

# Newsletter IDA



## EDITO

Créé le 1er Janvier 2002, l'IDA achèvera en fin d'année un premier cycle décennal, une étape dont l'importance est tant symbolique que réelle. Ce sera bien sûr l'heure des bilans mais aussi de la prospective pour... la prochaine décennie et au-delà ! Pour le bilan, laissons ce soin aux commissions et aux indicateurs. Je préfère me tourner vers le futur de l'IDA, qui doit dépendre, comme toute entreprise vivante, de nos capacités d'adaptation et de renouvellement. Son avenir prévisible, déjà en gestation dans le présent, devrait être marqué par une ouverture réaffirmée dans les directions suivantes: une prise en compte accrue de nouvelles disciplines complémentaires, telles que les mathématiques appliquées, élargissement de notre développement vers l'international, amorcé de façon exemplaire par le LEA "NaBi" avec le Weizmann, mais également vers d'autres horizons, enfin le soutien à des projets innovants porteurs en puissance de « start-ups » dont l'IDA souhaite promouvoir la création.

*Founded on January 1st 2002; The IDA will be completing by the end of this year its first decade, which is an important milestone at both symbolic and ground levels. There will be of course ample time for reviewing results but also for prospective...onto the next decade and beyond ! As for the bilan", let us leave it to committees and indicators. I would rather turn to the future of IDA which will depend, as for any living entity, of its adaptability and renewal capabilities. Its foreseeable future, already borne in its present, should be marked by an increased level of openings in the following directions: taking into account complementary disciplines such as applied mathematics, opening to new horizons our international network of associate institutes or laboratories, already seeded in an exemplary fashion through the NaBi CNRS-Weizmann LEA, and support projects that bear the promise to generate startup's that IDA wishes to promote and nurture.*

## EN BREF

### Séminaires

PPSM - "La spectroélectrochimie, c'est quoi et à quoi ça sert ?"  
Dr François-Xavier Sauvage (Laboratoire de Spectrochimie Infrarouge et Raman, Université Lille 1, Lille)- 27/01/11.

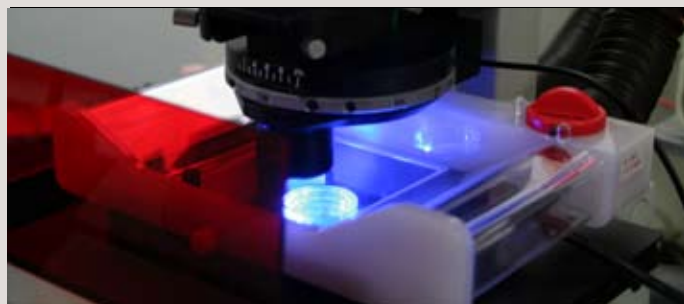
PPSM - "Generation of Natural Product-like Compounds via Tandem Reactions".  
Pr Jie Wu (Université de Fudan, Shanghai, Chine)- 09/02/11.

LBPA - "Electric injection of protein and dyes into single cells with nano-electrodes".  
Dr Akiko Hatakayama (Kyoto Sangyo University, Kyoto, Japan) – 11/02/11 Invitée par Malcolm Buckle (LBPA).

LBPA - "DNA conformational flexibility studied by molecular dynamics simulation of induced hinges and supercoiled minicircles".  
Dr Jeremy Curuksu (Ecole Polytechnique Fédérale de Lausanne, Lausanne, Suisse) – 28/02/11 Invité par Luba Tchertanov (LBPA).

IDA - "Nonlinear absorption and nonlinear refraction in metal containing chromophores, nanoobjects and bioderived materials".  
Marek Samoc (Institute of Physical and Theoretical Chemistry, Wroclaw University of Technology, Wroclaw, Poland) – 23/03/11 Invité par Katarzyna Matczyszyn.

LPQM - "Single spin manipulation in diamond".  
Fedor JELEZCO (Ulm University, Ulm, Germany)- 23/03/11  
Invité par Jean-Sébastien Lauret.



### Thèses

"Nanoscale engineering of semiconductor heterostructures for quadratic nonlinear optics and multiphoton Imaging".  
Marcin Zielinski (LPQM) – 09/02/11

"Sensorless control of brushless excitation synchronous starter/generator including standstill and low speed region for avionics application".  
Amira MAALOUF (SATIE) - 03/03/11

PUBLICATIONS

PPSM - "Meso-tetraphenyl porphyrin derivatives: The effect of structural modifications on binding to DMPC liposomes and albumin".

H. Ibrahim, A. Kasselouri, C. You, P. Maillard, V. Rosilio, R. Pansu and P. Prognon J. Photochem. Photobiol. A, 217, 10-21, 2011.

SATIE - "Statistical Performance Prediction of Generalized Monopulse Estimation".

Nickel URO, Chaumette E, Larzabal P. IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS Volume: 47 Issue: 1 Pages: 381-404 - January 2011.

PPSM - "Synthesis and optical properties of novel organic-inorganic hybrid UV (R-NH3)(2)PbCl4 semiconductors".

S. Zhang, P. Audebert, Y. Wei, J.-S. Lauret, L. Galmiche, E. Deleporte.

J. Mater. Chem, 21, 466-474- 2011.

PPSM - "Preparation of triazole-linked glycosylated alpha-ketocarboxylic acid derivatives as new PTP1B inhibitors".

Song Z, He XP, Li C, et al. CARBOHYDRATE RESEARCH Volume: 346 Issue: 1 Pages: 140-145 - 03/01/2011.

LBPA - "Structural insights into the cTAR DNA recognition by the HIV-1 nucleocapsid protein: role of sugar deoxyribose in the binding polarity of NC".

BAZZI A, ZARGARIAN L, CHAMINADE F, BOUDIER C, DE ROCQUIGNY H, RENE B, MELY Y, FOSSE P, MAUFFRET O. (LBPA)

Nucleic Acids Res - 11/01/11.

SATIE - "Behavior of HepG2/C3A cell cultures in a microfluidic bioreactor".

Baudoin R, Griscorn L, Prof JM, et al. BIOCHEMICAL ENGINEERING JOURNAL Volume: 53 Issue: 2 Pages: 172-181 - 15/01/11.

LBPA - "Pervasive regulation of nucleoid structure and function by nucleoid-associated proteins".

RIMSKY S, TRAVERS A.

Curr Opin Microbiol. - 31/01/11.

PPSM - "Designing Dye-Nanochannel Antenna Hybrid Materials for Light Harvesting, Transport and Trapping".

G. Calzaferri, R. Méallet-Renault, D. Brühwiler, R. Pansu, I. Dolamic, T. Dienel, P. Adler, P.; H. Li, A. Kunzmann. ChemPhysChem, 12, 580- 2011.

PPSM - "Highly optically selective and electrochemically active chemosensor for copper (II) based on triazole-linked glucosyl anthraquinone".

Zhang YJ, He XP, Hu M, et al. DYES AND PIGMENTS Volume: 88 Issue: 3 Pages: 391-395 - March 2011.

LBPA - "Hot Spots of Integrase Genotypic Changes Leading to HIV-2 Resistance to Raltegravir".

Charpentier C, Roquebert B, Delelis O, Larouy L, Matheron S, Tubiana R, Karmochkine M, Duval X, Chêne G, Storto A, Collin G, Bénard A, Diamond F, Mouscadet JF, Brun-Vézinet F, Descamps D.

The French ANRS HIV-2 Cohort (ANRS CO 05 VIH-2)- 2011.

## LPQM / PPSM - Synthesis and optical properties of novel organic-inorganic hybrid UV (R-NH3)2PbCl4 semiconductors.

Sanjun Zhang, Pierre Audebert, Yi Wei, Jean-Sébastien Lauret, Emmanuelle Deleporte and Laurent Galmiche.

Received 5th July 2010, Accepted 18th September 2010 | Journal of Materials Chemistry  
DOI: 10.1039/c0jm02121k

Table 1 : Chemical structures, complete names and abbreviation of the amines (R-(CH2)nNH2) employed in this study.

Chemical structure of (R-(CH2)nNH2)	Name	Abbreviation
	Cyclohexylmethanamine	CM
	Phenylmethanamine	PM
	2-Thiophenemethylamine	TPM
	(tetrahydrofuran-2-yl)methanamine	TFM
	5-Methyl-2-furanmethanamine	MFM
	2-Cyclohexylethanamine	CHE
	2-phenylethanamine	PE

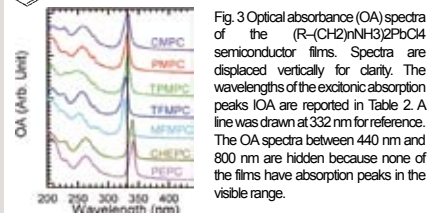


Fig. 3 Optical absorbance (OA) spectra of the (R-(CH2)nNH3)2PbCl4 semiconductor films. Spectra are displaced vertically for clarity. The wavelengths of the excitonic absorption peaks IOA are reported in Table 2. A line is drawn at 332 nm for reference. The OA spectra between 440 nm and 800 nm are hidden because none of the films have absorption peaks in the visible range.

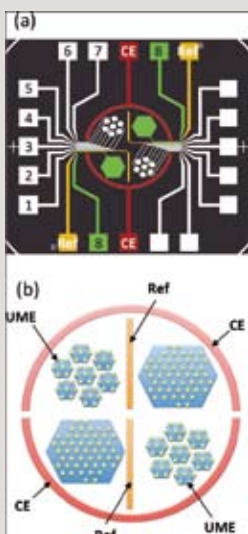
We report on the synthesis and the optical properties of several novel ultraviolet (UV) semiconductors (R-NH3)2PbCl4. These semiconductors are two dimensional organic-inorganic perovskite (2DOIP) materials and have multiple quantum-well energy level structures. We systematically varied the organic components (R-NH3+), and discussed their influence on the self-organization ability, excitonic optical features, and long-term photo-stabilities of the 2DOIPs. The trends of selecting the organic groups to tailor the optical features and to improve the self-organization and long-term photo-stabilities of 2DOIPs are obtained by analyzing the experimental results. Self-organization abilities are found to be highly dependent on the interactions among the organic components. The excitonic optical properties of 2DOIPs are found to depend more on the steric structures, and less on the electronic structures and chemical properties of the organic groups (R-NH2) as long as the organic groups are optically inert.

However, the long-term photo-stabilities of the (R-NH3)2PbCl4 semiconductors are highly dependent on the thermal and photo stabilities of organic components. We find a new UV semiconductor, CMPC, 2 which has better photo-stability than the usually used PEPC.

## SATIE - On-chip HepG2/C3A cell culture platform for simultaneous screening of nitric oxide and peroxynitrite.

Damien Quinton, Aurélie Girard, Loan To Thi Kim, Vincent Raimbault, Laurent Griscorn, Florence Razan, Sophie Griveau and Fethi Bedioui.

Received 11th November 2010, Accepted 13th January 2011 | The Royal Society of Chemistry.  
DOI: 10.1039/c0lc00585a



In this work we report on the design, microfabrication and analytical performances of a new electrochemical sensor array (ESA) which allows for the first time the simultaneous amperometric detection of nitric oxide (NO) and peroxynitrite (ONOO-), two biologically relevant molecules. The on-chip device includes individually addressable sets of gold ultramicroelectrodes (UMEs) of 50 nm diameter, Ag/AgCl reference electrode and gold counter electrode. The electrodes are separated into two groups; each has one reference electrode, one counter electrode and 110 UMEs specifically tailored to detect a specific analyte. The ESA is incorporated on a custom interface with a cell culture well and spring contact pins that can be easily interconnected to an external multichannel potentiostat. Each UME of the network dedicated to the detection of NO is electrochemically modified by electrodeposition of thin layers of poly(eugenol) and poly(phenol). The detection of NO is performed amperometrically at 0.8 V vs. Ag/AgCl in phosphate buffer solution (PBS, pH 7.4) and other buffers adapted to biological cell culture, using a NO-donor. The network of UMEs dedicated to the detection of ONOO- is used without further chemical modification of the surface and the uncoated gold electrodes operate at -0.1 V vs. Ag/AgCl to detect the reduction of ONOOH in PBS. The selectivity issue of both sensors against major biologically interfering analytes is examined. Simultaneous detection of NO and ONOO- in PBS is also achieved.

Fig. 1 (a) Layout and design of the ESA is contained on a 50 mm circular wafer. The electrical connections are permitted through 20 pads arranged around the periphery. (b) The arrayed UMEs are contained within the confines of the counter electrodes (CE) which are two half circles with a 7.5 mm radius. There are two reference electrodes which are centred vertical bars (Ref). The working UMEs are defined by the etching of the Polyene insulating layer on the gold electrode areas (hexagonal patterned pads). They can be addressed in sets of 7 electrodes (pads 1-7) or as a larger one (pad 8).

## JOSEPH ZYSS, Directeur de l'Institut d'Alembert.



1- En Avril 2010, vous avez reçu le prix « Gay-Lussac Humboldt Research Award » de la Fondation Alexander von Humboldt (Allemagne fédérale). A ce titre, vous allez rejoindre pendant 12 mois non consécutifs, le Max Planck Institute for the Science of Light à Erlangen (Allemagne), co-dirigé par Philip Russell et Gerd Leuchs. Quelles perspectives internationales envisagez-vous aussi pour l'Institut d'Alembert ?

*In April 2010, you received the « Gay-Lussac Humboldt Research Award » from Alexander von Humboldt Foundation (Federal Germany). As such, you're going to join during 12 non-consecutive months the Max Planck Institute for the Science of Light in Erlangen (Germany), co-directed by Philip Russell and Gerd Leuchs. Which international perspectives do you also consider for d'Alembert Institute ?*

Le domaine d'activités de l'IDA ne peut être qu'international. Il n'y a en effet pas de recherche digne de ce nom qui soit a priori borné par des frontières nationales, institutionnelles ou encore disciplinaires. Les activités internationales qui concernent le plus l'IDA sont celles qui lui amènent une valeur ajoutée multidisciplinaires. Le Laboratoire Européen Associé (LEA) CNRS-Weizmann "NaBi", en NanoBioSciences, coordonné par notre Institut, en est sans doute la meilleure illustration tant sur ce critère d'ouverture, qu'au vu de ses retombées déjà sensibles sur nos projets de recherche et leur évolution. Lors de notre deuxième réunion plénière annuelle au Centre Biomérieux à Annecy, face à des experts internationaux de haut niveau et à des représentants du CNRS, tous les participants ont pu constater le dynamisme d'une entreprise qui décolle au bout de seulement trois ans d'existence. Je citerais également une action en phase ultime de gestation, d'envergure potentiellement similaire à NaBi, entre le CNRS et le National Science Council de Taïwan, menée avec de prestigieuses universités taïwanaises, dont la NTU. Cette action mènera des projets, déjà actifs, allant de la plasmonique à la biophotonique et aux nanostructures. Je ne peux enfin omettre l'Institut Max Planck, en particulier son Institut pour la Science de la Lumière à Erlangen. Un des objectifs de mes visites au cours des prochaines années (de deux à trois mois par an sous les auspices de la Fondation Humboldt) sera de renforcer les liens avec cette prestigieuse institution qui est présente au plus haut niveau dans pratiquement tous les domaines de la photonique, allant de la nanophotonique à la biophotonique.

*The natural playground of IDA can only be international. There is no research worthy of this name, that would be limited by borders, be they national, institutional, or disciplinary. The international actions which primarily concern IDA are therefore those with a multidisciplinary added-value. The CNRS-Weizmann Institute Associated European Laboratory (LEA) in NanoBioSciences" nicknamed "NaBi" surely stands on top of the list in terms of its structuring added value for our Institute and of its scientifically boosting downfalls for IDA. In our second yearly review at the Biomérieux Center in Annecy, all participants, including top international experts and CNRS officials, agreed as to the taking-off of this highly visible action after only three years. Let me also cite a burgeoning action of potentially similar scale between CNRS and the National Science Council of Taiwan, with such prestigious partners as National Taiwan University as well as others, which nurtures projects ranging from plasmonics to biophotonics and imaging. I cannot omit the Max Planck Institute, in particular the Institute for the Science of Light in Erlangen. One of the purposes of my upcoming visits there (two or three months every year in the coming years under the auspices of the Humboldt Foundation) is to reinforce the ties of IDA with this newly founded Institute whereby almost every domain of photonics and nanophotonics, including molecular nanophotonics and biophotonics, is being addressed.*

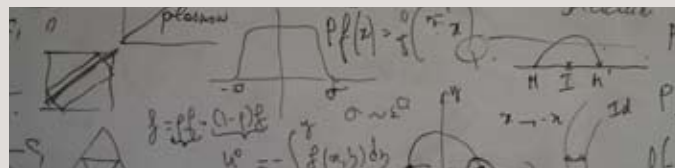
2- Quelles sont à votre avis les principales avancées à mettre au crédit de l'IDA ?

*What are in your opinion the main progresses to credit to IDA ?*

Je préfère de très loin évoquer l'IDA en termes de gestation d'une nouvelle culture et de nouvelles pratiques, plutôt que de designer telle ou telle avancée au risque d'être injuste avec d'autres. S'il est clair que nous avons le devoir de nous affirmer sur la base de résultats importants et originaux aux interfaces entre les disciplines et laboratoires constituants (interfaces diffuses qui ne sont pas aux frontières "géométriques entre laboratoires", mais bien souvent au cœur de leurs activités), je n'ai guère d'intérêt pour une compétition en tant que telle.

Tenir son rang au meilleur niveau dans la compétition internationale est un critère et une sanction, bien plus qu'une fin en soi. Ceci étant posé, je préfère me tourner vers des personnes qui sont à la fois l'âme et les véritables artisans des succès de l'IDA, qui cimentent concrètement nos projets et illustrent, de par leurs compétences mais aussi par une dose minimale mais indispensable d'adhésion instinctive et parfois même de passion, par exemple Joseph Lautru et Chi-Thanh Nguyen. C'est ainsi que Thanh a réussi à propulser les activités traditionnelles du LPQM dans le domaine de la technologie polymère pour les technologies de l'information dans le domaine des biocapteurs, sans relâcher l'effort sur le domaine d'origine, créant ainsi une émulation extraordinairement féconde entre les deux domaines. Les mêmes principes et applications du confinement optique, de l'optique intégrée, d'interférométrie irriguent maintenant de nouveaux biocomposants qui seront les biochips de demain. Nous lui devons, ainsi qu'à ses partenaires de recherche, Malcolm Buckle, Claude Nogues et Hervé Leh et d'autres, assistés par des doctorants aussi brillants qu'enthousiastes, des micro-interféromètres pour la détection d'espèces chimiques et biologiques, dont les facteurs de qualité battent des records internationaux. Joseph est quant à lui responsable de la plateforme dite salle blanche polymère, un apport majeur du LPQM à l'IDA où il déploie son savoir-faire et sa créativité dans de nouveaux domaines inspirés par les projets IDA: nanoplasmonique, microcavités laser et singulièrement la microfluidique, domaine d'excellence de l'IDA, qui concerne toutes ses composantes, et où un autre ingénieur de recherche, Jean-Pierre Lefèvre, joue un rôle majeur.

*I much prefer to think of IDA in terms of building-up a new culture and new practices, rather than designate this or that specific achievement at the risk of unfairness to others. Although we surely need to assert ourselves on precise results and eventual breakthroughs at interfaces (which are diffusing within the core laboratories, and not just at their frontiers), I do not believe in competition for the sake of it, which is sometimes at the expense of originality and independence. Ranking and comparison at the best possible international level are necessary sanctions, positive or negative of our activities, but not an objective per se. This being said, let me rather turn to people who are the real enablers of IDA's projects, cement its activities and pinpoint a few of them who illustrate with talent, competence, and the right dose of irrational belief and sometimes passion that is a necessary catalyst to any worthy human enterprise: namely Nguyen Chi-Thanh and Joseph Lautru. Thanh has managed to propel the traditional activities of LPQM in polymer based photonics, from telecom applications into biophotonics and biosensors, building-up on the same principles of light confinement and guiding, integrated resonators and interferometers that had been developed earlier (and still are) to the benefit of high speed modulators and such. We owe him, as well as to talented students that he guides, the achievements of record high finesse optical circuits that sense biomolecules (the latter with Malcolm Buckle, Claude Nogues, Hervé Leh and others). Joseph is running by and large the technological facilities of the Institute (formerly known as LPQM's clean room, then upgraded into the IDA's technology platform) where his know-how and creative technology has enabled new developments in plasmonics and microfluidics, the latter being a well developed "horizontal" domain at IDA whereby another talented research engineer, Jean-Pierre Lefèvre, is also playing a leading role.*



- 1950: Birth
- 1982: Doctorate in Physics (Université Pierre et Marie Curie)
- 1998: Foundation of LPQM (Director from 1998 to 2005)
- 2002: Foundation of IDA (Director from 2002 to -)
- 2008: Foundation of LEA NaBi (co-Director from 2008 to -)



## Séminaires

LPQM - "Etude expérimentale et théorique de l'interaction entre porteurs libres et déplacements atomiques".  
Prof. Robert Beserman (Solid State Institute and Physics Department, Technion-Israel Institute of Technology, Israel) – 05/04/11  
Invité par Isabelle Ledoux.

LBPA - 2nd ENSC-Schrödinger Meeting/Workshop - 12/09 au 15/09/11  
ENS Cachan, Schrödinger, BiMoDym.

Journée IDA à L'institut de la Vision à Paris – 23/05/11

LBPA - "Targeting the Chk1 kinase in oncology: structure-based discovery and elaboration of biologically active inhibitors".  
Dr Nicolas Foloppe (Vernalis R&D Ltd) – 01/06/11  
Invité par Olivier Mauffret.

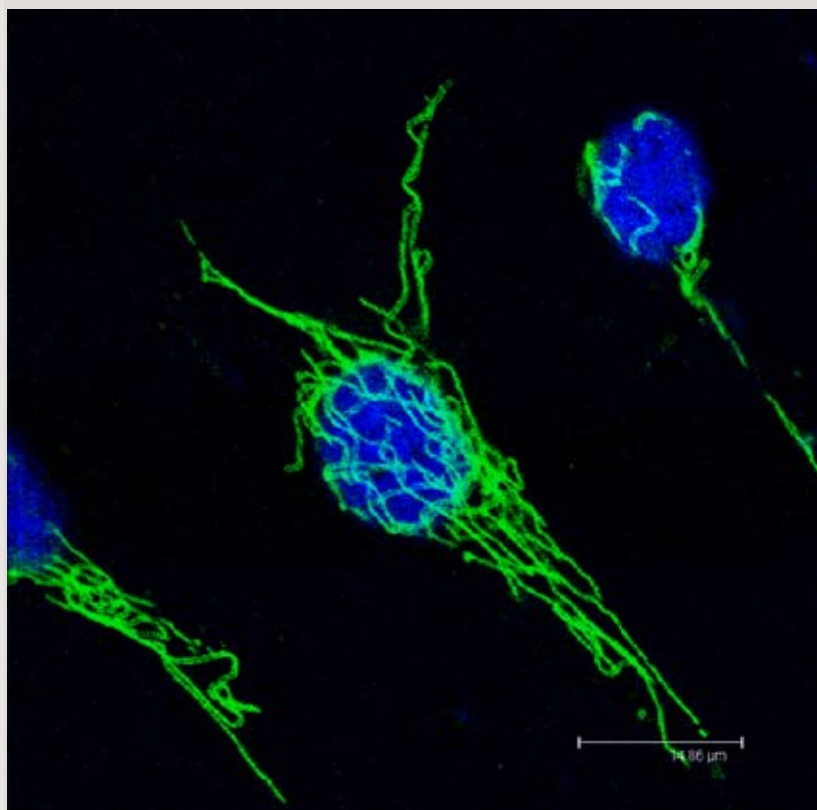
IDA - "Lumières et matières en miroir : symétries et brisures de symétries en art et en science".  
Prof. Joseph ZYSS – 22/06/2011

IDA - Symposium LEA NaBi – 12/09 au 15/09/11  
CNRS/Institut Weizmann à Cesarée en Israël.

Fête de la Science 2011- 10 au 14/10/11  
ENS Cachan.

IDA- France-Japan Workshop - The Nanotech Revolution from Science to Society - 12/12 au 14/12/11  
ENS Cachan / JSPS (Japan Society for the Promotion of Science) / Institut d'Alembert.

## L'IDA EN IMAGE



Fibroblastes de souris où le noyau de la cellule (ADN) est marqué au DAPI (en bleu) et les microtubules (cytosquelette) sont marqués par un anticorps anti-tubuline alpha couplé à l'Alexa 488 (vert). L'expérience avait pour objectif de visualiser le fuseau mitotique dans certaines cellules.

*Confocal microscopy of mouse fibroblasts. Nuclei (DNA) are stained with DAPI (Blue) and microtubules are stained with Alexa Fluor 488 Anti-Tubulin-alpha Antibody (Green).*

Auteurs : Pascale Rialland-Lefevre et Etienne Henry (LBPA) ; photo prise en 2010.

Groupe Communication : Gaëlle Callouard, Marjolaine Vernier, Sylvie Rimsky, Gilles Clavier, Sophie Abriet, Ginette Puyhaubert