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## Médecine régénératrice et squelette

Rapport Hcéres

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# HCERES

High Council for the Evaluation of Research  
and Higher Education

Research units

HCERES report on research unit:

Regenerative Medicine and Skeleton research

laboratory

RMeS-lab

Under the supervision of  
the following institutions  
and research bodies:

Université de Nantes

Institut National de la Santé et de la Recherche

Médicale - INSERM

ONIRIS - École Nationale Vétérinaire, Agroalimentaire  
et de l'Alimentation, Nantes Atlantique

# HCERES

High Council for the Evaluation of Research  
and Higher Education

Research units

*In the name of HCERES,<sup>1</sup>*

Michel COSNARD, president

*In the name of the experts committee,<sup>2</sup>*

Françoise PEYRIN, chairwoman of the committee

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Under the decree N<sup>o</sup>.2014-1365 dated 14 november 2014,

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

<sup>2</sup> 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:** Regenerative Medicine and Skeleton Research Laboratory

**Unit acronym:** RMeS-lab

**Label requested:** UMR

**Current number:** 791

**Name of Director (2015-2016):** Mr Pierre WEISS

**Name of Project Leader (2017-2021):** Mr Jérôme GUICHEUX

## Expert committee members

**Chair:** Ms Françoise PEYRIN, INSERM, Lyon (representative of INSERM)

**Experts:**

- Mr Jacques DEJOU, University of Marseille (representative of the CNU)
- Mr Axel NEFFE, Institut für Biomaterialforschung Helmholtz-Zentrum Geesthacht Zentrum für Material- und Küstenforschung GmbH, Teltow, Germany
- Mr Nuno NEVES, University of Minho, Guimaraes, Portugal
- Mr Hervé PETITE, University Paris Diderot
- Mr Arnaud SCHERBERICH, Laboratory of Tissue Engineering, Basel, Switzerland

**Scientific delegate representing the HCERES:**  
Mr Georges MASSIOT

Representatives of supervising institutions and bodies:

Ms Pauline BOUDANT, Université de Nantes

Ms Marie-Anne COLLE, ONIRIS

Ms Marianne DESMET, INSERM

Mr Olivier LABOUX, Université de Nantes

Ms Marie-Josephe LEROY-ZAMIA, INSERM

Mr Antoine MAGNAN, Université de Nantes

Head of Doctoral School:

Mr Frank BOURY, Doctoral School n° 34 “Biologie Santé”

## 1 • Introduction

### History and geographical location of the unit

The unit RMeS-Lab (Regenerative Medicine and Skeleton Research Laboratory) finds its origin in the INSERM unit LIOAD “Center for Osteoarticular and Dental Tissue Engineering” in the School of Dental Surgery at University of Nantes. This unit was established in 2006 and affiliated to University of Nantes, INSERM and to the Nantes-Atlantic College of Veterinary Medicine. This unit has a longstanding reputation in the domains of calcium phosphate ceramics for bone substitution and more recently tissue engineering. The laboratory was successively led by Mr Bertrand KEREBEL, Mr Guy DACULSI and Mr Pierre WEISS.

The LIOAD laboratory composed of 49 people in 2006 was organized in a single research team sharing its activities between three research themes working in tight collaboration. In the proposed project, the RMeS-Lab will extend its activity to hydrogels for tissue engineering and develop additional topics thanks to the arrival of new researchers. To reflect this orientation, the present structure, will be organized into two teams entitled STEP (“Skeletal Tissue Engineering and Physiopathology”) and REGOS (“Regenerative Medicine of Bone Tissues”). It also complies with the growth of the unit up to about 85 people, including permanent and temporary people, as well as PhD students and postdoctoral fellows in the RMeS-Lab.

The LIOAD, located within the School of Dental Surgery of the University of Nantes, spreads on about 1200 m<sup>2</sup>. This includes offices as well as 4 technical platforms composed of cell and tissue culture, molecular biology and physical-chemistry as well as state-of-the art imaging instruments. With the increase of human resources, the RMeS-Lab has obtained an additional space of 500 m<sup>2</sup>, yielding to a total area of 1700 m<sup>2</sup>.

### Management team

The LIOAD laboratory was headed by its director Mr Pierre WEISS (PU-PH) assisted by a deputy-director, Mr Jérôme GUICHEUX (DR INSERM), who will take the lead of the new RMeS-Lab. In the next term, he will be assisted by Ms Catherine LE VISAGE (DR INSERM) who will act as deputy-director. The direction team is assisted by a steering committee, a laboratory council and a scientific animation committee including representatives of research themes.

### HCERES nomenclature

SVE1\_LS4 Physiologie, physiopathologie, biologie systémique médicale

SVE1\_LS3 Biologie cellulaire et biologie du développement végétal

SVE1\_LS7 Epidémiologie, santé publique, recherche clinique, technologies biomédicales

### Scientific domains

The RMeS-lab operates in the field of biomaterials for bone substitution, tissue engineering of bone and cartilage for various skeletal applications and regenerative medicine.

Unit workforce

Unit workforce	Number on 30/06/2015	Number on 01/01/2017
N1: Permanent professors and similar positions	27 (9.1 FTE)	31 (10.5)
N2: Permanent researchers from Institutions and similar positions	6 (6)	8 (8)
N3: Other permanent staff (technicians and administrative personnel)	13 (12.3)	13 (12.3)
N4: Other professors (Emeritus Professor, on-contract Professor, etc.)	3 (1.5)	
N5: Other researchers from Institutions (Emeritus Research Director, Postdoctoral students, visitors, etc.)	5 (5)	
N6: Other contractual staff (technicians and administrative personnel)	8 (6.4)	
N7: PhD students	14	
TOTAL N1 to N7	76	
Qualified research supervisors (HDR) or similar positions	19	

Unit record	From 01/01/2010 to 30/06/2015
PhD theses defended	18
Postdoctoral scientists having spent at least 12 months in the unit	5
Number of Research Supervisor Qualifications (HDR) obtained during the period	3

2 • Overall assessment of the unit

Introduction

The RMeS-lab is a research unit that evolved over time from the conception of biomaterials, specifically calcium phosphate ceramics for bone substitution, into the field of biomaterial technology towards the development of scaffolds and hydrogels for tissue engineering of bone and cartilage for various skeletal applications. Lately, it has also focused on activities in stem cell biology, particularly for the understanding of embryonic development and aging of skeletal tissues, with the view to improve regenerative medicine strategies.

In the reference period, the unit was organized as a single team subdivided in three research topics: BIOMAT, STEP and ITO. It was recommended in the previous evaluation to adjust both the scientific strategy and the organization. In consequence, the proposed division into two teams STEP and REGOS and the re-focusing of the research activities into two main topics is coherent and appropriate.

The LIOAD research staff includes permanent researchers, associate professors, professors as well as university hospital staff, clinicians and dentists. The significant increase in the number of researchers in the last 5 years has to be highlighted, and in particular the mobility of 6 permanent researchers from CNRS and INSERM and 22 university hospital or ONIRIS researchers. The growth in human resources is impressive and supports a strategy of development of the proposed areas of research. This growth appears to be sustainable since it is supported by a dynamic strategy in fund raising.

The report shows some focus in developing new and emerging areas of research in both teams (STEP and REGOS). The focus of the research proposed for the next period is a combination of the previously developed areas with a stronger motivation for the translation of research results to the clinic and with new basic research areas, supported by the new researchers that joined or will join the unit. As such, the plan for the next period is a balanced combination of a few basic science topics aligned with the general goals of each team (bone, cartilage and intravertebral disc regeneration), more established research lines, and a strong emphasis in the translational potential of the research developed by both teams.

The latter is supported by a significant number of university hospital staff who combine their clinical activities with the research in the unit. The medical doctors involved in the research of the unit were referred (by several researchers who joined the unit recently) as providing a competitive advantage of the unit to attract researchers working in basic scientific topics who find there a possibility to translate their research works into the clinic.

Following the recommendations from AERES evaluation in 2011, the LIOAD has (i) shifted towards a multi-team unit; (ii) attracted senior scientists to increase its ratio of PH and PU-PH versus senior scientists; (iii) limited the number of research themes to limit dispersion of research; (iv) strengthened its collaboration with the Nantes University Hospital.

### Global assessment of the unit

The RMeS-lab evolved from the previous LIOAD at Nantes capitalizing on its excellent expertise on the development of calcium phosphate ceramics for bone substitution. The RMeS-lab, now organized into two teams, has the ambition to be a center dedicated to osteo-articular and dental tissue engineering as well as physiopathology of skeletal tissues. The research is targeting regenerative medicine for bone, joints and intravertebral disc in a larger sense relying on in highly trained researchers and state-of-the-art technical platforms.

In the past 5 years, LIOAD has undergone a consistent and significant increase in human resources of about 20% per year. The LIOAD research members are all experts in several aspects of tissue engineering with established expertise in dental science. The permanent staff, students and post-docs and the management team should be congratulated on having created a place where people are enthusiastic about their work and feel highly motivated to come and develop their project.

The scientific production of the unit is excellent in quality and quantity. The members of the LIOAD published in high-ranked biomaterials and tissue engineering journals as well as in clinical journals.

The research activities are supported by a large number of regional and national projects and many collaborations with partnerships through European networks, and are very well integrated in the socio-economic environment. The unit has also a strong strategy of integration in the local academic environment.

### Strengths and opportunities in the context

The RMeS-lab has positioned his project on regenerative medicine and tissue engineering, a very strategic domain. The unit has multidisciplinary expertise and cutting-edge lab facilities covering biomaterials and their characterization by histology, imaging, cell and molecular biology labs as well as physico-chemical characterization.

During the reference period, the LIOAD has had an offensive strategy to attract new members, following the recommendations of the previous evaluation committee. This plan resulted in the recruitment of 6 senior researchers enabling to cover some new and strategic areas of research. The lab succeeded also in expanding the area of the available lab facilities from 1200 m<sup>2</sup> to 1700 m<sup>2</sup>.

An organisation in two teams is appropriate with regard to the growth of the unit, both in terms of topics and of research staff. The management model is well adapted to the unit size and to its organization.

The unit succeeded in drastically increasing its funding (mostly national and regional but also European) to support its research activities (from 600 k€ in 2010 to 1400 k€ in 2014). It also has a strong network of national and international collaborations, creating opportunities for submitting European projects.

The unit has strong interactions with local and regional institutions and outstanding industrial partnerships. The unit has already created various spin-offs and currently has 10 active industrial collaborations. The unit is very effective in protecting Intellectual Property (IP) and generating resources by licensing some of the protected IP by royalties (25 k€ annually). The interaction with industrial partners is highly commendable and is an outstanding aspect of this unit.

The unit is highly competitive at the national level, has an excellent reputation, visibility and recognition documented by participations in panels and other prestigious boards, some of them with an international dimension. Some researchers received prestigious national and international awards. This is a strong basis to have an ambitious international exposure and to launch an offensive strategy to capture international funding's.

In conclusion, the unit has the critical mass of researchers, the expertise, the appropriate funding and national/international networking connections enabling working towards breakthrough discoveries in the field and having the potential to become a leading group in the future. The plan for the next 5 years is ambitious and embodies a clear vision for the development of the lab in terms of outputs, international projection and impact in the field.

### Weaknesses and threats in the context

The scientific production has been important and regular and has increased over the years. The articles have been published in a large number of different journals, which corresponds to the high diversity of disciplines of the laboratory. The number and level of the publications is somehow unequally distributed among members.

The number of PhD students on some of the research topics is limited, indicating the need to dedicate efforts in attracting young researchers, in finding adequate grants and having a more distributed PhD supervision between the qualified staff members.

The increased number of researchers in the last years is reportedly linked to the funding and is the result of a clear strategic vision aiming at covering the two domains, from basic to applied research and translation to clinics. The international competition and the broad spectrum of the project will require strong supervision and focus to ensure success in reaching a competitive level internationally.

The translation of research from bench to bedside can be further increased. To this aim the arrival of new university hospital staff is a good strategy. It is the belief of the committee that successful translation will be achieved through the implementation of mechanisms that create mutually beneficial conditions (for the unit, for the hospital and for the medical school).

The unit is involved in several European networks. Its participation in ambitious EU funded projects is still limited but could be further reinforced namely taking advantage of the arrival of new staff.

### Recommendations

The RMeS-lab has positioned his project on very strategic domains. It is recommended that both teams focused their activities in well-defined research areas to confirm the excellence of the research carried out in the laboratory. Moreover, the efforts, in interdisciplinary topics (such as the ones more clinically driven), should combine the expertise existing in the members of the various groups of the unit.

With the impressive growth of the unit, the effort in organisation should be pursued in order to ensure visibility of the different themes of each group. It is also recommended that the Unit closely monitor the progress of the different topics and encourage topics with high potential.

The unit should continue and reinforce the translational research at longer term, by promoting or being involved in clinical trials. The implication of many hospital researchers in the unit and the participation to 4 PHRCs and 2 clinical studies are expected to be fruitful, and to be further explored and potentiated in the next period.

With all the assets that the RMeS-Lab has gathered in human resources, technical platforms, national and international collaborations, the unit should now consider publishing in very top-ranking journals and (ii) applying for large international projects as feasible challenges in the next period. For these purposes, it may be helpful to more clearly specify the long-term goals (> 5 year timeframe) of the unit, to prioritize scientific challenges and further increase the cooperation with material scientists and chemists.