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HCERES

High Council for the Evaluation of Research
and Higher Education

Research units

HCERES report on research unit:

Department of Microbiology

Mic

Under the supervision of
the following institutions
and research bodies:

Institut Pasteur Paris

HCERES

High Council for the Evaluation of Research
and Higher Education

Research units

In the name of HCERES,¹

Michel Cosnard, president

In the name of the experts committee,²

Yves Brun, chairman of the committee

Under the decree No.2014-1365 dated 14 november 2014,

¹ The president of HCERES "countersigns the evaluation reports set up by the experts committees and signed by their chairman." (Article 8, paragraph 5)

² The evaluation reports "are signed by the chairman of the expert committee". (Article 11, paragraph 2)

Evaluation report

This report is the sole result of evaluation by the expert committee, the composition of which is specified below.

The assessments contained herein are the expression of an independent and collegial reviewing by the committee.

Unit name:	Department of Microbiology
Unit acronym:	Mic
Label requested:	Institut Pasteur, INSERM, Université Paris 7
Current number:	
Name of Director (2015-2016):	Ms Hilde DE REUSE
Name of Project Leader (2017-2021):	Ms Hilde DE REUSE

Expert committee members

Chair:	Mr Yves BRUN, University of Indiana, Bloomington, Indiana, USA
Experts:	Ms Cecília ARRAIANO, Instituto de Tecnologia Química e Biológica Universidade Nova de Lisboa, Portugal
	Mr Victor DE LORENZO, Centro Nacional de Biotecnología, Madrid, Spain
	Ms Petra DERSCH, Helmholtz Centre for Infection Research, Braunschweig, Germany
	Mr Michael DuBOW, Université Paris-Sud, Orsay, (representative of CNU)
	Mr Oscar KUIPERS, Faculty of Mathematics and Natural Sciences, Groningen, The Netherlands
	Mr Tim MITCHELL, University of Birmingham, UK
	Mr Richard NOVICK, New York University, USA
	Mr Eric OSWALD, Université Toulouse 3, Toulouse (representative of CSS INSERM)
	Mr Nicholas THOMSON, Wellcome Trust Sanger Institute, Cambridge, UK

Scientific delegate representing the HCERES:

Ms Catherine SCHUSTER

Representatives of supervising institutions and bodies:

Mr Alain ISRAEL, Institut Pasteur Paris

Ms Marie-Pascale MARTEL, Inserm

Ms Stéphanie POMMIER, Inserm

Mr Reiner VEITIA, Université Paris 7

Heads of Doctoral Schools:

Mr David TARESTE, Doctoral school ED FdV n°474, "Frontières du Vivant"

Ms Muriel UMBHAUER, Doctoral school ED n°515, "Complexité du Vivant"

Ms Sylvie VAN DER WERF, Doctoral school ED BioSPC n°562, "Bio Sorbonne Paris Cité"

1 • Introduction

History and geographical location of the unit

The "Microbiology" Department, located at the Institut Pasteur, was created in 2006 by merging the "Fundamental and Medical Microbiology" and "Microbial Pathogenesis" departments. It now includes 15 entities (three include National reference centers; NRCs): 8 research units, 2 provisional units, 2 five-year junior groups, 3 laboratories, 1 research and expertise unit, and 1 collection of microorganisms. Since 2014, the department is headed by Ms Hilde DE REUSE, assisted by Mr Jean-Marc GHIGO as deputy director. The former head for the period 2010-2014 was Mr Patrick TRIEU-CUOT. The research entities are distributed in 8 buildings located on both sides of the campus.

In the last 5 years, three research groups were closed as a consequence of the retirement of their heads: Ms Cécile WANDERSMAN "Bacterial Membranes", Mr Patrice COURVALIN "Antibacterial Agents" and Mr Anthony PUGSLEY, "Molecular Genetics". Part of the Molecular Genetics team regrouped into a new laboratory headed by Ms Olivera FRANÇETIC. In addition, three new teams have been formed. Two junior groups (five years mandates: G5s) have been recruited, Mr Sven VAN TEEFFELN "Microbial Morphogenesis and Growth" in January 2014 and Mr David BIKARD "Synthetic Biology" team E9 in April 2014. Mr Philippe GLASER (who supervised a subgroup in the research group E7) was selected to create a novel joined unit "Institut Pasteur/Assistance Publique-Hôpitaux de Paris" (AP-HP) Kremlin-Bicêtre Hospital, University Paris-Sud "Evolution and ecology of antibiotic resistance". In addition, a "Pasteur International joint research unit" has been created this year, comprising the group of Mr Matthieu PICARDEAU (team E6) and that of Ms Alejandro BUSCHIAZZO (Montevideo Institut Pasteur, Uruguay). The laboratory "Pathogenesis of bacterial toxoinfections" (team E14) headed by Mr Pierre GOOSSENS will be closed end 2015. Among the research entities of the Department, 6 are affiliated to the Institut Pasteur IBEID (for "Integrative Biology of Emerging Infectious Diseases") Laboratory of Excellence (LabEx) program. Finally, the Department of Microbiology is member of the Carnot Institute called "Pasteur Infectious Diseases" supervised by Mr Jean-Christophe OLIVO-MARIN (IP). This initiative promotes academic-industrial partnerships with biotechnology and healthcare industries.

Management team

Department head: Ms Hilde DE REUSE

Department deputy head: Mr Jean-Marc GHIGO

HCERES nomenclature

Principal: SVE1 Biologie, santé

Secondaire: SVE1_LS6 Immunologie, microbiologie, virologie, parasitologie

SVE1_LS2 Génétique, génomique, bioinformatique

SVE1_LS1 Biologie moléculaire et structurale, biochimie

Scientific domains

Research is focused on microorganisms, including model systems and pathogens, and the transfer of the acquired knowledge to facilitate the development of anti-bacterial strategies. Major strengths still reside in genetics, microbial physiology, and molecular approaches; however a number of groups have expanded into cell biology, *in vivo* imaging and microscopy, structural biology and biophysics, multispecies microbiology, and animal models. Large-scale approaches are also widely used with every aspect of genomics and evolutionary biology. Research programs have expanded from a traditional focus on isolated microorganisms to incorporate multicellular processes and the interaction of microbes with the environment, including hosts. Finally, high-resolution imaging, microfluidics, single cell analysis, and synthetic biology expertise are the newest approaches used in the department.

Unit workforce

Unit workforce	Number on 30/06/2015	Number on 01/01/2017
N1: Permanent professors and similar positions	16	16
N2: Permanent researchers from Institutions and similar positions	33	31
N3: Other permanent staff (technicians and administrative personnel)	40	37
N4: Other professors (Emeritus Professor, on-contract Professor, etc.)		
N5: Other researchers from Institutions (Emeritus Research Director, Postdoctoral students, visitors, etc.)	33	
N6: Other contractual staff (technicians and administrative personnel)	2	
N7: PhD students	27	
TOTAL N1 to N7	151	
Qualified research supervisors (HDR) or similar positions	32	

Unit record	From 1/01/2010 to 30/06/2015
PhD theses defended	47
Postdoctoral scientists having spent at least 12 months in the unit	65
Number of Research Supervisor Qualifications (HDR) obtained during the period	7

2 • Overall assessment of the unit

Introduction

The Department of Microbiology has continued the strong commitment of the Institut Pasteur to curiosity-driven research focused on microorganisms, including model systems and pathogens, and the transfer of the acquired knowledge to facilitate the development of anti-bacterial strategies. The scientific coherence of the department is high. While major strengths still reside in genetics, microbial physiology, and molecular approaches, a number of groups have expanded into cell biology, *in vivo* imaging and microscopy, structural biology and biophysics, multispecies microbiology, and animal models. Large-scale approaches are also widely used with every aspect of genomics and evolutionary biology. Many groups have expanded from a traditional focus on isolated microorganisms to incorporate multicellular processes and the interaction of microbes with the environment, including hosts. Finally,

addition of high-resolution imaging, microfluidics, single cell analysis, and synthetic biology expertise should impact most research groups.

The Department includes 14 entities under evaluation (8 research units, 2 provisional units, 2 five-year junior groups, 2 laboratories), 1 research and expertise unit, and 1 collection of microorganisms. An important challenge highlighted in the previous evaluation report (2011) was the fact that a number of prominent team leaders were approaching retirement. In the last 5 years, three research groups were closed as a consequence of the retirement of their heads. The department has responded admirably to this challenge. Part of the Molecular Genetics team regrouped into a new laboratory headed by Ms Olivera FRANCETIC. In addition, three new teams have been formed. Two junior groups (five years mandates: G5s) have been recruited, Mr Sven VAN TEEFFELLEN "Microbial Morphogenesis and Growth" in January 2014 and Mr David BIKARD "Synthetic Biology" team E9 in April 2014. Mr Philippe GLASER (who supervised a subgroup in the research group E7) was selected to create a novel joined unit Institut Pasteur/AP-HP Kremlin-Bicêtre Hospital, University Paris-Sud "Evolution and ecology of antibiotic resistance". In addition, a "Pasteur International joint research unit" has been created this year, comprising the group of Mr Matthieu PICARDEAU (team E6) and that of Ms Alejandro BUSCHIAZZO (Montevideo Institut Pasteur, Uruguay). Three groups including Ivo Gomperts-Mr Ivo GOMPERTS BONECA, Mr Jean-Marc GHIGO and Mr Patrick TRIEU-CUOT are currently postulating for the creation of an INSERM unit, to combine their complementary expertise to study the bacterial cell surface and its role in bacterial physiology and virulence. Finally, the status of group leader, created in 2015 within established research groups, has to clarify the organization of these groups and to better recognize the work performed by mid-career researchers. These researchers lead a group of 3-4 people in total (within a team), apply for funding in their name, and sign their articles as senior authors. Therefore, it appears that the department has risen to the challenge and has ensured that its vitality and excellence are maintained.

Global assessment of the unit

The Microbiology Department exemplifies the strong commitment of the Institut Pasteur to curiosity-driven research focussed on microorganisms, including model systems and pathogens, and the transfer of the acquired knowledge to facilitate the development of anti-bacterial strategies. Such a focus is particularly timely since the entire world faces a crisis due to the emergence and rapid spread of antibiotic-resistant human pathogenic bacteria, in which routine medical procedures, minor injuries, and food consumption can result in bacterial infections that can no longer be effectively treated by antibiotics. The research teams focus on three related areas: 1) regulatory mechanisms, metabolism, components of cell surface, and determinants of microbial shape; 2) virulence determinants, toxins, mechanisms of pathogenesis and host-interactions, host immune response, and bacterial escape strategies, and 3) antibiotic resistance, vaccines and development of innovative tools for diagnosis and therapy. The 15 research teams constitute an impressive critical mass in microbiology with very few institutions having a similar combination of breadth and strength. Combination of these units into a well-integrated department with excellent research facilities facilitates intellectual exchange and the development of synergistic research efforts, for example the proposal for a new INSERM Unit on "Envelope and Bacterial Pathogenesis" regrouping three outstanding research teams. Excellence is demonstrated by the strong publication record, including many articles in leading journals, the strong external funding record, numerous invitations to serve on journal editorial boards and to present at other institutions and international conferences, the organization of many important conferences and the many patent applications that have resulted from the research.

Strengths and opportunities in the context

The strong tradition and current excellence of the Institut Pasteur in basic research in microbiology, at a time when the application of new technologies are revealing the critical role of microbes in the biosphere and the human body, and are providing unprecedented opportunities to harness their immensely versatile biochemical and physiological properties.

The department implemented an impressive response, reorganization, and rejuvenation after the retirement of three outstanding team leaders at the head of large research units.

The department represents a critical mass in microbiology with very few institutions having a similar combination of breadth, strength, and accomplishments.

The strength of the two recently recruited junior groups who bring to the department important new expertise in cutting-edge areas, who have hit the ground running, and who have already obtained prestigious ERC Startup Grants.

The availability of important strain collections that provide important resources to capitalize on the recent ability to use natural variation as a powerful tool to study basic biological mechanisms, giving Pasteur researchers an important advantage over other researchers who will need to develop their own collection to launch similar studies.

The department has an outstanding publication record with 70% of research articles published in journals in the top quartile, including many in high profile journals.

The pro-activity and clear positive dynamics of the department in organizing meetings of Team Leaders and Group Leaders to discuss priorities and opportunities in the scientific direction of the department.

The department integrates small Group Leaders into the research teams and also into the life and planning of the department's scientific directions.

Weaknesses and threats in the context

The department puts a continued overemphasis on numerical indicators such as impact factors and h-index, which both miss the true impact of research programs by neglecting the necessary, and more time-consuming, critical analysis of research output.

The department lacks clear paths for the career advancement of successful small group Leaders.

The reorganization of proximity support laboratories into separate, distant and centralized structures in charge of media and glassware preparation is counter-productive.

The department lacks opportunities for targeted recruitment of new teams that would complement strengths of the department while adding expertise in areas that are propelling some of the most exciting discoveries in microbiology.

Recommendations

The committee recommends that the department continue to implement strategies to increase the already successful integration of the department's researchers, and expand them to facilitate integration with the other microbiologists at the Institut Pasteur.

The reorganization of proximity support laboratories into separate, distant and centralized structures in charge of media and glassware preparation should be the subject of a serious evaluation.

The committee recommends that emphasis on numerical indicators be reduced in favor of a critical evaluation of the true impact of research programs and the importance of the research field, acknowledging the fact that curiosity-driven research is still the source of a significant number of, if not most, important applications.

There should be clear and transparent criteria for career development of group Leaders and opportunities to become a team Leader. Current team Leaders and the higher management should think and take action about the succession of team Leaders long before their retirement.

The panel recommends that teams develop strategies to apply to international calls for large consortium and network grants to provide their strong expertise, to benefit from expertise available elsewhere, and to increase the visibility of the department.