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## **C-BIOSENS - Caractérisation et sécurité biologique des surfaces nanostructurées**

Rapport Hcéres

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agence d'évaluation de la recherche  
et de l'enseignement supérieur

Section des Unités de recherche

AERES report on the research unit  
Caractérisation et Sécurité Biologique des Surfaces  
Nano-Structurées (C-Biosenss)  
From the  
Université d'Auvergne

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Le Président de l'AERES

**Didier Houssin**

Section des unités  
de recherche

Le Directeur

**Pierre Glorieux**

February 2011



# Research Unit

**Name of the research unit:** Caractérisation et Sécurité Biologique des Surfaces Nano-Structurées (C-Biosenss)

**Requested label :** EA

**N° in the case of renewal**

**Name of the director:** M. Stéphane DESCAMPS

# Members of the review committee

## Committee chairman

M. Frédéric CUISINIER, Université Montpellier 1, France

## Other committee members

M. Robert HORVARTH, Académie des Sciences de Hongrie, Budapest, Hungria

M. Csilla GERGELY, Université de Montpellier 2, Montpellier, France

M. Dominique BONNET, Université de Strasbourg, France

# Observers

## AERES scientific advisor

M. Jacques HAIECH

## University, School and Research Organization representatives

M. Philippe DULBECCO, Université d'Auvergne



# Report

## 1 • Introduction

- Date and execution of the visit

The Visiting Committee was held on February 15, 2011 and started at 9am. After a close-door meeting of the committee to recall the role of AERES and the visiting committee, the history and record of the unit was presented by Stephane DESCAMPS in one of the amphitheatres of the Faculty of Medicine in front of all the unit members. The three main axes of the unit's project were then presented. The committee has asked to visit the laboratories located at the Faculty of Medicine and also at the Department of the IUT (Department of Physical Measurements).

- History and geographical localization of the research unit, and brief presentation of its field and scientific activities

The unit was created in 2010 by the joining of a laboratory of clinical Pharmacy and Biotechnology, the Faculty of pharmacy CHU Clermont-Ferrand, two surgical teams (Orthopaedics and Gynaecology) CHU Clermont-Ferrand, the Laboratory of Physical Chemistry IUT de Cezeaux, Clermont-Ferrand and Le Puy en Velay and the Laboratory of cell cultures, Department of Haematology CHU Clermont-Ferrand. The activities of the unit are organized around three main axes as follows: (1) Stability of nano-structured surfaces in living systems, (2) Release and toxicity of nano-structured surfaces and (3) Functionalization of nano-structured surfaces.

- Management team

The research unit is managed by M. DESCAMPS and by M. AWITOR.

- Staff members

	Past	Future
N1: Number of researchers with teaching duties (Form 2.1 of the application file)	NA	10
N2: Number of full time researchers from research organizations (Form 2.3 of the application file)	NA	0
N3: Number of other researchers including postdoctoral fellows (Form 2.2 and 2.4 of the application file)	NA	2
N4: Number of engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)	NA	2
N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file)	NA	0
N6: Number of Ph.D. students (Form 2.7 of the application file)	NA	2
N7: Number of staff members with a HDR or a similar grade	NA	6



## 2 • Overall appreciation on the research unit

- Summary

This young team was established in the beginning of 2010 by the merging of four groups around the thematic of assessing the safety of nanomaterial surfaces used in different clinical fields. The unanimous supports of the university, the university hospital and the technological college (IUT) have allowed the two managers to achieve an initial scientific management plan. These efforts made possible initial scientific achievements with patents and publications.

- Strengths and opportunities

The scientific concept of the toxicity of nanomaterial surface and its influence on clinical problems was clearly identified and is shared by all members. This opportunity is well illustrated in the topic “releases of phthalates” from PVC tubing of infused solutions. The team investigated the coextruded devices (PVC associated with a layer of polyethylene) supposed to protect from release of phthalates. They showed that the deposition of titanium dioxide on the surface of the tubes decrease the leaching of plasticizers. They successfully deposited a patent on this topic. The enthusiasm that leads the group and the involvement of the leaders well supported by the researcher is a strong point. The multi-disciplinarity of the group is a strong point as it is difficult in France to gather in a single research unit, end users, biologists, chemists, medical doctor and pharmacists working on the same topic. The integration of such competences has to be reinforced.

- Weaknesses and threats

The geographical splitting of the groups between different cities, campuses and hospital is a weakness. To lead the three main axes of the project, the number of equivalent full time employees is limited as well as the time given by the two technical persons. For the moment, the financial support is quite low regarding the challenging tasks to achieve in the three main axes involving in particular in vivo experiments.

- Recommendations to the head of the research unit

Due to recent evolution of the scientific plan following the visit of AERES committee, the unit heads should rewrite a new more focused scientific plan. The huge task to manage such a team is time consuming and imply that the manager who is central to project has to be liberated at least partly from his clinical work and teaching duties. The team has to participate to consortium to response to national calls for proposal (ANR).

- Production results

A1: Number of permanent researchers with teaching duties (recorded in N1) who are active in research	NA
A2: Number of permanent researchers without teaching duties (recorded in N2) who are active in research	NA
A3: Ratio of members who are active in research among staff members $[(A1 + A2)/(N1 + N2)]$	NA
A4: Number of HDR granted during the past 4 years	NA
A5: Number of PhD granted during the past 4 years	NA



### 3 • Specific comments on the research unit

- **Appreciation on the results**

The research is focused on nano-materials and the detailed investigations of their toxicological effects. These materials have huge potentials in further technological applications in the health sector, but obviously their toxicity has to be well characterized. This is an important point often neglected today. Therefore, the chosen research field is significant with a number of societal and economic issues.

This new team has achieved in one year the development of an original set of three approaches on nanostructured surfaces. In such a short period the team was able to patent one innovation and to start two PhD theses and will get two CIFRE fellowships. However at this stage their scientific contributions and their capacity to take the subject beyond the state of the art are not completely identified. Especially, a very detailed literature search should be conducted to be able to develop their research plan further.

The research project consists of three axes: stability of nanostructure in the living, released and toxicity of nanostructure surfaces, functionalization of nanostructures surfaces. The more advanced domain with promising results is the release of plasticizers. The chosen methodology to address the problem is pertinent and innovative.

The methodology for the two others axis has to be developed. The “Functionalization of nano-structured surfaces” is quite a competitive field with different chemical or electrochemical techniques developed. To build a sustainable and original project, the team has to bench mark their techniques to the existing methods.

In that aspect the committee recommends the constitution of a scientific advisory board with external members, specialists of the domains, as it was presented by the head of the unit. It would be already beneficial to involve consultants from industry.

Since the creation of the joined team an increase in the overall impact factor of their publications was noted. The publications are in well known journals of the concerned fields.

A strong support of the supporting authorities is noted and the creation of such an interdisciplinary lab is coherent with the politics of the university.

- **Appreciation on the impact, the attractiveness of the research unit and of the quality of its links with international, national and local partners**

There are 14 invited lectures in the different field of research concerned. This is evidencing the international visibility of the leading researchers of the project in particular of the gynecological surgeon.

The team was built by gathering researchers of different fields on the campus of Clermont-Ferrand. The two PhD students with strong scientific background are highly motivated and even if they are working part time their contribution is very beneficial for this young team. The existing collaboration with international laboratories is increasing the visibility of the lab further.

They are already involved in one FP7 project and they were successful in attracting additional industrial supports. One member is in charge of the budget and external contracting and this is very positive regarding the organization of the team.

The team intends to respond to national (ANR) and international (EEC) calls in the next years.

The submission of a patent is a clear indication of the important valorization expected by the university hospital and university. This patent is linked to the “Pôle de compétitivité de plasturgie du Puy en Velay”. The involvement of two industrial partners, attested by the two CIFFRE grants, is clearly showing the valorization prospective and the importance of economic issues.

The academic partnerships exist already with the department of Physics and Astronomy, University of Oklahoma; the Bristol Implant Research Centre, University of Bristol and the laboratory of Pharmaceutics, Biopharmaceutics and Hospital, University of Lille II.

The strongest collaboration is with the University of Oklahoma with frequent research staff exchange. The US group is developing nanoporous surfaces and is not at all involved in medical research leaving this task to be fulfilled by Biosenss.



- **Appreciation on the management and life of the research unit**

The co-direction of an 18 member team is surprising but is justified by the interdisciplinary character of the lab. The two directors are very dynamic and have a close relationship.

The scientific meetings are held once a month and almost all members assist despite the different geographical localization and the clinical activities.

The good relationship between the members whatever their origin is visible and a good repartition of duties was noted.

The two technical persons are well informed of the research strategy and are willing to increase their involvements and their times.

In fall of 2011 the team is organizing a national conference on nanostructured surfaces.

The members have important teaching duties in the master on biomedical technologies. They are also participating to external masters.

- **Appreciation on the scientific strategy and the project**

The project is clearly focused on nanostructured surface properties and toxicities that is a pertinent subject. Clinical issues were identified: inadequate responses of scar tissue in contact with devices, release of toxic compounds by medical devices. To answer these issues it is clear that physical chemists, cellular biologist, clinicians are needed.

The chosen topics and the problems to solve are fitting well with the size of the group.

The project is oriented towards three medical devices, gynecological implants, orthopedic implant and medical polymers. In all of these fields they have significant experiences; together with the well managed project planning the overall feasibility is great. This is already proven by the first patent deposited, which could potentially help them to establish links with industries and obtain additional funding.

There are other laboratories in France working in the domain of medical devices but this lab is one of the few focus on nanostructured surfaces and related toxicity. At this stage of the project the risk are limited because they have a strong knowledge in the fabrication of the nanostructures and they plan to use existing protocols to evaluate the toxicity of the surfaces.

<b>Intitulé UR / équipe</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C4</b>	<b>Note globale</b>
<b>C-BIOSENS: CARACTÉRISATION ET SÉCURITÉ BIOLOGIQUE DES SURFACES NANOSTRUCTURÉES</b>	<b>B</b>	<b>B</b>	<b>A+</b>	<b>A</b>	<b>B</b>

**C1** Qualité scientifique et production

**C2** Rayonnement et attractivité, intégration dans l'environnement

**C3** Gouvernance et vie du laboratoire

**C4** Stratégie et projet scientifique





## Statistiques de notes globales par domaines scientifiques (État au 06/05/2011)

### Sciences du Vivant et Environnement

Note globale	SVE1_LS1_LS2	SVE1_LS3	SVE1_LS4	SVE1_LS5	SVE1_LS6	SVE1_LS7	SVE2_LS3 *	SVE2_LS8 *	SVE2_LS9 *	Total
A+	7	3	1	4	7	6		2		30
A	27	1	13	20	21	26	2	12	23	145
B	6	1	6	2	8	23	3	3	6	58
C	1					4				5
Non noté	1									1
<b>Total</b>	<b>42</b>	<b>5</b>	<b>20</b>	<b>26</b>	<b>36</b>	<b>59</b>	<b>5</b>	<b>17</b>	<b>29</b>	<b>239</b>
A+	16,7%	60,0%	5,0%	15,4%	19,4%	10,2%		11,8%		12,6%
A	64,3%	20,0%	65,0%	76,9%	58,3%	44,1%	40,0%	70,6%	79,3%	60,7%
B	14,3%	20,0%	30,0%	7,7%	22,2%	39,0%	60,0%	17,6%	20,7%	24,3%
C	2,4%					6,8%				2,1%
Non noté	2,4%									0,4%
Total	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

\* les résultats SVE2 ne sont pas définitifs au 06/05/2011.

### Intitulés des domaines scientifiques

#### Sciences du Vivant et Environnement

- SVE1 Biologie, santé
  - SVE1\_LS1 Biologie moléculaire, Biologie structurale, Biochimie
  - SVE1\_LS2 Génétique, Génomique, Bioinformatique, Biologie des systèmes
  - SVE1\_LS3 Biologie cellulaire, Biologie du développement animal
  - SVE1\_LS4 Physiologie, Physiopathologie, Endocrinologie
  - SVE1\_LS5 Neurosciences
  - SVE1\_LS6 Immunologie, Infectiologie
  - SVE1\_LS7 Recherche clinique, Santé publique
- SVE2 Ecologie, environnement
  - SVE2\_LS8 Evolution, Ecologie, Biologie de l'environnement
  - SVE2\_LS9 Sciences et technologies du vivant, Biotechnologie
  - SVE2\_LS3 Biologie cellulaire, Biologie du développement végétal



Clermont-Ferrand, le 8 juillet 2011

**Le Président**

**et**

**Le Vice-président du Conseil Scientifique**

**à**

**Monsieur Pierre Glorieux  
Directeur de la section des unités de recherche  
AERES  
20 rue Vivienne  
75002 Paris**

**OBJET : Rapport d'évaluation S2UR120001922 – C-BIOSENS : Caractérisation et sécurité biologique des surfaces nanostructurées – 0631262E**

Direction de la Recherche

Dossier suivi par :  
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Monsieur le Directeur,

Je vous prie de bien vouloir trouver ci-joint les observations de portée générale concernant le rapport d'évaluation de l'unité « C-BIOSENS » dirigée par Stéphane Descamps, envoyé le 6 avril 2011, observations que j'approuve bien évidemment.

Je vous prie d'agréer, Monsieur le Directeur, l'expression de mes sentiments les plus cordiaux.

**Professeur Philippe Dulbecco  
Président de l'Université d'Auvergne**

**Professeur Alain Eschaliér  
Vice-président du Conseil Scientifique**

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Monsieur le Professeur Frédéric Cuisinier  
Président du Comité d'évaluation Aeres

**Objet:** Réponses au rapport d'évaluation par l'AERES du Laboratoire C-Biosenss

Monsieur le Président,

Nous tenons dans un premier temps à vous remercier ainsi que l'ensemble des membres du Comité AERES et le coordinateur de l'Agence Jacques Haiech pour la qualité de la réunion d'évaluation qui s'est déroulée sur la journée du Mardi 15 Février 2011 et pour la pertinence des remarques faites dans le rapport d'évaluation fourni à l'issue de cette journée.

Nous notons que le Comité a relevé que le développement du laboratoire s'appuie sur un projet «pertinent» (p.6), «adapté à la taille du groupe» (p.6) et renforcé par une organisation «multi disciplinaire» (p.4).

Nous souhaitons commenter un certain nombre de points relatifs au rapport d'évaluation:

**P.4: «The geographical splitting of the group between different locations».**

Nous avons pleinement conscience de la difficulté engendrée par cet état de fait. La multidisciplinarité du groupe explique historiquement cette répartition. De nouveaux locaux destinés à notre équipe ont été alloués au début de cette année par les Facultés de Médecine et de Pharmacie. Ces locaux sont destinés à devenir le cœur du laboratoire. L'enthousiasme (identifié par le comité dans son rapport) des membres de l'équipe doit permettre d'amplifier un sentiment d'appartenance fort au laboratoire et favoriser la présence physique au sein de ces nouveaux locaux.

**P.4: «The number of ETP and technician is limited» et «has to be liberated at least partly from clinical work and teaching duties».**

Cette remarque illustre les nombreuses missions effectivement portées par les Enseignants Chercheurs et Hospitalo-Universitaires dans le système français. Nous souhaitons d'une part améliorer cet aspect par la mise en place d'un emploi du temps hebdomadaire défini et récurrent de l'ensemble des membres du groupe, et en particulier des directeurs. Les activités spécifiques de recherche seront identifiées, en associant les différentes structures hospitalières et universitaires. D'autre part, la montée en puissance du budget de l'équipe au travers de réponses à appels d'offres devra nous permettre au cours du prochain plan quadriennal de financer un poste de technicien au sein de notre équipe.

**P.4 : «The financial support is quite low regarding the challenging task»**

Comme nous l'avions présenté au Comité, cette faiblesse avait été identifiée en interne, expliquée par la jeunesse du groupe. La remarque confirme donc que la recherche de financement doit être une de nos tâches prioritaires cette année. Nous pouvons d'ailleurs préciser et que, depuis la visite d'évaluation il y a un mois et demi, nous avons déposé deux dossiers : un appel à projets « Nouveau Chercheur » auprès du conseil régional d'Auvergne et une demande de bourse auprès de la fondation « groupe Pasteur ». Nous avons par ailleurs bénéficié d'un budget de la part de l'Université d'Auvergne dès cette année.

**P.4: «due to recent evolution of the scientific plan following the visit of the committee, the unit heads should rewrite a new more focused scientific plan».**

Nous prendrons en compte cette remarque faite par le comité et notamment en ce qui concerne le caractère concurrentiel (« competitive field » p. 5) de l'axe numéro trois.

Nous vous prions d'agréer, Monsieur le Président, l'expression de notre considération distinguée

Les directeurs,

Stephane Descamps et Oscar-Komla Awitor