team 3; some of these were not addressed.

Recommendation 1 in the previous report: Whenever possible, pursue the leads provided by the high-throughput analyses towards a more focused "functional" investigation, that will increase the usefulness and visibility of the data generated.
 Not addressed.

Recommendation 2 in the previous report: The experts committee recommends to remain focused on a limited number of pathogens and cell types/pathology, in order to keep a synergy between projects developed in the team. Some aspects of the project need to be thought into more details, in order to increase the probability that "fishing" expeditions will be fruitful. Mechanistic and hypothesis-driven approaches should complement beneficially the activity of the team.
 Not addressed.

Recommendation 3 in the previous report: The team should work on gaining more visibility at the national and international level.
 This comment was addressed and visibility of the team was improved by depositing publications in preprint archives such as MedRxiv or BioRxiv, the IHU-MI website, and by publishing results in open access journals.

Recommendation 4 in the previous report: The expert committee recommends to give more visibility to members of the team by sharing direction of students, or even give full direction to other senior researchers.
 This comment was addressed and visibility of members of the team was improved through participation in scientific meetings, seminars and webinars, which allow communication and discussion of results.

WORKFORCE OF THE TEAM

Permanent personnel in active employment	
Professors and associate professors	6
Lecturer and associate lecturer	3
Senior scientist (Directeur de recherche, DR) and associate	1
Scientist (Chargé de recherche, CR) and associate	0
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	0

Subtotal permanent personnel in active employment	10
Non-permanent teacher-researchers, researchers and associates	0
Non-permanent research supporting personnel (PAR)	0
Post-docs	0
PhD Students	11
Subtotal non-permanent personnel	11
Total	21

EVALUATION

Overall assessment of the team

The scientific production is excellent. Inclusion in society is excellent. Attractiveness is very good, but very poor towards post-doctoral fellows. The overall assessment is very good. However, the team is absent from the scene of competitive calls for projects. Mechanistic and hypothesis-driven approaches are far too absent from the team's scientific strategy.

Strengths and possibilities linked to the context

The group emphasizes their alignment to ethical recommendations and regulations in relation to utilization of human blood and tissue specimens and work with murine models.

To address the complexity of tissue models, the group has developed placental and intestinal organoids to be used for identification prognostic and diagnostic markers.

Approximately 260 articles have been published by the team with over 150 publications contributed by the different tenured members of the group as first or last authors (57%). A quarter of the publications were obtained in collaboration with international teams and approximately 60% of the articles by the group was published in journals of solid reputation. The group publishes mostly in speciality oriented journals and, sometimes, in journals of large audience, including journals of the Lancet family and Science. All professors and tenured scientists contribute to scientific publications of the unit. Over 140 publications by the team have one (or several) PhD students from the team included as author.

The group has strong cooperative links with immunologists at "Centre d'Immunologie de Marseille-Luminy" (CIML) infectious diseases physicians at IHU-MI, histologists (team 6).

Emphasis was given to increase visibility of the scientific production of the team through participation in scientific meetings and publications in open access journals and preprint servers.

Ten PhD students have completed their thesis during the evaluation period with an average of 6.8 publications/student. One post-doctoral fellow working in team 3 published 35 articles. There are four tenured researchers with HDR within the unit to train a total of seventeen PhD students.

The thematic diversity of the team can be viewed as a strength, which gave the possibility to respond to SARS-CoV-2 epidemic.

The team collaborates with several industrial partners, including ThermoFisher Scientific and Beckman Coulter and the training of four young doctors was supported through Cifre contracts.

The team addresses societal and technological challenges with non-academic partners, including pharmaceutical companies and the AMU midwifery school. The team has developed diagnostic test to monitor IL-10 levels in patients with Q fever and aims at developing assays to characterize allergies to food components.

An important collaboration was established with the French national blood bank through the use of placental stem cells for the conservation of corneal grafts.

The team contributes to the drafting of recommendations for national bodies including HCSP, IHU-MI, AMU, IRD; One member of the unit participates in the AMU research committee and leads the work of the scientific council.

The team has a comprehensive record of outreach activities.

Weaknesses and risks linked to the context

The team reports the absence of tenured technical staff. It is a limitation that research protocols are maintained by PhD students and post-docs as this may represent a problem for scientific quality and continuity.

The team did not obtain important funding; and it should be noticed that 3 of the four grants received were obtained by the same scientist in the team. This may have been dictated by the large amount of work conducted by the team with SARS-CoV-2.

The thematic diversity present within the team may also represent a point of risk for this team as the topics in which the different PIs engage are very diversified.

It is remarkable that the unit does not enrol at the moment post-doctoral fellows.

No patents were taken during the evaluation period.

RECOMMENDATIONS TO THE TEAM

It is of relevance to dissect why large grants could not be obtained on the important scientific topics addressed by the team.

Efforts should be made to regulate the scientific activities of this team in fewer aspects; it is possible that this is already ongoing as the acute phase of research on SARS-CoV-2 has been terminated.

The number of PhD students is satisfactory but emphasis should be made to recruit more post-docs as, at the moment, there is no post-doc enrolled.

Mechanistic and hypothesis-driven approaches should be taken in consideration in the activity of the team. Further attention should be devoted to publish articles in journals of high visibility.

Team 4: Human, animal and environmental (mega)viromes within microbiota

Name of the supervisor: Mr Bernard La Scola

THEMES OF THE TEAM

Team 4 works on three main scientific areas: 1) Viral metagenomics and the genomics of giant viruses, which focuses on the description of the viral repertoire using culturomics and metagenomics. This topic is the subject of the majority of the publications of the team; 2) Human microbiota (enterocolitis, vaginosis, cutaneous and periodontal), which includes different studies: for example, the analysis of the role of *Clostridium* in necrotising enterocolitis in new-borns and a study on the culture members of the cutaneous microbiota; 3) Hepatitis, which includes studies on viral hepatitis B, delta, C and E. From the beginning of Covid-19, the team has refocused a part of its work on the analysis of SARS-CoV-2, by making use of its expertise in viral cultures and genomics.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

Two previous recommendations were made to Team 4 that were partly addressed.

Recommendation 1 in the previous report: The team proposed for the new contract may benefit from an expanded collaborative network.

This recommendation was only partly addressed. The team's main international collaboration remains a long-standing collaboration with Universidade de Minas Gerais, Brazil. Other international collaborations (Swansea University, United Kingdom, and New York University, US) and one national collaboration (IGR, Paris, France) were mentioned.

Recommendation 2 in the previous report: The project should give more emphasis on the fundamental research which will be carried out on the newly identified microorganisms.

This recommendation was not fully addressed. Studies remained mainly focused on microbial strains isolation and description rather than in-depth characterization.

WORKFORCE OF THE TEAM

Permanent personnel in active employment	
Professors and associate professors	4
Lecturer and associate lecturer	1
Senior scientist (Directeur de recherche, DR) and associate	1
Scientist (Chargé de recherche, CR) and associate	0
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	4
Subtotal permanent personnel in active employment	10
Non-permanent teacher-researchers, researchers and associates	2
Non-permanent research supporting personnel (PAR)	3
Post-docs	0
PhD Students	10
Subtotal non-permanent personnel	15
Total	25

EVALUATION

Overall assessment of the team

The scientific production is excellent. Inclusion in society is very good. Attractiveness is very good but very poor towards post-doctoral fellows. The overall assessment is very good. However, the success to competitive calls for project is relatively modest. The team's activity is essentially based on two of its members, including the team leader. Studies are mainly based on a descriptive approach.

Strengths and possibilities linked to the context

The team has specific skills in the culturomics and genomics of microbes.

The team reports a total of 307 publications over the evaluation period. Some of these articles are published in high-profile journals, including 1 paper in Nat. commun., in PNAS and more recently in Microbiome and ISME J.

Members of the team are involved in national and international committees as experts (member of the "Comité Scientifique Sectoriel (CSS) 7, Hépatite virale, ANRS" since 2016; expert advisor of the NCBI RefSeq Virus group since 2017; International Committee on Taxonomy of Viruses Marseilleviridae from 2016 to 2018; Director of the "Centre de références hépatites virales" since 2018).

The team has been flexible enough to redirect a part of its work toward SARS-CoV-2 during the pandemic and has significantly contributed to the development of a SARS-CoV-2 database.

The team collaborated with two industrial partners (Amoeba, a company that develops applications using the biocidal functions of *Amoeba Willaertia* and L'Occitane, a cosmetics company) including the training of two PhDs supported by Cifre conventions. In addition, the team mentioned several service delivery contracts with industrials (HBC One group, Airbus helicopter, P&B group and Sapir pharma).

During the evaluation period, 24 PhD students started or completed their thesis (12 PhD students). Most PhD students have a satisfactory number of publications (for example four students who defended PhD work in the previous two years, published more than three articles as a first author). Thanks to the link with the hospital, the team has access to samples coming from human cohorts and manages the NSB3 and NSB2 laboratories. The team has access to cutting-edge technical platforms, equipment, facilities and infrastructures of the IHU-MI. The team has collaborations with the other teams of MEPHI (Teams 1, 2, and 7).

Weaknesses and risks linked to the context

Obtaining funding was pretty low over the time of the contract and not focused on the main scientific areas (for example service deliveries were used to fund projects on giant viruses that were not funded elsewhere). There is an imbalance between the subjects of the major publications and the project funding.

The diversity of the research projects seemed to increase during the evaluation period (project on cutaneous microbiota for example) and, as a risk of dispersion, this might be a potential weak point.

The number of scientific publications of the team is high but seems unequally distributed among the researchers of the team (>150 for two researchers including the leader of the team; < 50 for other researchers).

Thesis supervision is mainly carried out by the team leader. Thus, over the evaluation period, the team leader supervised 15 theses out of 24, although there are other HDRs in the team.

No post-doctoral fellows were enrolled during the period of evaluation.

The industrial collaborations have not generated any patents for the team for the moment.

RECOMMENDATIONS TO THE TEAM

The team should improve its search for funding.

The team should be careful not to disperse its activity, for example by multiplying service deliveries to fund other projects of the team.

PhD supervision should be distributed among all HDRs of the teams and post-docs should be recruited.

Team 5: Antimicrobial agents and resistance, surveillance, and therapeutic strategies

Name of the supervisor: Mr Jean-Marc Rolain

THEMES OF THE TEAM

Team 5 concentrates its activities on antimicrobial agents and the resistance developed against them. Axis 1 deals with surveillance of antimicrobial resistance in a "One Health" context, i.e. including animals, humans and the environment. Axis 2 aims at deciphering new resistance mechanisms. Axis 3 includes the development of new diagnostic tools for the surveillance of antimicrobial resistances, whereas Axis 4 includes genomic analysis of multi-resistant bacteria. The team also had some activities in virology related to the recent pandemic.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

Recommendation 1 in the previous report: The experts committee recommends to increase the focus on innovative research, in addition to descriptive research, to reach a higher biological impact, in addition to clinical impact.

Although a few publications reveal interesting new findings, the main stream of the research remains descriptive including new genome sequences, isolation and characterization of antibiotic resistant bacteria in African countries, amongst others.

Recommendation 2 in the previous report: The experts committee recommends to increase internationalisation through more active participation in European projects.

The main activities remain interactions with countries from the South.

Recommendation 3 in the previous report: The experts committee recommends to be active in communication activities.

As per decision of the unit, participations at congresses remain limited.

Recommendation 4 in the previous report: The experts committee recommends to consider being more specific about target microorganisms. The team continues its discovery of new microorganisms, e.g. in human gut, that in many cases do not have an established link to human disease.

The team continues to have a very broad approach to antibiotic resistant bacteria in a One Health context.

WORKFORCE OF THE TEAM

Permanent personnel in active employment	
Professors and associate professors	1
Lecturer and associate lecturer	4
Senior scientist (Directeur de recherche, DR) and associate	0
Scientist (Chargé de recherche, CR) and associate	0
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	2
Subtotal permanent personnel in active employment	7
Non-permanent teacher-researchers, researchers and associates	1
Non-permanent research supporting personnel (PAR)	0
Post-docs	1
PhD Students	12

Subtotal non-permanent personnel	14
Total	21

EVALUATION

Overall assessment of the team

The scientific production is very good. Inclusion in society is very good. Attractiveness is very good but very concentrated on one member. The overall assessment is very good. The main stream of the research is too descriptive. The internationalisation of the team is low and participations at congresses is limited. The articles selected by the team as representative of its activity are of low impact.

Strengths and possibilities linked to the context

The strength of the team is the timely research topic of antimicrobial treatment and the appearance of antimicrobial resistance. The team has a very strong publication output in many different fields of microbes with identified or potential links to human diseases. A total of 236 publications is listed, of which 133 are in collaborations with other groups from the unit. Amongst the remaining 103 publications many are in collaboration with countries from the South. The curiosity-driven identification of new microbes is interesting. Large part of the publications concern descriptions of antibiotic resistant strains (e.g. carbapenem resistance and colistin resistance), the publication of the genome sequences, case reports amongst others. One article in the selected representative publications is an in-depth analysis of a metallo-beta-lactamase published in Scientific Reports, with first and last authors from the group.

The team attracts many PhD students who also participate to the large publication output.

The PI is currently Editor-in-chief of the International Journal of Antimicrobial Agents (where the group has published 12 articles). He managed to increase considerably the notoriety of the journal through the inclusion of reviews. The PI and one member of the team have several responsibilities or memberships in scientific societies and organisations (EUCAST, Int. Soc. of Antimicrobial Chemistry).

Weaknesses and risks linked to the context

The activities of the team are too dispersed, ranging from viruses to bacteria, fungi and archaea. Although curiosity-driven detection of new organisms or the high throughput analysis of a large number of microbial genomes are welcome, the impact without in-depth research remains drastically weakened. A large number of publications concern the description of one or several bacteria and their antibiotic resistances pointing for example to the importance of hospital hygiene or the necessity of reduction of colistin in agricultural methods. Although important, this is not an innovative and in-depth research activity, as it could be expected from an UMR research team. Amongst the many very descriptive or technology-driven publications, there are also a few of direct interest to the main research axis of the team.

Amongst the four highlighted publications is a review article that does not confer important new messages and one 2-page publication on the impact of glyphosate on bacteria, containing one figure and without real impact, since the phenomenon is known for several years. The question remains open why these articles have been selected as representative.

The PI supervises seventeen and co-supervises fourteen PhD thesis, which seems a large number especially as the other one HDR holding researcher does not supervise any PhD student.

RECOMMENDATIONS TO THE TEAM

The team should concentrate its activities on the evolution and selection of resistance against antimicrobials and in particular antibacterial treatments to contribute to a decrease of antibiotic resistant infections.

Team 6: Cardiovascular infections

Name of the supervisor: Mr Gilbert Habib

THEMES OF THE TEAM

Team 6 aims at strengthening knowledge on infective endocarditis (IE) and its management at the level of both diagnostics and therapeutics. Research activities are divided into three areas: 1) Identification of risk factors for embolic IE complications, 2) Development of new diagnostic approaches, and 3) Understanding of the formation and structure of vegetations using electron microscopy.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

Only one recommendation was made previously to Team 6.

Recommendation 1 in the previous report: The experts committee recommends to develop more fundamental studies.

This was mostly addressed. Indeed, the team has demonstrated its ability to conduct a more fundamental approach by developing an innovative method to study the structure of vegetations by electron microscopy.

WORKFORCE OF THE TEAM

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

EVALUATION

Overall assessment of the team

The scientific production is excellent in terms of clinical impact. Attractiveness is limited: the number of PhD students is insufficient and there is no post-doc present in the team. No grant has been obtained during the period. There is no dissemination of knowledge to the general public. The overall assessment is very good.

Strengths and possibilities linked to the context

This is a small team but internationally renowned in the field of cardiovascular infections, especially Infective Endocarditis (IE).

The team comprises members with complementary skills with a cross-disciplinarity in cardiology, microbiology, pathology and hematology. Its scientific production is excellent with 169 publications reported over the evaluation period, mainly in journals of solid reputation. This includes eight papers in high-profile journals of the speciality such as one paper in *J. Am. Coll. Cardiol.* (2019) and another in *Eur. Heart J.* (2019). All team members contribute to the scientific production.

The team has a high visibility in IE management, with the leader being the chair of the European task force.

The team has deposited one patent over the evaluation period.

Thanks to the findings of the team, new embolism risk factors were identified (with a change in the embolism score) and a new major criterion (PET scanning) was added for IE diagnostic, which both led to a revision/update of international recommendations for IE management.

Weaknesses and risks linked to the context

Even though the team leader is undoubtedly an international expert in the field, it is surprising that he has neither editorial activities nor research grants.

The number of PhD students is insufficient and there is no post-doc present in the team.

The lack of funding is a major concern since no grant is indicated for the evaluation period.

There is no dissemination of knowledge to the general public.

RECOMMENDATIONS TO THE TEAM

A more fundamental approach has been developed by the team and should be pursued from a mechanistic point of view.

Obtaining one patent is promising but collaborations with socio-economic partners must be encouraged.

The lack of funding is a major concern and efforts should be made.

The number of PhD students is insufficient and must be increased and post-docs must be recruited.

A communication strategy to the general public should be implemented.

However, the team as such will no longer exist in the next five-year programme since the PI will move to another team studying host-pathogen interactions in cardiovascular infections.

Team 7: Evolutionary biology and computational biology

Name of the supervisor: Mr Anthony Levasseur & Mr Pierre Pontarotti

THEMES OF THE TEAM

Team 7 is hosting the bioinformatic platform. For the research activities, it develops two themes, led by two different researchers. Theme A focuses on the large-scale study of the genetic and functional diversity of microbes using genomic approaches. Theme B, Evolutionary biology, immunity polymorphism, focuses on the evolution of immune system of infected patients.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

Recommendation 1 in the previous report: The committee indicated the need to find a right balance between developing their own science and providing bioinformatic support.

While the platform has gained considerable visibility with a strong involvement in SARS-CoV-2 sequencing during the Covid-19 pandemic, it seems that the two team leaders managed unevenly in conducting their own research. One of the team leaders claims over 100 publications during the five-year period, however, an examination of these publications (WoS) reveals that he is the last author of only three publications (two in 2020 and one in 2021), thus questioning his leadership. It nevertheless shows that this PI is very active and efficient in managing the bioinformatic platform as evidenced by these numerous contributions to the publications of other researchers from the unit. During the same five-year period, the second PI published nine articles as last author, which reveals a stronger leadership ability despite a lower scientific production.

WORKFORCE OF THE TEAM

Permanent personnel in active employment	
Professors and associate professors	1
Lecturer and associate lecturer	0
Senior scientist (Directeur de recherche, DR) and associate	1
Scientist (Chargé de recherche, CR) and associate	1
Other scientists (Chercheurs des EPIC et autres organismes, fondations ou entreprises privées)	0
Research supporting personnel (PAR)	2
Subtotal permanent personnel in active employment	5
Non-permanent teacher-researchers, researchers and associates	0
Non-permanent research supporting personnel (PAR)	2
Post-docs	0
PhD Students	1
Subtotal non-permanent personnel	3
Total	8

EVALUATION

Overall assessment of the team

The scientific production is very good. Inclusion in society is very good. Attractiveness is limited: there is only one PhD student in the team and no post-doctoral fellow. The overall assessment is very good.

Strengths and possibilities linked to the context

The main strength of Team 7 is the bioinformatic platform that it hosts. This facility provides a considerable potential for genomic analyses and its efficiency is proven by the high number of publications for which it provided support. The implication of the platform during the Covid-19 pandemic has been remarkable with other 60,000 sequences analysed and deposited in dedicated databases.

The scientific production of the team is overall very good, with an impressive number of publications albeit not in highly visible journals, except for two publications in the prestigious multidisciplinary journal Nature (one in each sub-group), although without leadership (neither first nor last authors).

The permanent researchers are acknowledged specialists of phylogenomics of viruses and evolutionary genomics. Their involvement in the discovery of new viruses and in the evolution of immune response is significant.

Weaknesses and risks linked to the context

The main weakness of the team is that it is split into two subgroups with hardly any interactions, especially considering the small number of permanent researchers (three in total).

RECOMMENDATIONS TO THE TEAM

The team is well integrated in the unit through its platform activities, which appears to be essential to the overall scientific production of MEPHI. However, the team as such will no longer exist in the next five-year programme since one PI will join another unit of IHU while the other one will move to another team.

Team 8: Innovative approaches to understand and control contagion in hospital

Name of the supervisor: Mr Philippe Brouqui

THEMES OF THE TEAM

Addressing public health issues, Team 8 is a multidisciplinary team involving epidemiology, clinical sciences, microbiology, biostatistics, medical information systems, human and social sciences, and cognitive psychology. It focuses on technological innovation (such as alarms) and new approaches (based on behaviour modifications) to fight against contagions.

Findings of the team bring a solid basis for decision-making actors involved in the management of healthcare-associated infections.

CONSIDERATION OF THE RECOMMENDATIONS OF THE PREVIOUS REPORT

Two recommendations were previously made to the team 8.

Recommendation 1 in the previous report: The experts committee recommends to increase general public interventions.

This has not been addressed since there was no dissemination of knowledge to the general public.

Recommendation 2 in the previous report: The experts committee recommends to consider recruiting an epidemiologist in the team.

Apparently this has not been addressed since it seems that no epidemiologist has been recruited.

WORKFORCE OF THE TEAM

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

EVALUATION

Overall assessment of the team

The scientific production is good; Most of the articles are published in very specialized or low-profile journals. Inclusion in society is excellent. Attractiveness is limited: the number of PhD students is low and there was only one post-doc in the team. The overall assessment is good. There was no dissemination of knowledge to the general public.

Strengths and possibilities linked to the context

This is a small but multidisciplinary team focused on technological innovation and new approaches to fight contagions.

Team 8 has important and pertinent collaborations with local partners such as other IHU-MI Foundation teams (SESSTIM UMR 1252 and VITROME UMR 257) and external laboratories, including the cognitive psychology laboratory of St Charles UMR 7290 AMU and the Mediterranean Institute of Scientific Information and Communication IMSIC/IRSIC within the AMU.

The team has strong partnerships with industrial and economic sectors to develop new technologies.

The team created a start-up (MediHandTrace) in 2015, which was acquired by CHRISTEYNS, France in 2019. The team is also a member of COREB and actively participates in the European SHARP network.

The team has also contributed to ANR funding through two projects, ANR MEDITRACE LAB (PI) – 2015/2019 – 232 k€; and ParcourspreHospCovid19 (Co-I) – 2021/2022 – 74 k€.

Weaknesses and risks linked to the context

Most of the articles are published in very specialized or low-profile journals, such as Front. Digit. Health, J. Hosp. Infect., Nurs. Open or J. Infect. to name a few recent highlights of the team.

It seems that there is no tenured technical staff.

The number of PhD students is low and there was only one post-doc in the team.

No communication actions to the general public are implemented.

RECOMMENDATIONS TO THE TEAM

The quality of the scientific production must be improved by publishing articles on technological innovations in higher-profile journals.

The funding must be reinforced since two of the three grants will end in 2022.

The number of PhD students is insufficient and must be increased as well as that of post-docs.

A communication to the general public should be implemented.

However, this team as such will no longer exist in the next 5-year programme and one of the researchers would become the co-lead of a team investigating health status to pathologies of the oral cavity.

CONDUCT OF THE INTERVIEWS

Date

Start: 05 December 2022 at 09:00

End: 06 December 2022 at 17:00

Interview conducted: online

INTERVIEW SCHEDULE

Day 1 of the interview 5/12/2022

9:00-9:30	Hcéres Committee meeting <i>Closed-door meeting</i>
9:30-9:35	Hcéres rules and procedures by M. Mercier-Bonin <i>Public session (all unit members)</i>
9:35-10:25	Scientific and administrative presentation of the Unit 30 min presentation + 20 min discussion J-C. Lagier <i>Public session (all unit members)</i>
(10:25-15:05)	Scientific presentations by team leaders 10 min presentation + 10 min discussion <i>Public session (all unit members)</i>
10:25-10:45	Team 1 (Jean-Christophe Lagier & Oleg Mediannikov)
10:50-11:10	Team 2 (Michel Drancourt)
11:15-11:35	Team 3 (Benoît Desnues & Joana Vitte)
11:40-12:00	Team 4 (Bernard La Scola)
12:05-12:35	Committee debriefing <i>Closed-door meeting</i>
12:35-13:30	Lunch break
13:30-13:50	Team 5 (Jean-Marc Rolain)
13:55-14:15	Team 6 (Gilbert Habib)
14:20-14:40	Team 7 (Anthony Levasseur & Pierre Pontarotti)
14:45-15:05	Team 8 (Philippe Brouqui)
15:05-15:35	Committee debriefing <i>Closed-door meeting</i>
15:35-16:05	Break
16:05-16:35	Meeting with ITAs (in French) <i>In the absence of any managing staff (director, team leaders)</i>

16:40-17:10 **Meeting with researchers**
In the absence of any managing staff (director, team leaders)

17:15-17:45 **Meeting with post-docs and students**
In the absence of any managing staff (director, team leaders)

17:45-18:00 **Committee debriefing**
Closed-door meeting

18:00 **End of the first day**

Day 2 of the interview 6/12/2022

8:30-9:00 **Committee debriefing**
Closed-door meeting

9:00-9:30 **Meeting with the IHU ‘Méditerranée Infection’ director (P-E. Fournier)**
Closed-door meeting

9:30-10:20 **Meeting with institution representatives: Aix-Marseille University* & IRD****
Closed-door meeting

10:20-10:40 **Committee debriefing**
Closed-door meeting

10:40-11:30 **Meeting with the Director and deputy Director of the Unit**
Closed-door meeting

11:30-12:00 **Committee debriefing**
Closed-door meeting

12:00-13:00 **Lunch Break**

13:00-17:00 **Redaction of the final report**
Closed-door meeting

17:00 **End of the interview**

GENERAL OBSERVATIONS OF THE SUPERVISORS

The institution responsible for the submission, which is also responsible for coordinating the response on behalf of all the research unit's supervisory bodies, has not submitted any general comments.

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

Evaluation of Universities and Schools

Evaluation of research units

Evaluation of the academic formations

Evaluation of the national research organisms

Evaluation and International accreditation



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

hceres.fr

 [@Hceres_](https://twitter.com/Hceres_)

 [Hcéres](https://www.youtube.com/Hceres)