The Letter
of the Collège de France

6

ACADEMIC YEAR 2010-2011 N° 6

COLLÈGE
DE FRANCE
1530

Teaching research in the making

The Collège de France was created in 1530 by King Francis I

The Collège's motto is *Docet omnia*: the vocation to teach everything

The lectures are open to anyone, there are no registration fees and no degrees are awarded
The programme is changed each year

Diffusion of knowledge

- Lectures, seminars, guest lecturers from abroad, international and multidisciplinary conferences: attended by 140,000 people annually
- Publications and institutional review (printing and electronic publications): abstracts of work under way (Yearbook), Inaugural lectures, reopening symposiums and guest professors' lectures, The Letter of the Collège de France
- Website in French and English (www.college-de-france.fr): 2,100,000 visits (5,750 visits/day), 17,900,000 hours of lessons download in 2011, audio and video retransmissions
- Lectures broadcast by France-Culture (1,000,000 listeners/month)

57 Chairs

- 52 Chairs + 5 Chairs renewed annually (Artistic Creation, Information Technology and Digital Sciences, Knowledge against Poverty, Sustainable Development–Environment, Energy and Society, Technological Innovation Liliane Bettencourt)
- Promoting the emergence of new disciplines
- Multidisciplinary approach to cutting-edge research
- Creation of a new Chair in the scientific domain of every nominated professor (Mathematics, Physics and Chemistry, Biology and Medicine, Philosophy, Sociology, Economics, Archaeology, History, Study of the great civilizations, Linguistics and Literature)

International relations

- Lectures and conferences delivered abroad
- The professors may deliver some of their lectures abroad (Agreements with: Belgium, Brazil, Canada, Czech Republic, China, Germany, Israel, Italy, Lebanon, Sweden, Switzerland, USA)
- Agreements with Institut Français
- Foreign professors invited
- Programme for hosting post-doctoral researchers from abroad

Research at the Collège de France and training through research

- 5 institutes (Institute of Biology, Institute of the Contemporary World, Institute of Oriental Studies, Institute of Literary Studies, Centre for Interdisciplinary Research in Biology–CIRB)
- 20 laboratories hosted on the site or outside
- 300 researchers
- 166 PhD students and post-doctoral students
- 68 agreements with graduate schools
- 315 engineers, technicians and administrative staff
- 12 research teams hosted
- Affiliated organizations: Collège de France, CNRS, INSERM, Universities, EPHE, EHESS, Pasteur Institute, INRIA

The Collège de France libraries

A heritage of rare books and some of the best specialized libraries in Europe
Open to a public of outside specialists

- General library: 120,000 books
- Social anthropology library: 29,000 books
- Libraries of the Oriental Studies Institute: Egyptology, Ancient Near East, Byzantium, Arab, Turkish and Islamic Studies, Far East (India, Tibet, China, Korea, Japan): 500,000 books

Budget

- Operating budget: €14,9m
  - State grant: €7,9m
  - Own income: €1m
  - Institutional contracts : €6m
- Total payroll: €22,5m

Sponsorship and philanthropy

- Collège de France Foundation
- Collège de France Hugot Foundation
- Private sponsors and businesses
- Donations and legacies

Relations with the business world

- Contracts with industry
- Budé Committee, corporate managers club

"What the Collège de France is expected to bring to its audiences is not established knowledge, but the idea of free research."

(Ce que le Collège de France, depuis sa fondation, est chargé de donner à ses auditeurs, ce ne sont pas des vérités acquises, c'est l'idée d'une recherche libre.)

Maurice Merleau-Ponty

6 SUMMARY

Selected Papers

The articles included in this issue of *The Letter of the Collège de France* in English are a selection of papers originally published in *La lettre du Collège de France* nos. 30, 31 and 32 (Academic Year 2010-2011).

Campus Plan, Labex, Equipex, Idex...:

Why and How the Collège de France has engaged in Competition for Investments for the Future

EDITORIAL

Prof. Pierre Corvol
Administrator of the Collège de France
Holder of the Chair of Experimental Medicine

It is widely agreed that knowledge and research appear to be priorities in a world fraught with uncertainty regarding the directions to take to solve its demographic, economic and ecological problems. Many countries, including those known as emergent, have clearly understood this and are developing means to ensure that they will eventually be leaders in these fields. In today's world, higher education and research can be conceived of only in an international context. Although France ranks between 4th and 7th globally for its scientific production, [1]and 4th and 2nd, respectively, for the number of its Nobel laureates and Fields medals, this status is by no means guaranteed indefinitely and must be strengthened even further.

For these reasons, the French government has decided to substantially increase funding for higher education and research. Rather than granting funds to individual institutions, it has opted for a strategy of providing additional funds to institutions that group together. The aim is to create high-level, coherent research and education entities which are internationally competitive and visible.

Two series of measures have been implemented, the "Plan Campus" and the "Grand Emprunt":
1/ In 2008, a 'Campus Plan' was adopted with the aim of grouping together several institutions in the form of centres ("poles") of higher education and research (PRES—Pôles de recherche et d'enseignement), and to enable them to promote a policy of property development on their site.
2/ As part of the "Grand Emprunt" ("Big Loan") scheme, a very considerable sum was allocated by the government to higher education and research (close to 20 billion Euros).

The Grand Emprunt put out several calls for proposals designed to support research. Project proposals had to be submitted by several laboratories working in partnership: either laboratories of excellence (Labex) or facilities of excellence (Equipex). The "excellence initiative" (IDEX) call for proposals by the "investments for the future" (investissements d'avenir) programme of the Commissariat Général à l'Investissement is by far the largest. It is designed to support the emergence of 5 to 10 centres (poles) of excellence and has received 7.7 billion Euros in the form of a non-expendable endowment, for a period of 20 years.

1. *Repères no. 7*, July 2011.

In this context, the Collège de France had to decide whether it should participate in these operations or not; whether it ought to remain aside, outside the groupings that were taking shape around it, or, on the contrary, whether it should consider joining forces with partners close to it both geographically and intellectually. This was a dilemma, for the Collège de France, founded in 1530, is proud of its traditions and jealously maintains them. It has passed relatively uneventfully, and without any major reforms, through historical and political upheavals. In this respect, it is France's oldest higher education and research institution. Its main mission, "teaching research in the making" freely, in all senses of the word, without the constraint of delivering degrees, is still the same as the mission assigned to it by King Francis I. The Collège de France differs from other institutions in the status of its professors and in its particular mode of governance based on a sovereign general assembly of professors which enjoys a broad leeway, similar to that which still prevails in some prestigious British and American institutions.

The International Committee on Scientific and Strategic Orientation (COSS) has emphasized that these original features must be maintained, for "they contribute to making the Collège probably the only place in the world where cutting-edge research can be shared with anyone who is motivated and interested, without any barriers of qualifications, age or social background". From this point of view, it is a "specialized laboratory for experimenting with the democratization of knowledge".[2]

A unique scientific environment

2008: the Campus Plan was an opportunity for the Collège de France to embark on the creation of the PSL (*Paris Sciences et Lettres*) foundation for scientific cooperation.

The Collège de France, a unique and original institution, is already open to interaction with universities, with the economic and social worlds, and with institutions abroad. This was evidenced recently by its creation of several annual Chairs on social topics, by its promotion of teaching and research between several of its Chairs and other institutions (notably the *École des Chartes*, EHESS and EPHE), by the fact that it gives PhD students the possibility of validating a part of their PhD course by attending lectures and seminars at the Collège, and by signing many international teaching and research agreements.

The Collège naturally maintains a long history of collaboration in teaching, training and research with its closest neighbours in the Montagne Sainte-Geneviève area of Paris: ENS-Ulm, the École d'Ingénieurs de Physique Chimie de Paris (ESPCI ParisTech), the École d'Ingénieurs de Chimie de Paris (ENSCP ParisTech) and the Institut Curie. An illustration of this collaboration is the career of Pierre-Gilles de Gennes, who was simultaneously professor at the Collège de France and director of the ESPCI. The renovation of the laboratories currently underway on the Marcelin-Berthelot campus of the Collège is contributing to the revival of a long tradition of collaborative research in biology, chemistry and physics. The Collège is furthermore building technology platforms in partnership with teams from other institutions, and is setting up research projects with them. All these actions require substantial investments which cannot be covered by the Collège's usual recurrent grants.

In 2008, the Collège de France therefore decided to fully adopt the "Campus Plan" with a view to more rapidly attaining and amplifying the objectives shared with these neighbours, based on its long history of rich collaboration with them. From the outset, it was instrumental in creating an original research and higher education group with the ENS-Ulm, the ESPCI ParisTech, the École de Chimie ParisTech and the Observatoire de Paris Meudon, to form a "PRES"[3] called "PSL, Paris Sciences et Lettres". The legal structure of PSL is a foundation for scientific cooperation that has the advantages of flexibility peculiar to a private law foundation, while nonetheless having the possibility of receiving public funds. This foundation was created by decree on 8 July 2010.

PSL's application for funds from the Campus Plan includes several building and renovation projects. The Collège de France's project for its Institute for Civilizations immediately appeared to be a priority, due to the unique complementarity

2. COSS Report, March 2011.

3. Pôle de recherche et d'enseignement supérieur (Research and higher education pole)

of this prestigious unit with the documentary resources of the ENS-Ulm, in particular. This Institute, situated on the Cardinal Lemoine Campus, currently groups together in dilapidated premises a set of nine human science Chairs in the fields of oriental studies and anthropology, as well as specialized libraries, laboratories and several research teams working on the Middle East (Egyptology, Ancient Near East, Assyriology, Semitic and ancient Christian studies, Byzantine studies), East Asia (China, Japan, India, Korea and Tibet) and social anthropology.

Located on the former premises of the École Polytechnique, at the top of the Montagne Sainte-Geneviève, this remarkable entity owns exceptionally rich archives and attracts French and foreign researchers of the highest calibre—but not in conditions worthy of its reputation. The buildings in which these libraries and research teams are housed have not been refurbished since 1979 and require extensive renovations at an estimated cost of 22 million Euros. The Collège de France, wanting to ensure a balance between development projects in the hard sciences and the diversity of research in the human and social sciences, at the heart of Paris' Latin Quarter, has prioritized this particular project. A work group led by Pierre-Étienne Will, Chair of the History of Modern China, is responsible for it. The scientific study of these past and present civilizations is one of our only means to further our understanding of the contemporary world in its full diversity, with all its surprises. This Institute of Civilizations will be an exceptional tool to ensure the visibility of French research.

In April 2011, the Collège de France was therefore particularly pleased that the PSL Campus project was selected by the Ministry of Higher Education and Research, and allocated a grant of 70 million Euros. The PSL renovations subsidized under this project, along with the level of funding, will be known shortly.

A unique opportunity

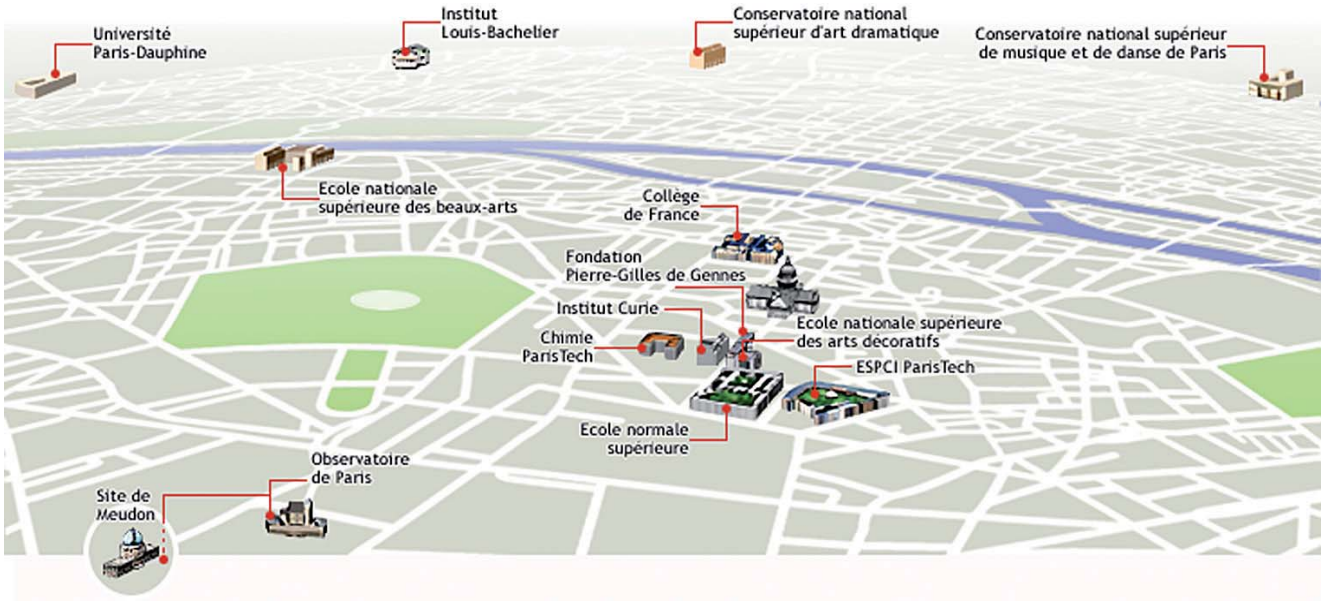
2010: PSL engages in the competition for IDEX (excellence initiatives)

Under the Grand Emprunt, the government's IDEX call for proposals is intended to stimulate the emergence of groups of training and research institutions of an excellent standard. This corresponds to the PSL's objectives and to that which constitutes the very essence of the Collège de France: creation of new forms of teaching, development of original interdisciplinary research, transfer of research results and imparting of knowledge.

Within the PSL Foundation, the Collège de France therefore naturally took up this new challenge, with determination and conviction but also with caution and very careful assessment of the circumstances and implications. To adequately meet these new challenges, PSL decided to approach other institutions in the fields of economics and financial management, health and artistic creation. In September 2011, the PSL Foundation consequently incorporated four new founding members (the Institut Curie, the Université Paris-Dauphine, the CNRS and the INSERM) and seven associate members (four art schools—the École Nationale Supérieure des Arts Décoratifs, the École Nationale Supérieure des Beaux-Arts, the Conservatoire National Supérieur de Musique et de Danse de Paris, the Conservatoire National Supérieur d'Art Dramatique—as well as the Institut National de la Recherche en Informatique et en Automatique (INRIA), the Institut Louis Bachelier, and the Pierre-Gilles de Gennes Foundation for Research).

The Collège de France is involved at several levels of this IDEX project: participation in two Labex programmes ("Memolife" in the bio-sciences and "TransferS" in the human and social sciences); head of Liberlabo, an original initiative for sharing and using PSL's documentary resources; and creation of PSL's website, in addition to the huge task of managing the information systems that have to be set up to interconnect the various institutions.

In July 2011, PSL's IDEX project application, encompassing 6 Labex and 6 Equipex, was selected along with only two other IDEX for the entire country (the Universities of Strasbourg and Bordeaux) by an international jury and the ministry. The funding received will enable PSL to undertake ambitious research and training programmes and to enhance the visibility of the high-quality research conducted in participating institutions.



A unique experience

A new model for singular institutions

For the IDEX, the independent international jury and the ministry made the bold choice of selecting and recognizing a new model. Each of the PSL institutions has its own history, in some cases very old and in others more recent. Each one was founded with a particular research and teaching mission, at a particular point in the history of higher education in France, when the universities did not fulfil such missions. Each one has shown, with its singular trajectory and the specific mission that it has fulfilled and continues to fulfil, what it was created for. The strong identity of each of these historical institutions suffices in itself to show that PSL is not a project for the integration or merging of various institutions grouped together into a foundation for scientific cooperation.

PSL is thus a reactive, creative and ambitious structure, at the service of projects common to the institutions comprising it, and which will be funded by the additional grants provided by the IDEX. PSL is governed by a Board on which each of the founding institutions is represented, as well as a chairperson, appointed by the Board and assisted by a vice-chairperson and an administrative vice-chairperson. Three councils (for training, research, and knowledge transfer) will each have the task of determining the PSL's policies in these different areas. They will interact closely with the management team.

This governance team will have at their disposal the new resources provided by the "investment for the future" funds and will allocate them to target objectives, following the recommendations of the three councils. Each institution's autonomy is deliberately preserved in the project, as each one has its own particularities, statutes and budget which cannot be challenged. The Collège de France, under the direct protection of the President of the Republic, will never do anything to undermine its scientific independence, be it with regard to the particular status of its professors, their appointment, the organization of its teaching, the way its own research is conducted, or the management of its own resources and those provided by the state.

Thus, PSL will bring together the different institutions constituting it on ambitious and innovative projects, and at the same time respect their specific characteristics. The funding provided by the IDEX to PSL, as well as the choice of fostering cooperation between various exceptional institutions, are a unique historical opportunity to boost French academic life by building on the particularities that differentiate it from most higher education organizations internationally.

The Collège de France is therefore concerned above all about the visibility of French research in the context of globalization and of accelerated competition in which we now live. It is aware of the national effort that the Grand Emprunt represents, and of the trust thus placed in the research community during such difficult economic times.

Therefore, alongside its main partners within PSL, the Collège de France will be the initiator and guarantor of innovative operations, while vigilantly maintaining the secular traditions of independence and academic freedom underpinning our international image of excellence.

Source: *La lettre du Collège de France*, no. 32, October 2011.

Ismail Serageldin
Hunger and Food Security in the World

Excerpt from the inaugural lecture 18 November 2010

Why this lecture series, why this subject? Because in the West we are so used to eating well that we have largely forgotten famine.

The last real famine that struck Europe was probably the Irish famine in the 19th century, which caused the death of a large number of people and triggered a massive wave of emigration. But famine continues to plague people in other parts of the world. The human family still suffers from hunger daily. While the US is confronted with huge problems of obesity, elsewhere poverty is the problem. I say that whereas in the 19th century some people considered the condition of slavery and spoke out against it, denouncing it as shameful and inhuman and calling for its abolition—these were the abolitionists—, today in the 21st century, in a productive, networked and rich world, it is inconceivable that close to a sixth of the human family goes hungry.

At a time when so many people throw away the leftovers of their meals, in other parts of the world there is not enough to eat. What can we do? To abolish hunger in the 21st century, we have to show the same passion that was shown in the 19th century to abolish slavery.

In this inaugural lecture I would like to review the situation and briefly mention most of the subjects that will be examined in more detail in each of the lectures in this series.
I will cover the following topics:
- Hunger and food security
- Diagnosing poverty
- Hunger and urban poverty
- Hunger and rural poverty
- The gender dimension
- The environmental dimension
- The role of science
- The instruments enabling us to reach our objectives: prices, taxes, subsidies and trade
- The transformation of the world's agriculture.

Why is it that over a billion people in the world today suffer from chronic malnutrition? The vast majority of them are in Asia and the Pacific (642 million) but their numbers are growing in Sub-Saharan Africa (265 million). The prevailing opinion among experts is that Sub-Saharan Africa is far more vulnerable than Asia, and that this is where the problem is going to increase in the future.

Considering the map of global hunger and chronic malnutrition published in 2010 by the FAO (the United Nations Food and Agriculture Organization), we see that it corresponds closely to the map of global income. Those who are hungry are poor, it's as simple as that. As I have mentioned, Sub-Saharan Africa is the most vulnerable region but also the one where the greatest demographic growth can be expected. In vast areas of this region, the population is expected to double by 2050, that is, within the next four decades.

It is distressing to see that all our efforts since the late 1960s have hardly changed the situation of global hunger. The number of people who are hungry rose after the explosion in prices in 2002, and is now below the objectives set in 2000 when we undertook to halve poverty. We wanted to reduce the number of undernourished people from 850 million to 425 million, but instead of declining, the initial figure has increased and hunger in the world has spread.

Inaugural lecture published by Éditions Fayard.
Online edition: http://lecons-cdf.revues.org/
Online videos: www.college-de-france.fr
The Chair receives support from AFD (Agence française de développement)

Source: *La lettre du Collège de France*, no. 30, December 2010.

Ismail SERAGELDIN
Economist in education and human resources, Director of the Alexandria Library

Anselm Kiefer
Art will Survive its Ruins

Excerpt from the inaugural lecture 2 December 2010

I'll tell you that there is no definition of art. Any attempt at defining it fails even before it is expressed, like art itself, which never ceases to waver between its loss and its rebirth.

It is never where we expect it, where we hoped to grasp it. With allusion to the Gospel according to Saint John, I would say: there where it is, we can never reach it. Rather than developing some aesthetic theory, I am going to discuss my artistic practice with you. We are also going to examine works other than mine, by modern and contemporary artists, as well as poets, writers and philosophers, […] in the most diverse fields: literature, astrophysics, mysticism, evolutionary theory, alchemy, biology, etc. For nothing can defy art. I am indeed an artist, I'm a painter and sculptor, and during these lectures I'm going to talk to you about works of art, paintings and poems. I believe in nothing but art; without it I'm lost. Only poems have a reality. As you can see, it's impossible for me to live without poems and paintings, not only because I don't know how to do anything else, because I never learned anything else, but almost for ontological reasons: because I'm wary of reality, even though in their own way, works of art are also an illusion.

The series of lectures following this introduction will be of a highly personal nature. There will be no scientific argumentation whatsoever, and often I will not be able to cite my sources. Some of them have remained in my mind intact, but others have been transformed to the extent that their origins can't be guessed. […] I increasingly often reach the conclusion that the personal, which is creative in the sense most commonly used in the 19th century, does not actually exist. As a student I derided the stormy debates that sometimes took place at the Académie des Beaux-Arts, consisting in denouncing what some had borrowed from others. But that is how ideas circulate; they're in the air. Discoveries have always taken place simultaneously in different parts of the world, without their authors knowing one another. Over 8,000 scientists work at the CERN in Geneva, and many of them are focused on the billionth of a second that followed the Big Bang in order to refine their knowledge on that instant when everything came to be in the history of the universe: matter, antimatter, the constants of nature, etc. […] But which of these scientists is the most advanced: the inventor or the creator? Is it a person, a subject? Or is it not rather a collective intelligence that operates in this domain? We must nevertheless acknowledge that the history of science has renowned personalities who individually made great discoveries. Galileo ensured that astronomy became a science in its own right, thus revolutionizing science through self-limitation. It was through this specialization that science was able to start its march forward. But it was also because of this limitation that the ensuing conception of the world proved to be narrower and narrower. When it comes to science results are temporary, as we know, for science constantly evolves from one stage to the next. Art, on the other hand, develops without any precise specialization, yet also goes through stages of evolution, like for example the invention of perspective in the Renaissance. This does not however mean that it is not possible, in one's own process of artistic creation, to revert to what preceded. Nowadays, are many paintings not devoid of perspective? We have even seen some that seem to belong to the stage of development of the cave paintings at Lascaux. It is obvious that artists of the Palaeolithic era were very different from our contemporaries. Yet what we call progress, strictly speaking, is not necessarily relevant to the world of art. This means that art is entelechy, a perfect union between the material and the spiritual, including in its apparently most rudimentary incarnation.

Anselm KIEFER
Plastic artist, Praemium Imperial Prize (Tokyo, 1999), Peace Prize of the German Book Trade (2008)

Source: *La lettre du Collège de France*, no. 30, December 2010.

Inaugural lecture published by Éditions Fayard.
Online edition: http://lecons-cdf.revues.org/
Online videos: www.college-de-france.fr

Jean-Marie Tarascon

Implications and Challenges of Storing and Converting Energy in the Context of Sustainable Development

Excerpt from the inaugural lecture 16 December 2010

Energy is at the heart of our day-to-day concerns and has definitively become a vital element of our modern societies. Electricity being an essential form of the energy on which we rely, some alarmists predict that the watt-hour may well become our next monetary unit.
But what is the truth of the matter? […]

Our growing dependence on energy is related to the discoveries of the 18th century and the resulting technologies. Initially, human beings had only biomass as a source of energy, and environmental impacts were nil because the CO_2 released was reabsorbed by plants *via* photosynthesis. This situation lasted until the late 18th century, when James Watt invented the steam engine, the first machine capable of transforming thermal energy into mechanical energy. His invention marked the beginning of the first industrial revolution, with the appearance of steam locomotives, *inter alia*. This industrialization intensified in the late 19th century with, in particular, the invention of the internal combustion engine by Étienne Lenoir and of electricity, leading to our growing dependence on fossil fuels. […]

The primary energy used in the world (82%) is derived from fossil fuels, and the rest is from renewable energies (11%) and nuclear energy (7%). The energy from the sun is so abundant that if 0.1% of the surface of the earth were covered with solar cells with a 10% yield, all of humanity's needs would be covered. […] The main problem with photovoltaic energy is the high cost ($0.5/kWh) compared to that of conventional energies ($0.05/kWh). This situation is not likely to last, as many experts agree that—based on recent progress in the yields and development of low-cost solar cells—the price of the photovoltaic kWh could rival that of the nuclear kWh by 2030.

Another difficulty inherent in renewable energies is based on their intermittence which causes large fluctuations in the energy delivered. It is therefore imperative that new technologies be invented for storing energy, and be adapted to network applications. This would help us to better manage our earth's renewable energy resources; in other words, to deliver energy when we need it. Likewise, the switch from the thermal vehicle to the electric vehicle, with a view to reducing CO_2 emissions, necessitates on-board energy to ensure the vehicle's autonomy. And here again, efficient energy storage systems are required. […]

Networks and transport necessitate the storage of energy so that it can be given back in the form of electricity. One of the best solutions is to convert chemical energy into electrical energy since both of them share the same vector: the electron. Electrochemical devices capable of this type of conversion (fuel cells, ultracapacitors and batteries) will be described below.

Notwithstanding its recent media coverage, the battery/electric vehicle combination is not new. It goes back to the late 19th century, when the *Jamais contente*, equipped with lead-acid batteries with an autonomy of 89 km, achieved a speed of 109 km/h. Note that in 1900, in the US, there was an equal number of electric cars and combustion engine cars (1,500 of each), and that in 1914, 30% of the cars in the US were still electric. But why did they all disappear? There are two main reasons: first, the abundance of easy-to-use fossil fuels, and second, the performance of electrochemical systems that had been limited for a long time. Although a great deal of progress has already been made, it is still the limited autonomy of batteries that is impeding the development of the electric vehicle today.

Inaugural lecture published by Éditions Fayard.
Online edition: http://lecons-cdf.revues.org/
Online videos: www.college-de-france.fr
The Chair receives support from Total.

Source: *La lettre du Collège de France*, no. 31, June 2011.

Jean-Marie TARASCON
Professor at the Jules Verne University of Picardy (Amiens) and Director of the Laboratory of Solid State Reactivity and Chemistry (UMR CNRS 6007)

TECHNOLOGICAL INNOVATION
LILIANE BETTENCOURT
ACADEMIC YEAR 2010 / 2011

Elias Zerhouni
The Main Trends in Biomedical Innovation in the 21st Century

Excerpt from the inaugural lecture 20 January 2011

In these early years of the 21st century, discoveries in the life sciences are occurring at a constantly accelerating pace. The sequencing of the human genome promises major opportunities for researchers but creates as many challenges that point in the directions in which medical research is likely to go.

Whereas the public is expecting rapid progress, the rate at which new, effective treatments are being put on the market is slowing down. The US Food and Drug Administration has approved half as many innovative molecules as it did in the 1990s, for instance. This imbalance between the extraordinary advances of basic science and the inability to rapidly transfer results is a problem. Is our innovation system jammed?

Whereas science is becoming increasingly complex, we are also witnessing a convergence of unifying principles linking apparently disparate diseases through common biological routes and therapeutic approaches. For example, basic mechanisms such as cellular signalling and inflammation seem to be common to ailments formerly considered as completely distinct. Likewise, emergent methodologies such as proteomics, bio-informatics and nanotechnologies, among others, now concern all diseases. These new domains of innovation are a challenge to organizations such as the National Institutes of Health (NIH), designed decades ago at a time when our concepts and the classification of diseases were more limited. But the NIH's research needed to reflect the new reality more closely, and reform became necessary.

How can change be implemented in such a complex organization? Faced with the need to reform an institution, it is first necessary to assess the resistance that is bound to arise. I had learned that no authority can change a scientific institution without a strong case in favour of such change. This has to be widely communicated, accepted and, most importantly, evaluated before being deployed on a large scale. I therefore engaged the NIH in a process of self-evaluation with a view to exploring all the questions that such a complex and accomplished research organization, faced with the new challenges of science, should periodically ask itself. […]

Since no one can predict where the real breakthroughs will be, I subscribed to the idea that we had to devote a percentage of our budgets to unconventional, adventurous research, that is, high-risk research but with a potentially strong impact in what I have called "a protected experimental space for innovation on the fringes of innovation". This approach was institutionalized in 2006 by the law reforming the NIH. It serves to justify the most daring ventures when unexpected opportunities and new ideas arise. The lesson is that no organization devoted to science can be really audacious without specifically devoting a certain percentage of its resources to high-risk research.

Another aspect of scientific policy is the taking into account of the demographics of the research community. At the time of steeply rising budgets and the baby boom it was easier to obtain funds at a young age. David Baltimore was 37 when he received the Nobel Prize for his discovery of inverse transcriptase. Given the fact that today the average age for receiving one's own research grants is 38, Baltimore would have received his Nobel Prize before his first NIH grant! Our studies have shown that this phenomenon is primarily linked to the length and rigidity of young researchers' degree course and career paths, which delay access to independent funding. On this basis, we decided to finance some very young scientists, irrespective of their level of qualification. When an idea is good, why not support it as early as possible?

Elias ZERHOUNI
Professor at Johns Hopkins University, Director of the National Institutes of Health (NIH) from 2002 to 2008, and President of Global Research and Development, Sanofi Aventis, 2011.

Source: *La lettre du Collège de France*, no. 31, June 2011.

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Clément Sanchez
Chemistry of Hybrid Materials

Excerpt from the inaugural lecture 10 February 2011

In chemistry, the term "hybridization" is associated with Molecular Orbital Theory, specifically a model based on the hybridization of atomic orbitals.

The simplest of the hybrid orbitals, called sp^3, sp^2 and sp, are generated by combining the 2s and 2p orbitals of the carbon valence bands. This is the basis on which Linus Pauling, Nobel laureate in 1954, proposed the hybridization model to describe the chemical bonds.

In chemistry, the term sp^n is represented by the image of a tetrahedron, a planar or linear molecule, the simplest of these correspond respectively to a methane, ethylene and acetylene molecule. Hybridization is thus used to describe the chemical bonds on which chemistry is fundamentally based. The concept of hybridization also permits the design and production of materials in which two apparently incompatible species (organic-biological and inorganic) can be combined.

Organic and inorganic compounds have different properties. In general, minerals are dense and have good thermal stability and durability, as well as specific mechanical properties: they are often hard and brittle, and can be used at high temperature. Organic compounds have low density, are more easily deformable, are heat-sensitive, etc. Some of them are self-healing and even can self-replicate. These differences, combined with the fact that for centuries the majority of organic molecules could only be synthesized biologically, led to the "vital force" hypothesis in the 18th century, to explain the formation of organic matter within living beings. In 1828, Friedrich Wöhler obtained urea, an organic compound, by heating a mineral compound ammonium isocyanate, thus invalidating the vitalist belief and creating the first bridge between the inorganic and organic domains. This discovery could have united chemistry, but the disconnect between organic and inorganic chemistry, solution and solid-state chemistry endured for much longer.

Yet in the living world, nature often produces organic-inorganic hybrids: metalloenzymes are at the heart of photosynthesis and other biological processes, and vital materials—blood, bones, the shells of crustaceans, etc. Thus, nature did not wait for us to create hybrid biomaterials and high performing organic-inorganic nanocomposites.

The processes of bio-mineralization observed in nature consist of a bottom-up assembly from molecular and macromolecular structures under mild temperature conditions.

The chemistry of hybrid materials stems from environmentally responsible soft chemistry.

Based on inorganic polymerization reactions under mild temperatures using molecular precursors, in aqueous or hydro-alcoholic mediums, hybrid material chemistry exploits the flexibility and versatility of molecular and Supramolecular chemistry. It thus allows for the creation of customized materials, by "lego-like" chemical construction.

These hybrid materials already have numerous applications in various fields (automotive, textiles, packaging, construction, micro-optics, micro-electronics, functional coatings, environmental and biomedical science, etc.).

All the strategies that combine soft chemistry, Supramolecular chemistry, organo-inorganic or bio-inorganic hybridization, physical chemistry in the broad sense, including soft matter, kinetic and diffusion processes and process engineering, have created a powerful research stream known as "integrative" chemistry. This stream is already fuelling an innovative branch of materials science. I am convinced that this emerging and multidisciplinary field will go much further than simple integration. Novel architectures will be achieved resulting in abundant new applications. In the future, hybrid material chemistry will allow us to access the previously "inaccessible stars".

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Source: *La lettre du Collège de France*, no. 31, June 2011.

Clément SANCHEZ
Director of the Laboratory of Condensed Matter Chemistry of Paris. UMR CNRS UPMC Collège de France 7574. Gay Lussac—Humboldt Prize for 2008, Member of the French Academy of Sciences (2011), of the European Academy of Sciences (2010) and of the Academia Europaea/the Academy of Europe (2011).

INFORMATION TECHNOLOGY AND DIGITAL SCIENCES
ACADEMIC YEAR 2010 / 2011

Martin Abadi
Computer Security

Excerpt from the inaugural lecture 10 March 2011

Computer security has been a key issue in the political and military spheres since the birth of modern computer technology. A prime example is the work of Alan Turing and his colleagues at Bletchley Park to decipher the German codes during the Second World War.

More recently, we have witnessed attempts to control the political debate on the Internet. The case of China is well known but is not the only one. Even if modern systems of surveillance and censorship do not have the same old-fashioned charm as Bletchley Park, they are vast and powerful. Finally, the massive scale of the dissemination of confidential documents by WikiLeaks was unimaginable before modern information technology.

Industry, trade, banking, medical data management and many other fields are increasingly digital. There is a fear that the integrity and confidentiality of information may become fragile. […]

Issues of computer security are particularly sensitive in so far as we use open and heterogeneous systems. These include, among other things, personal computers, mobile phones, games consoles, servers, huge computing centres, and networks, with complex and diverse software everywhere. These elements are managed by users and administrators functioning independently of one another, with differing levels of competency in the matter. Computer security concerns each of these elements, their combinations and their interactions.

Our modern systems interact with environments that are sometimes hostile and on which we have no direct control. Our computers or their hard drives can fall into enemy hands; we are connected to a public network full of dangers; on this network, the software on our computer may, without us knowing it, exchange data with small programmes that have surreptitiously come from suspect Web pages; moreover, users, programmers and system administrators are not always reliable either. Yet there are many good reasons to prefer interaction, despite its dangers, to the former monolithic systems closed to the world.

Interaction is a central theme in any information processing: interaction between several processors in a computer; interaction between programmes; interaction between computers distributed on the Internet; interaction between users with computers nearby or far away; interaction between users *via* email or on social networks like Facebook or Twitter. For the users of the early 21st century, computer technology is not limited to complex numeric, financial or scientific calculations, in specialized centres; it is omnipresent and provides an extraordinary means of communication and collaboration. Interaction is therefore a legitimate subject of study for computer science, and security is an essential aspect of interaction. […]

> My colleague Chuck Thacker, who is fundamentally realistic, sometimes says that any information entered into a computer becomes *de facto* public information.

From this extreme point of view, security is never compromised even if an outsider has access to our files, as they contain only data that we are willing to share. In 2010 Thacker received the Turing Award (the "Nobel Prize" of computing), partly for designing and creating the Alto machine, often considered to be the first modern personal computer. So he knows what he's talking about. I however prefer to believe that he's wrong and that we can hope for better. The current and future applications of computers certainly do require stronger guarantees. What these guarantees might be remains to be determined, and the techniques to provide them will then have to be developed.

Martin ABADI
Professor at the University of California, Santa Cruz. Principal researcher at Microsoft Research Silicon Valley since 2006.

Source: *La lettre du Collège de France*, no. 31, June 2011.

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Claudine Tiercelin
Metaphysical Knowledge

Excerpt from the inaugural lecture 5 May 2011

I am aware of the boldness and perhaps the temerity or recklessness that it took for Pierre Corvol, Jacques Bouveresse and all of you, dear colleagues, to entrust me with the honour of holding a Chair which, for the first time in the history of the Collège de France, not only has the word "metaphysics" in its name but also associates it with the term "philosophy of knowledge"—so remarkably illustrated by the masters that Jules Vuillemin and especially Jacques Bouveresse have been for me.

It may indeed seem preposterous or audacious to propose an association of this nature, for in the minds of many, doubt is no longer permitted. Today the fate of what used to be "the queen of the sciences" is sealed, for we entered the age of post-metaphysical "thinking" ages ago. Senseless dogmatism, verbal rambling of minds yielding to logical or onto-theological idols, or to fantasies of possible access to Reality, Truth, Knowledge: that is how we often imagine metaphysics and ironize about its partisans, when there are any left. Disgruntled or supposedly lucid minds consider that certain "turns" (Kantian, Heidegerrian, positivist, linguistic, cognitivist) have been taken, for once and for all. Who would dare to go beyond phenomena? Reality is inaccessible to us, ensnared as we also are, in any case, by language. Unless it is presented as research aimed at some celestial transcendence, or simply as the reverse side of which theology is naturally the right side, an approach that still claimed, in the pure tradition of *metaphysica generalis*, to be investigating the essence of things or the being as being, would indeed seem ignorant, naïve or plain stupid. For the optimists or simply for those who, following their good sense, find that, in spite of it all, many things still remain knowable, and that it is conceivable, even possible, to hold them as true, it generally stands to reason that it's up to the numerous sciences to deal with it—something which, let's admit, they do do, and very well at that. And if, strictly speaking, rather than "knowing," at least according to some, there are things left "to think," "to express" or "to live," literature and art take care of them, and even better, without any doubt, than metaphysics. Assuming that the latter still had meaning, what would be left to keep them occupied?

It is customary to be very pleased about the creation of a new Chair. I'd be tempted to say that, in the present instance, this is not such good news. For we may well wonder whether the reason for which it was necessary, for the first time, to introduce into the title of a Chair the term "metaphysics"—to which all the philosophers who have made the history of the Collège de France, irrespective of their tradition, naturally resorted—might not actually be that, for a while now, we have completely forgotten what Emile Meyerson emphasized, that "man practices metaphysics just as he breathes"[1]. I will therefore not endeavour to define it and even less so to defend it here.

Paradoxically, one of the unquestionable characteristics of metaphysics is indeed the impression that one has, when practicing it, of being able to "simultaneously achieve the greatest certainty possible," while being incapable of giving or constructing a definition of its object. Kant noted that in metaphysics, contrary to mathematics, where I have absolutely no concept of my object, I already have a concept that is given to me, albeit confusedly, and I have to seek its distinct notion.[2]

I would therefore like to use this lecture to refresh our memories and seek to understand why and how there is actually nothing inconceivable, and even less so improper, in choosing to associate metaphysics with the philosophy of knowledge. On the contrary, it is still possible today to envisage an authentic metaphysic knowledge, with distinctive methods and criteria of validation, and even to see in it a form of rational enquiry that is both legitimate and indispensable.

1. "De l'analyse des produits de la pensée," *Revue Philosophique*, t. CXVIII, no. 9-10, September-October 1934.
2. *Recherches sur l'évidence des principes de la théologie naturelle et de la morale*, Paris, Vrin, 1973, p. 40.

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Source: *La lettre du Collège de France*, no. 32, October 2011.

Claudine TIERCELIN
Agrégée and Doctor in Philosophy.
Professor at the Université Paris XII from 1996 to 2010. From 2008 to 2011, scientific manager of the "KNOWJUST" project (knowledge, meta-cognition and modes of justification), Jean Nicod Institute.

PHYSICS OF THE EARTH'S INTERIOR

Barbara Romanowicz

Excerpt from the inaugural lecture 6 October 2011

In this lecture I'm going to present recent advances in seismic imaging on a global scale, which is my specific research field.

I am only going to talk about imaging of the mantle, and not that of the core or of the solid inner core. Seismic imaging is unquestionably the most effective method we have to "see" inside the earth. It uses elastic waves emitted by earthquakes across the globe and recorded by highly sensitive wave sensors, or seismometers. These instruments can detect shifts to the order of a micron, corresponding to earthquakes of a magnitude greater than five, at distances as large as the antipode of the epicenter. Elastic waves illuminate the interior of the globe: on the one hand, like light, they are reflected, converted or refracted on the obstacles encountered, and, on the other hand, the speed at which they propagate, and their amplitude, are altered by the physical state of the matter that they encounter. By combining the recordings of many earthquakes in numerous stations throughout the world, we can use "tomographic" methods similar to those used in medicine (ultrasound, MRI, etc.) to obtain 3D images of the earth's interior. However, unlike medical methods, in tomography we do not control the distribution of the sources of vibrations (situated primarily along the edges of the tectonic plates) and we are strongly limited in the distribution of stations. In addition to logistic and political considerations, two thirds of the earth's surface is covered by the oceans, there are relatively few islands, and setting up high-quality seismic stations on the ocean bed still involves considerable technical and financial difficulties. Sophisticated techniques are therefore needed to extract as much information as possible from seismic recordings. This is currently one of the main challenges of cutting-edge research. Fortunately, seismic recordings are a rich source of information. First, there are two types of seismic waves: longitudinal waves (known as "P waves") and transverse waves (known as "S waves"). As the latter do not travel in liquids, we have known with certainty, since the work of Oldham in 1906 and those who followed in his footsteps in the first half of the 20th century, by observing seismic waves in relation to the distance from the source, that the external part of the earth's core is liquid.

More subtle variations in research findings successively revealed the existence of a solid inner core (Lehmann, 1936) and discontinuities of structure present on a global scale in the so-called "upper" mantle, at depths of 400 and 660km. In particular, the comparison with materials physics has enabled scientists to establish that these discontinuities correspond to changes of the crystalline structure of minerals under the effect of pressure—called "phase changes"—, into increasingly compact structures. The discontinuity situated at 660km, which marks the limit between the "upper" and "lower" mantle, is probably also a mechanical barrier that makes the transfer of matter between the two parts of the mantle difficult but not impossible.

Seismic waves are also rich in information on frequencies. The waves with longer periods (the lowest vibration has a period of about 54mn) travel in the form of surface waves that circle the earth many times. Interference between them produces stationary waves, the earth's normal modes, the spectrum of which (i.e. all the frequencies together) is characteristic of the internal structure. Thanks to all these tools, we have had, for a long time, a precise idea of the earth's spherically symmetric structure (the first reliable models were produced in the late 1940s), that is, an onion-skin structure consisting of successive layers: the crust and solid mantle, composed primarily of silicates, then the liquid core composed of an iron and nickel alloy and, finally, the solid inner core composed of even purer crystalline iron.

Barbara ROMANOWICZ
Agrégée in Mathematics, PhD in Geophysics. Director of the Géoscope programme (global network of broadband seismic stations) at the Institut de Physique du Globe in Paris from 1981 to 1990. Professor at the University of Berkeley, California, and Director of the Seismological Laboratory from 1991 to 2011.

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Globalization of Research: Competition, Cooperation, Restructuring

Gérard Fussman
14-15 October 2010

Since 2001, on the initiative of Jean-Pierre Changeux, the Collège de France has been organizing a large annual multidisciplinary symposium on a topical social issue or a theme of general interest.

This symposium takes place in mid-October, at the beginning of the new Academic Year. In 2010 it was devoted to the bicentenary of Darwin's birth, and in 2009 the theme was "At the origins of human dialogue: speech and music". The purpose of these symposiums is to show, in two days, the lay and specialist public the difficulty and relevance of the Collège de France's mission: teaching of a very high standard, which nevertheless remains intelligible, as well as the professors' own research. Science today is no longer the hobby of an isolated genius; it is a collective driver of progress. Its results have to be disseminated as quickly and widely as possible so that it can be accessible and so that society can recognize its interest and grant it the increasingly huge resources it needs if it is to carry on progressing.

The 2010 symposium, organised by Professors Gérard Fussman, Antoine Compagnon, Philippe Descola and Philippe Kourilsky, was designed to report on science's quantitative and qualitative leap forward in the past ten years, and the ethical, epistemological, financial and organizational problems that this revolution has entailed. The topic: "Globalization of research: competition, cooperation, restructuring," is of particular interest at a time when profound structural reforms are being made in research and universities worldwide. This is also a period when all governments, aware of the huge investments that contemporary research requires, have to decide where to make them.

We therefore asked the best specialists, many of whom are professors at the Collège de France, to discuss the current conditions in which research is done. The first talk described the ways in which information technology has simultaneously revolutionized data collection and become an indispensable tool for ordering and understanding those data, at a time when research centres are proliferating throughout the world. Even computer technology is unable to keep up with the exponential growth of the quantity of information. The focus then turned to the artificial distinction between applied research and basic research, the latter being the only real source of innovation. Applied research, the costs of which are rising inordinately, to the extent of impeding the creation of new products, cannot do without the confidentiality of results and the financial gains derived from patents. And, at least for pharmaceuticals, the actual lifespan of a patent does not exceed ten years.

Of course the revolution in cognitive science and its philosophical implications were also discussed. It was shown how in areas less dependent on large research facilities, albeit equally reliant on information technology and international cooperation, the evolution of knowledge has been so fast that it has overturned many truths long considered to be intangible. This has directly impacted on society: for example, progress in French archaeology has challenged the very concepts of land (terroir), landscape and national identity; and the detailed study of demographic curves suggests the need to at least qualify what have long been considered to be facts regarding female fertility, the increase in the duration of life in good health, the unpredictable costs of ageing, etc.

Population growth, along with internal and external migration, has led to such upheavals in habitat that we can no longer talk about towns in the same way as in the 19th century. The town-country distinction has become almost meaningless. Town planners, geographers and architects will have to envisage a new way of structuring a constantly expanding urban space and making it liveable.

In the human sciences, this progress and the control of large commercial companies over scientific publishing have made it necessary to reconsider the role of libraries in the dissemination and sorting of information, as well as in the conservation and digitization of written material. For all the sciences, the costs of research are so high that funding organizations have to choose, and require objective indicators for doing so. The evaluation of organizations and researchers has consequently become crucial.

Image caption.
From left to right:
Michel Gras, Former Head of the École Française de Rome, Prof. Gérard Fussman, Jean-Paul Demoule, Former Head of INRAP.

Prof. Gérard FUSSMAN
History of India and Greater India

The symposium afforded an opportunity to point out the extent to which researchers challenge the purely quantitative and statistical viewpoint of such evaluation. Researchers argue that, despite impact studies—which are affected by fashion—evaluation does not take into account the real novelty of certain scientific productions.

Research is no longer exclusively the privilege of the Western World. Large emerging countries—India, China, Brazil, even North African countries—have become recognized and in many cases leading players. Cooperation is necessary, and in certain areas it needs to go way beyond relations between states. Only international organizations are meaningful in areas such as nuclear physics, geodynamics, astronomy, etc. This globalization of research, as beneficial and indispensable as it may be, is not however problem-free. The multiplication of researchers and data sometimes begs the question of whether we can still control information and whether its production in an increasing number of places is not largely redundant. The race for funding leads to a lack of objectivity, a loss of historicity, a difficulty in having synthetic points of view, and sometimes in scientific fraud. But these generally concern facts that are already known and thus contribute nothing new. Real innovation can hardly be a fraud, or is likely to be found out very quickly, for its results cannot be reproduced.

Researchers are moreover not absent from the global management of the planet. Jurists have to use their knowledge and diplomacy to oppose states tempted to impose their own rules on the rest of the world or on other members of their confederation. Respect for cultures, on the other hand, facilitates the hybridization of rules of law, guaranteeing a better functioning of world governance. In the large international organizations, researchers have to ensure that their knowledge is taken on board in governance by politicians who are swamped with information and not always fully abreast with the issues at hand. In case of failure, the consequences in the fields of health, food, and so on can entail millions of deaths. The final afternoon of the symposium was devoted to a round table discussion where we considered how issues addressed during the symposium were envisaged in the rest of the world, the measures that governments took to organize and finance research, and what the researchers concerned thought about it, including the directors of large organizations. Even though merging smaller organizations is desirable, this is not a panacea and size is not the solution to everything.

Participants

Gérard FUSSMAN, Professor at the Collège de France

Gérard BERRY, Senior Researcher at INRIA, Professor at the Collège de France (2007-2010)

Jean-Louis MANDEL, Professor at the Collège de France

Jean-Paul CLOZEL, C.E.O. of Actelion Pharmaceuticals Ltd, Professor at the Collège de France (2007-2008),

Pierre JOLIOT, Emeritus Professor at the Collège de France

Denis LE BIHAN, Senior Researcher at CEA, Head and founder of Neurospin, physicist and Doctor of Medicine, Professor at the University of Kyoto

Claudine TIERCELIN, Professor at the Collège de France

Jean-Paul DEMOULE, Professor of archaeology at University Paris I, former Director of the INRAP (Institut national de recherches archéologiques préventives)

Michel GRAS, Director of the École française de Rome

Hervé LE BRAS, Senior researcher at the EHESS (École des hautes études en sciences sociales)

Brigitte DORMONT, Professor of Economics at the Université Paris-Dauphine, Head of the Chair of Health of the Fondation du Risque

Roland CASTRO, Urban Planner/Architect

Michel LUSSAULT, Professor of geography at the ENS-Lyon, Director of the Urban Planning Institute at the ENS (École normale supérieure) in Lyon

Daniel RENOULT, Dean of the Inspection générale des bibliothèques

Roger CHARTIER, Professor at the Collège de France

Jacques MAIRESSE, Honorary senior researcher at the EHESS, Head of the scientific committee of the Observatoire des Sciences et Techniques

Serge HAROCHE, Professor at the Collège de France

Marc FONTECAVE, Professor at the Collège de France

Jacques LIVAGE, Emeritus Professor at the Collège de France

Gabriele VENEZIANO, Professor at the Collège de France, Emeritus professor at the CERN (particle physics)

Xavier LE PICHON, Emeritus Professor at the Collège de France

Philippe KOURILSKY, Professor at the Collège de France

Pierre CORVOL, Professor at the Collège de France

Anne FAGOT-LARGEAULT, Emeritus Professor at the Collège de France

Alain PROCHIANTZ, Professor at the Collège de France

Mireille DELMAS-MARTY, Professor at the Collège de France

Peter PIOT, Former Chief executive of UNAIDS, Professor at Imperial College, London, Professor at the Collège de France (2009-2010)

Roundtable: Stephan LEIBFRIED (Professor of political science at the University of Bremen); Jacob PALIS (Professor at the Institute of Pure and Applied Mathematics in Rio de Janeiro—Brazil); Jean-François SABOURET (Senior Researcher at the CNRS, Director of Réseau-Asie); Pierre VELTZ (Professor at the École des Sciences Politiques and at the École des Ponts, ParisTech); Elias Zerhouni (Former Director, National Institutes of Health (USA), Professor at the Collège de France, 2010-2011).

The papers can be consulted on the Collège de France website: www.college-de-france.fr (audio-video tab)

The symposium proceedings have been published online in the collection "Les conférences du Collège de France" on the platform revues.org (http://conferences-cdf.revues.org/).

Source: *La lettre du Collège de France*, no. 30, December 2010.

INTERNATIONAL YEAR OF CHEMISTRY 2011

SPECIAL REPORT

Chemistry at the Collège de France

On the occasion of the International Year of Chemistry 2011, the professors of chemistry presented the history of their discipline and shared their thoughts and views on research.

Microfibres of titanium oxide obtained by electrospinning

Source: *La lettre du Collège de France*, no. 31, June 2011.

Perspectives in Chemistry: Molecular, Supramolecular, Adaptive...

Jean-Marie Lehn

Chemistry is of crucial importance, given its central role in the sciences, its economic importance, and its ubiquitous presence in our daily lifes.

As it is present everywhere, we end up forgetting about it, and there is the risk that it not be noticed anywhere. Yet without it, numerous achievements that we agree are spectacular would not be possible: therapeutic exploits, spatial feats, technological marvels, etc. It contributes decisively to the needs of humanity for food and medicines, clothes and housing, energy and raw materials, transport and communications. It provides materials for physics and industry, models and substrates for biology and pharmacology, properties and processes for science and techniques.

The most promising paths for the future lie thus at the interfaces of chemistry with biology, physics and society. Chemistry is *the science of the structure and transformation of matter*. It plays a crucial part in our understanding of the material phenomena, in our ability to act on them, to control them and to invent new expressions of them. It is also a science of transfer, a node of communication and interaction between the simple and the complex, between the laws of physics and the rules of life, between the basic and the a ppl ied.

Chemistry is a science, but an industry as well, encompassing substances ranging from bulk products to the most innovative fine chemicals, including nano-materials and finely targeted therapeutic molecules.

For the past two centuries, *molecular chemistry* has produced a vast body of increasingly sophisticated molecules and materials. From the synthesis of urea in 1828 to the completion of the synthesis of vitamin B12 in 1970, this discipline has constantly asserted its power over the structure and transformation of matter.

Significantly, the synthesis of urea, a molecule contained in living organisms, also demonstrated that it was possible to obtain an "organic" molecule from a mineral compound and that no mysterious "vital force" was required. This triggered a profound conceptual shift with regard to the animate and inanimate.

Beyond molecular chemistry lies the field of *Supramolecular chemistry*, concerning not what happens *inside* molecules but *between* them. Its aim is to understand and control the way in which molecules interact with one another and generate larger entities, beyond molecules themselves. Already in 1894, Emil Fischer proposed the powerful image of the lock and the key to describe the relationship between an enzyme and its substrate. Today we talk about "molecular recognition," implementing a dual complementarity that is both geometric and interactional between the receptor and the substrate, and which represents molecular information coming into play. Supramolecular chemistry has thus been at the origin of the increasingly acute perception, the increasingly in-depth analysis, and the increasingly deliberate application of the information paradigm in chemistry, in the elaboration and transformation of matter. It has paved the way from simply condensed matter towards increasingly highly organized matter and systems of growing complexity. It applies the concept of molecular information with the aim of progressively acquiring control over the spatial (structural) and temporal (dynamic) properties of matter, and over its complexification through self-organization.

In addition to being a science of the structure and transformation of matter, chemistry is thus also an information science, the science of informed matter, dealing with the storage of information at the molecular level, in the structure, shape and composition of molecules, and with the reading and processing of this information on the supramolecular level, through the interactions between them. As these processes became better understood, scientists began to wonder about how they could be used to achieve the spontaneous but controlled generation of complex supramolecular architectures, from suitably designed molecular bricks, in a sort of self-fabrication. Thus, in chemistry, as in other fields, the language of information extends and expands that of the constitution, structure and transformation leading to the elaboration of increasingly complex architectures and behaviours. It will profoundly influence our perception of chemistry and the way in which we think about it and practice it.

Prof. Jean-Marie LEHN
Nobel Prize in Chemistry
Chair of Chemistry of Molecular Interactions
from 1979 to 2010

The storage of information at molecular level and its processing at supramolecular level open broad perspectives in chemistry, biology and physics. It enables the design and implementation of programmed chemical systems to induce the formation of complex forms of matter through self-organization processes. In particular, the generation of nanostructures through the spontaneous but controlled assembly of their components offers the nanosciences and nanotechnologies a powerful and attractive alternative or complement to the techniques of nanofabrication.

Supramolecular chemistry is in essence also a dynamic chemistry, whose objects—due to the lability of the interactions binding them together—have the ability to change themselves: their constitution can vary through incorporation, decorporation or exchange of components. The extension of this property to molecules has taken place through the introduction of connections resulting from reversible reactions. Thus, a constitutional dynamic chemistry has emerged that opens onto a new phase, that of *adaptive chemistry*, where the system selects among the available bricks/components those needed to build itself. It becomes capable of adapting the constitution of its objects in response to physical stimuli or chemical effectors. Selection, variation of constitution, and adaptation represent a profound paradigm change in chemistry, which thus takes on a Darwinian tingee.

Physics reveals the laws of the Universe; biology deciphers the rules of Life. But we can argue that the most fundamental process is the one that led the evolution of the universe towards increasingly complex forms of matter: self-organization. From divided matter to condensed and then organised living and thinking matter, the deployment of the universe nurtures the evolution of matter towards increasing complexity through self-organization under the pressure of information. Chemistry is part of the grand project of science, whose main task is to explore and reveal the paths of self-organization, leading to more and more complex non-living matter, by way of a purely chemical prebiotic evolution, and to the emergence of Life and, beyond that, of thinking matter.

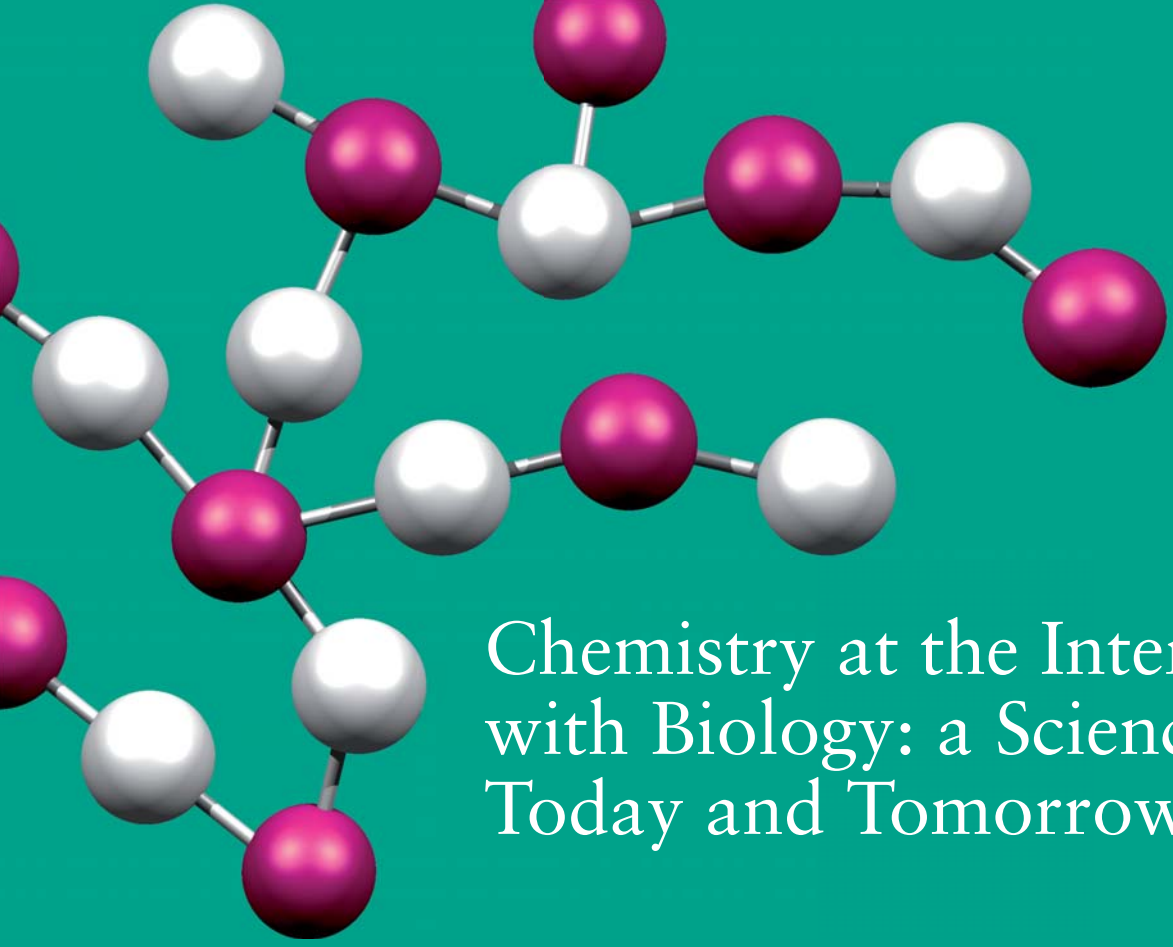
In the long term, chemical science develops towards a chemistry of complex systems, encompassing increasingly vast perspectives towards ever more complexity. Hence, chemistry in its broadest sense provides the means to untangle the threads and to fi nd the ways leading towards gradual complexifi cation of matter through self-organization. The aim is to discover, understand and implement, step by step, the rules governing the evolution of matter from the inanimate to the animate and beyond, through to the acquisition of the ability to create new forms of complex matter.

> Chemistry provides the means to investigate the past, explore the present, and build bridges into the future.

Through its objects—molecules and materials—it expresses its *creative force*, its power to produce new molecules and materials, endowed with new properties. They are new as they did not exist before being created through the rearrangement of atoms in original and infinitely varied combinations and structures. Owing to the plasticity of the forms and functions of the chemical object, and to its creative power, chemistry is also an art.

Like the artist, the chemist imprints in matter the products of his or her creative imagination. Stone, sounds and words do not contain the work that the sculptor, composer or writer shapes from them. Likewise, the chemist creates original molecules, new materials and novel properties from the elements provided by matter.

Chemistry has the particular characteristic of not only discovering but also of inventing and *above all of creating*. The book of chemistry is not just to be read; it is to be written! The score of chemistry is not just to be played; it is to be composed!



Chemistry at the Interface with Biology: a Science for Today and Tomorrow

Marc Fontecave

The International Year of Chemistry 2011 is an opportunity to highlight several characteristics of this discipline, all too often unfairly discredited by public opinion and the media and yet so crucial to our societies' economic development and welfare.

First, chemistry is perhaps the only discipline to border on all the others. This affords it the possibility of intervening in a relevant and original way with regard to most of the main challenges facing humanity in the 21st century (food, energy, health, environment, etc.). Whereas the scientific disciplines have become essentially interdependent today, chemistry is probably the one that has the most often and most profoundly multiplied its incursions into the domain of other disciplines, all of which constantly solicit it: life sciences, medicine, physics and materials science, engineering sciences, earth sciences and the environment. The development of these interfaces is probably one of the most important challenges of contemporary science. Unfortunately, there is no guarantee that French science is able to meet that challenge, given the strength of the cultural and organizational barriers against multidisciplinarity.

Chemistry is in demand because it is above all the science of the creation of the molecules and materials on which all the rest depends. In other words, it shapes the concrete world in which we live (medicines, cosmetics, polymers, plastics, glass—to mention but a few of the chemical components of our world). Our future will take shape around molecules and materials invented in chemistry laboratories. The possibilities are countless, because the potential of chemical transformation of matter and of societies is huge, and because the basic questions that chemistry—a positive science *par excellence*—raises are marked by their potential practical usefulness. We need to bear in mind that chemistry is also an industry. In France it is the second largest industry after car manufacturing, and accounts for €1bn turnover generated by over a thousand firms and 250,000 employees. In this respect France ranks second in Europe and fifth in the world.

The important thing now is to build a sustainable society in which people are able to satisfy their needs without compromising the future of the next generations. Science will be called upon to find totally innovative, clean, economic, effective and above all sustainable strategies for the production of fuel, electricity and materials.

Prof. Marc FONTECAVE
Chemistry of Biological Processes

Chemistry—the kind that is now called "green"—is set to play a major role in the development of this new science. Its new synthetic processes will take into account concerns on the potential toxicity of solvents, products and reagents, and will reflect the wish to use renewable products and to ensure the limitation of waste and related energy expenditures.

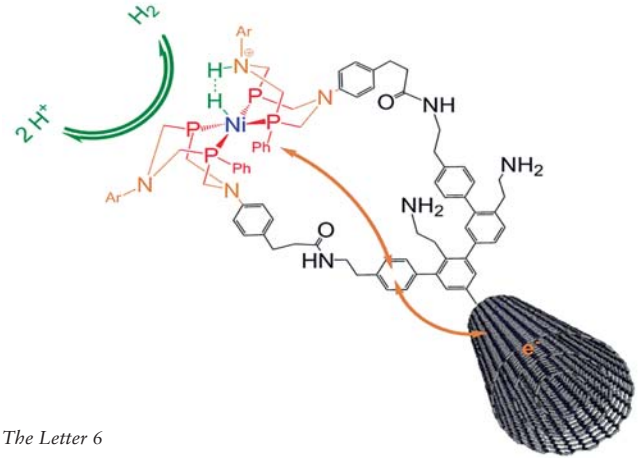
Clearly, biochemistry—both bio-organic and bio-inorganic—will play a key part in this new context. For example, we urgently need to develop the field of toxicology. The understanding, on a molecular scale, of the impact of a chemical product on a complex living organism is an exciting challenge for chemists. They have to establish this chemistry/toxicity relationship that makes it possible not only to avoid the introduction of toxic substances into our environment, but also, in relevant cases, to validate the exploitation of new components, something which has become increasingly difficult. Another field is biocatalysis, which provides unprecedented means to accelerate, orientate and optimize chemical reactions, including on an industrial scale, in order to make them cleaner and more economical from the point of view of matter, energy and waste. The discovery of new enzymes and the understanding of their functioning will provide original and practical solutions for the chemical transformation of matter. They will, for example, allow for the use of whole micro-organisms or enzymes as catalysts in numerous industrial and biotechnological processes: using methane and hydrocarbons, breaking down the lining of plant cells and transforming cellulose into biofuels, recovering and using carbon dioxide, or producing key intermediaries with a high value added in drug synthesis. Synthetic biotechnological processes accounted for 5% of the chemicals market in 2003. They are expected to account for 30% of the production in 2020 and become a leading technology in the future. Biochemistry will continue to find original solutions in the medical field. Biology and its applications in medicine constituted a great scientific adventure in the late 20th century. The result is extraordinary, as the constant lengthening of life expectancy shows, especially in developed countries, and chemistry has been instrumental in this progress. There is no doubt that the search for new medicines will remain a key activity of biochemistry in the fields of infectious diseases, major neuro-degenerative or cardio-vascular diseases, and cancer. Despite progress in genetic and cellular therapies which are opening fascinating perspectives, drugs will remain essentially molecular for a long time—synthetic or natural molecules, small molecules or biological macromolecules—and progress in medicine and health will remain largely dependent on chemistry.

The Chair of Chemistry of Biological Processes at the Collège de France is clearly set at this interface between chemistry and biology, with regard to both the content of its teaching and its research work, especially in the fields of catalysis and biocatalysis, through studies on complex enzymatic systems (notably metalloenzymatic) involved in metabolic processes, biosynthetic reactions and bioenergetic processes that remain to be discovered and understood.

> An emblematic approach in this research intended to invent new catalysts is so-called "biomimetic" or "bio-inspired" chemistry.

In this approach the chemist seeks to identify an interesting biological reaction, to characterize as completely as possible the enzyme responsible for this transformation, and more particularly its active site—i.e. the tiny part of the enzyme where the reaction takes place—, to understand the principles of its functioning (the structure-activity relationship) and, finally, to synthesize an original chemical model which, by adhering to these principles, may reproduce the structure and especially the reactivity of this active site.

One of our recent publications (*Science*, 2009) illustrates this approach. The necessity to replace platinum by catalysts made essentially of non-noble metals in applications such as electrolyzers and fuel cells led us to study hydrogenases, fascinating metalloenzymes that catalyze the water-hydrogen inter-conversion in various micro-organisms. Inspired by their active site based on nickel and iron, and which is unique in many respects, we were able to "invent" an original catalyst consisting of a compound of nickel set on nanotubes of carbon, with performances similar to those of platinum (see picture below). Immobilized on an electrode, this material has proved extremely stable and capable of functioning in highly acid environments, without excess tension, and reversibly. This means that it is compatible with the exchange membranes of protons (like Nafion®), used almost universally in electrochemical devices functioning at low temperatures. This bio-inspired chemical approach will be exploited in the near future to develop devices for the photo-transformation of carbon dioxide into fuel. This "artificial photosynthesis" is a major challenge for science.



◄ Diagram of the structure and reactivity of the material obtained by grafting the bio-inspired nickel-bidiphosphine catalyst (the diphosphine ligand is represented in red and the amine functions that it contains are in orange) on carbon nanotubes. The orange arrows indicate the exchange of electrons between the nanotubes and the catalyst. The interaction between a hydrogen atom carried by the nickel and a proton carried by an amine function which facilitates the reduction of protons or the oxidation of hydrogen is represented in green.

Reference

A. Le Goff, V. Artero, B. Jousselme, N. Guillet, R. Métayé, A. Fihri, S. Palacin, M. Fontecave "From Hydrogenase Mimics to Noble-Metal Free Hydrogen-Evolving Electrocatalytic Nanomaterials," *Science*, 2009, vol. 326, p. 1384-1387.

Laboratories of Condensed Matter Chemistry
Chemistry of Hybrid Materials

Jacques Livage and Clément Sanchez

Materials have played a key part in the history of humanity. After the stone, the bronze and the iron ages, we are now in the age of silicon. The mastery of this material has allowed for the development of electronics, computer technology and nanotechnologies.

The creation of these nanomaterials usually requires high temperatures and sophisticated techniques. Yet by observing nature we see that, under mild chemical conditions, it is able to create biomaterials whose properties often exceed those of our most advanced materials. A striking example is diatoms. These photosynthetic micro-algae surround themselves with a silica shell produced at ambient temperature. The beauty of these "glass cages" fascinated Darwin, who wondered what their purpose was. In fact, these fine structures have the properties of photonic crystal enabling them to play with light. The living world is certainly a real challenge for materials chemists!

Are we able of creating nanostructured materialsin biocompatible conditions?

> We took up this challenge by developing inorganic polymerization methods now known as "sol-gel processes".

For millennia, silica glasses have been produced by the fusion of sand at temperatures over 1,000°C, but it is possible to obtain a similar material simply by polymerization, in solution and at ambient temperature, from molecular precursors such as silicic acid ($Si(OH)_4$) or alkoxides ($Si(OR)_4$). In addition to an obvious energy saving, the "sol-gel" processes make it possible to control the course of polymerization at each stage of the synthesis, from the precursor molecule up to the final solid. It is thus possible to develop nanostructured materials whose composition, structure and even morphology are optimized for the intended application. A material does not simply correspond to a compound, or to a chemical composition. Thus, silica (SiO_2), consisting of chains of tetrahedrons (SiO_4), tetrahedra is the main component of sand, quartz crystals, glass panes and the elegant frustules surrounding diatoms. As a material it is actually the result of a combination between a chemical component and a process, the use properties of the material and their robustness depend largely on the quality of that chemical-process combination.

That is how, by combining soft chemistry with a very inexpensive aerosol shaping process, we synthesized mesostructured aluminium-silicate particles in which we can change the size of the pores at will, between 4 and 50nm. These catalysts can be applied to allow for the use of stocks of heavy hydrocarbons consisting of molecules that are too large to penetrate the pores of the zeolites currently used to refine crude oil.

Organic-mineral hybrids

The development of this "soft chemistry" in the past two decades has led to the appearance of new "hybrid" materials, real nanocompounds, in which mineral, organic and even biological components are closely mixed on a molecular scale. A whole range of new materials has thus been obtained, ranging from fragile glasses to plastic polymers. This chemistry of hybrid materials is currently in a phase of exponential development, bringing together chemists specialized in solids, solutions, polymers and organic molecules. Hybrid materials present innovative properties of particular interest to the academic and industrial worlds. They open fascinating perspectives in many domains, including optics, medicine, nanoscience, etc.

Inorganic components can have several roles: strengthening the mechanical and thermal quality of the material, providing it with a physical property (optical, magnetic, electronic, etc.) and, owing to its porosity, enabling the accessibility of reagents in order to create sensors or catalysts. The presence of organic components paves the way for entirely new matrices. Mechanical properties can be optimized, thus facilitating the application of film coatings, the stretching of fibres or the production of massive moulded materials.

This chemistry of hybrids is widely diverse and can be explored in terms not only of the organic components, but also, simultaneously, of the mineral components, through the use of a large number of elements such as the transition metals (V, Ti, Zr, W, Cr), metals in the p group (Sn) or the rare earths (La, Eu, Y).

Knowledge of species' chemical reactivity and reaction mechanisms makes it possible to select the nature of the objects chosen and to control their size, structure and form, by controlling the chemical and physical parameters (concentration of reagents, nature of the solvent, presence of sequestering agents, temperature, acidity, ionic force, surface charge and therefore surface tension). The selected object will become exactly like a piece of lego, which can function in a "customized" way and from which we can build more complex structures, that is, new and diverse hybrid

Prof. Clément SANCHEZ
Chemistry of Hybrid Materials

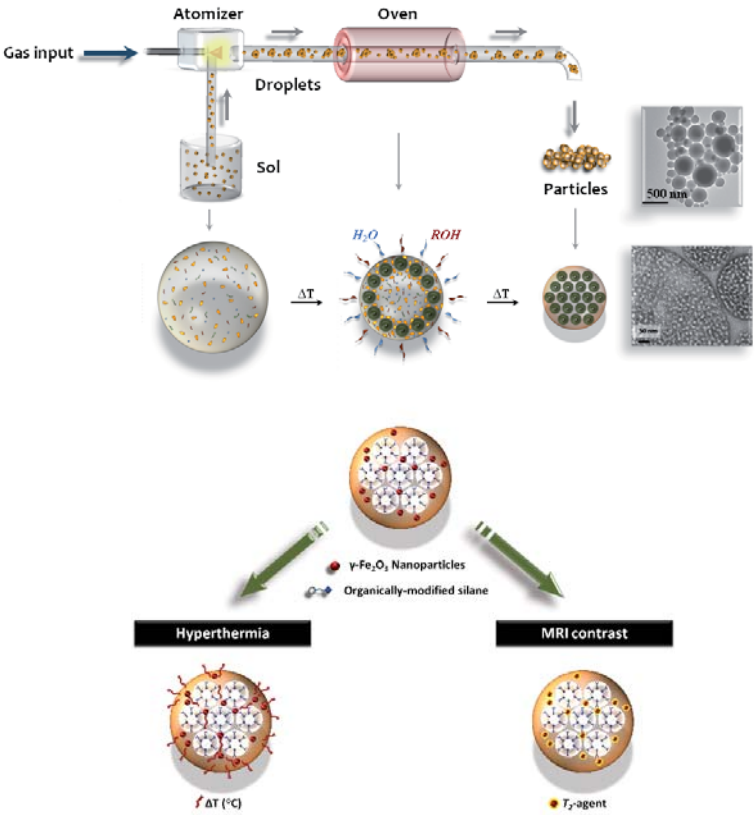
materials. These pieces of chemical lego are very small: on average between 1 and 50 nonometres (1nm = 1 millionth of a millimetre). Using these basic bricks, nanostructured and very often mesostructured hybrid materials can be built. The core properties (optical, electric, magnetic, mechanical, etc.) can be associated with the external organic functions that will serve as an interface with the outside environment, in order to obtain a better solubility in varied environments (solvents, polymers) or controlled auto-assemblages.

> The industrial applications of organic-mineral hybrids are countless today: from the soleplate of an iron to the roof of the Peking national theatre, a glass dome covered with a self-cleaning sol-gel coating in which nanoparticles of titanium oxide (TiO2) are scattered in a hydrophilic matrix.

A field that has been intensely developed is 'sol-gel optics' in which optically active organic molecules have been dispersed in a mineral matrix that ensures transparency, certain mechanical properties and protection.

Soft chemistry and biotechnologies

The sol-gel synthesis of glasses or ceramics is performed in conditions compatible with those in which living organisms survive. It is therefore possible to immobilize biological species (biomolecules, enzymes, antibodies, micro-organisms, etc.) within a mineral matrix. The immobilization of enzymes such as lipases has made it possible to create bio-catalysts which are now commercialized. The ability to produce materials in the form of coatings, fibres or nanoparticles, directly from the solution, opens up interesting possibilities for creating bio-sensors. The sol-gel matrix then serves as an interface between the active bio-molecules and the optical or electronic measurement system. Many publications describe the development of bio-sensors that can be used to measure out the right proportions of sugar in diabetics' blood. The corresponding enzyme, glucose oxidase, can be trapped within a silica coating that is applied to a Clark electrode to obtain an amperometric titration. The colloidal particles of silica into which the enzyme has been injected can also be applied by means of an ink-jet printer. Micro-networks consisting of spots are thus obtained, which can be used to simultaneously carry out several analyses by optical reading.



The properties of a material do not only depend on the structure or its chemical composition. Their formation is also essential. We therefore developed an aerosol spray method that makes it possible to obtain nanoparticle hybrids directly from components in a solution.

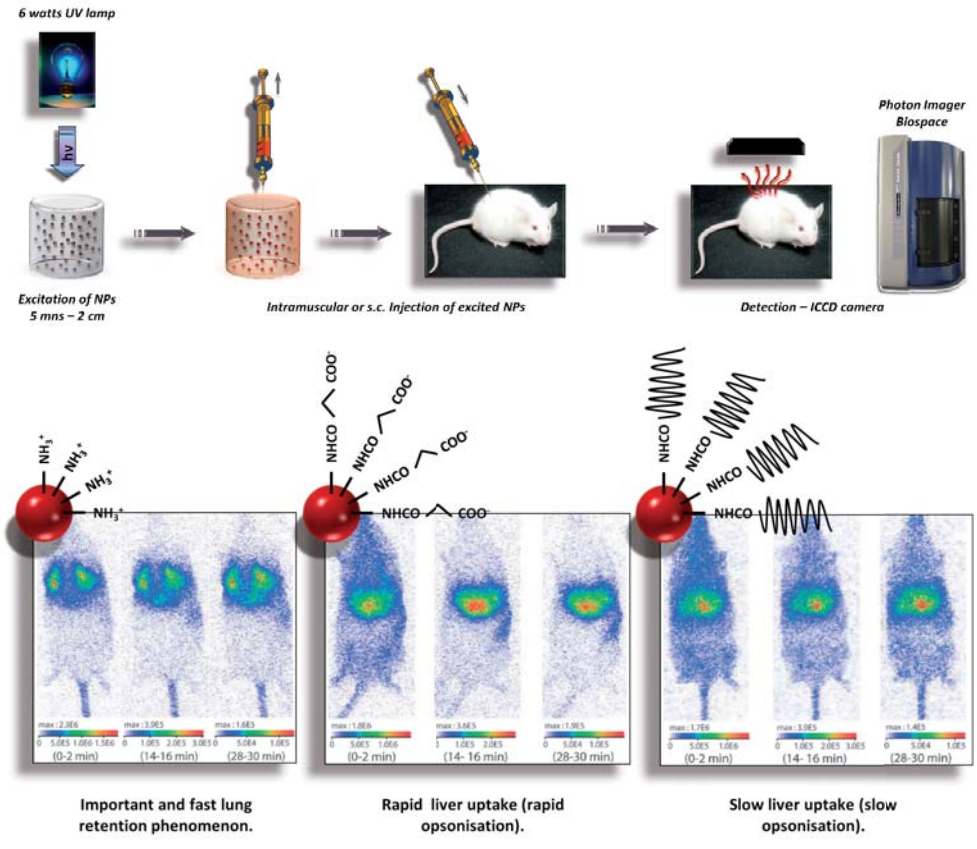
The mesoporous nanoparticles of silica produced *in vitro* open up interesting avenues in the field of nanomedicine. Many methods (*via* aerosol, micro-emulsions, etc.) make it possible to synthesize particles of around one hundred nanometers in diameter, that are small enough to cross through cell walls. The target molecules can be grafted to their surface via coupling agents, which gives these nanoparticles properties of furtiveness and targeting, enabling them to concentrate specifically on cancer cells. The toxicity of therapeutic agents is thus reduced and their efficacy enhanced, as they are administered only within the diseased cells and avoid the healthy cells.

Many micro-organisms such as bacteria, fungi, micro-algae, plant cells and even animal cells have been immobilized in silica gels. Studies show that our cells remain viable and maintain their metabolic activity for several weeks or even months.

It is possible to control the porosity of the silica enveloping the cells in order to regulate interaction with the outside environment. Reactions of specific antigen-antibody recognition have thus been obtained within silica gels. In collaboration with the parasitology department at the Pitié-Salpêtrière hospital in Paris, we developed immunological tests using Leishmania cells as antigen material.

Trapped in a silica gel, these cells retain their property of fixing the antibodies present in the serum of a patient with Leishmania. Blood tests can thus be carried out in particularly simple conditions.

In what is known as quorum sensing, bacteria communicate and exchange chemical signals in the form of molecules. The encapsulation of these bacteria within a silica matrix makes it possible to avoid the formation of colonies and the exchange of such signals. It then becomes possible to study the individual behaviour of these bacteria when we add the quorum sensing molecules. Detecting the agents that may make it possible to inhibit chemical exchanges (quorum quenching) could enable us to treat bacterial infections without antibiotics!



Chemical modification of the luminescent nanoparticles' surface led to lung of liver targeting or to long-lasting blood circulation.

Particularly interesting results have been obtained in the field of medical imagery by injecting nanoparticles with rare earth ions whose luminescence persists for several hours after excitation. It is thus possible to monitor *in vivo* the route of nanoparticles up to their target cell.

"Mineral gardens" obtained by osmotic growth of silicates in an aqueous solution.

THE
OpenLab PROJECT

LABORATORY OF CONDENSED
MATTER CHEMISTRY

The OpenLab project is the fruit of collaboration between materials chemistry and art critique. It is one of the actions organised within the framework of international year of chemistry, with the aim of fostering a new perspective on research in the fields of chemistry and nanoscience.

OpenLab consists of the creation of art works by contemporary artists, in close interaction with researchers in chemistry and nanoscience. The Laboratory of Condensed Matter Chemistry of Paris (LCMCP), headed by Clément Sanchez—Professor at the Collège de France as of 2011—, is the promoter of the OpenLab project. Under the impetus of one of its researchers, Niki Baccile, and in association with Margherita Balzerani, art critic and exhibition curator, the laboratory is currently steering three collaborative projects with artists. These projects, of different natures and with differing scientific and artistic approaches, are under way at the Collège de France.

The activities of this laboratory, which is at the interface of chemistry and biology—especially with regard to its ability to reproduce bone matter in vivo, with its multi-scale composition and morphology—, are at the heart of the project of two visual artists, Raphael Siboni and Fabien Giraud. Lorenzo Pagliei, composer and researcher at the IRCAM (Institut de Recherche et Coordination Acoustique/Musique), will work on exploiting the sound signal produced by nuclear magnetic resonance, a technology used as standard practice at the LCMCP for studying the internal structure of matter.

A second project has been undertaken in collaboration with Eduardo Kac, an artist known internationally for his interactive installations on the Internet and his Bio-Art creations integrating scientific research and especially biology. He will test the properties of encapsulation and release of odorous molecules within the micrometric transparent layers of glass obtained by sol-gel processing.

The OpenLab project is supported by the UPMC, the CNRS, the Nanosciences Ile-de-France committee and the Institut des Matériaux de Paris-centre. A conference entitled “Du Bio-Art au Nano-Bio-Art” (“From organic art to nano-organic art”), in the presence of Eduardo Kac, Claire-Marie Pradier, director of the UMR 7197, and Thibaud Coradin, senior researcher, UMR 7574, was held at the Enghien-les-Bains Arts Centre on 7 April 2011.

www.open-lab.fr

Chemistry for better Energy Management

Jean-Marie Tarascon

Energy has definitively become the main driver of modern societies, their growth and their development.

Today’s world is a machine, driven by the electricity carried on high-tension lines. Some analysts have predicted that the watt could become our next monetary unit. That is questionable, even though energy is increasingly at the heart of day-to-day economic and social challenges. Just as there are many currencies, so too there are several sources of watts, and tomorrow the strongest watt will be the one requiring the least currency. This type of scenario justifies a growing need for the conversion and storage of energy, in order to facilitate the use of renewable energies and to facilitate electric transport. Irrespective of the current systems of storage/conversion of energy (fuel cells, batteries, photovoltaic cells), they all lack adequate materials for their production. This makes them all dependent on the whims of chemistry and therefore the risk of it not producing high-performance materials on demand.

Chemists have succeeded in partially meeting this demand by developing the Li-ion technology, the greatest electrochemical breakthrough of the 20th century.

In only twenty years, this technology has spawned a booming industry. It has conquered the portable electronics market and become the best choice for the electric vehicle and even for network applications.

Unfortunately, like many technologies, it cannot fulfil all the hopes that are placed on it. Estimates of the world’s finite lithium reserves highlight the limits of a very large-scale use of this technology. To deal with a possible shortage of lithium, which many publications—admittedly, alarmist—have repeatedly mentioned recently, chemists are currently giving a second life to sodium-based chemistry by developing new materials with open structures, into which sodium ions can be inserted reversibly.

When it comes to energy, the buzz word today is of course sustainable development, which adds another constraint, or opportunity, for chemists. Technological breakthroughs, not incremental improvements, are needed. For that, scientists have to move off the beaten track and be encouraged to turn towards innovative modes of synthesis, to explore new routes, and even to invent new concepts.

One of the most fascinating options consists in turning to primitive organisms (viruses, unicellular algae, bacteria) capable of producing nanometric materials through bio-mineralization, using very effective catalysts (enzymes). This seems to be an approach that is likely to

give a second life to neglected materials or those which seem to have little value for energy-related applications. In this respect, even though it is still in its early stages, current research on batteries based on renewable organic electrodes, in which "green chemistry" is applied, could revolutionize the way in which we store energy in the future. All the energy processes of life are based on redox couples involving organic molecules (e.g. Krebs cycle). Why would we chemists not be able to ensure that one day they drive both our home appliances and our cars? Without dreams, the chemist's profession would not exist.

What is tomorrow's energy-related chemistry likely to be?

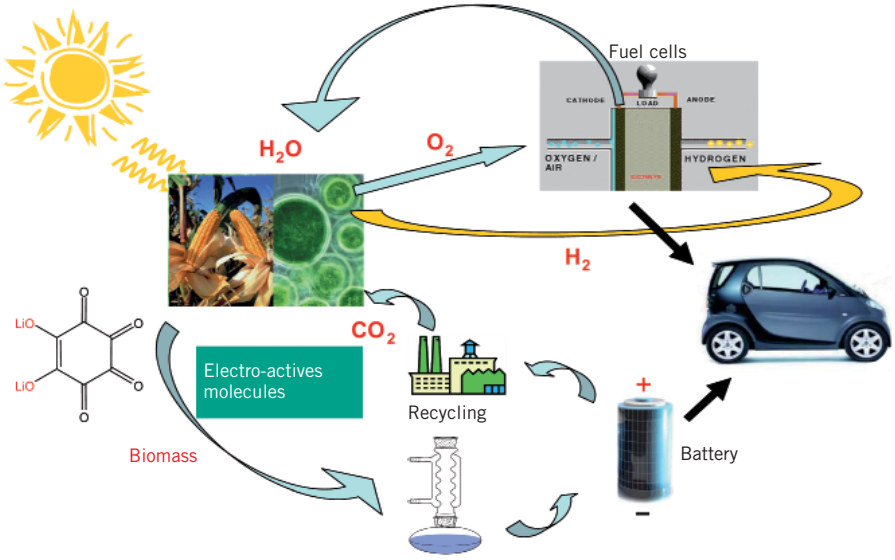
Time constraints will require it to be guided by predictive studies. Advances made in theoretical calculations aimed at creating a "materials genome" are encouraging. Yet the researcher's intuition, curiosity and green fingers will remain essential for any future adventure. There is also no doubt that the increase in inter-disciplinary collaboration will facilitate further progress. It therefore seems highly likely that the next discoveries will be made within the confines of several disciplines, between biology, chemistry and physics. Hence, the necessity to cluster diverse communities and to create melting pots of scientific culture.

Chemistry has definitively revolutionized our life expectancy, our resources and our lifestyles. To achieve that, it has drawn on our earth's mineral and plant reserves. Without fossil materials and petrochemicals, our synthesis chemistry would be an orphan. Without the minerals and chemistry associated with materials (association between a chemical compound and its production process) which make it possible to endow them with specific magnetic, electronic and optical properties, we would not have this diversity of efficient devices on which humanity is becoming dependent.

We depend on a planet from which, in a few centuries and especially the last few decades, we have consumed ingredients that it took billions of years to produce.

> Chemists, let's unite to spread this message and to ensure that the Year of Chemistry raises everyone's awareness, thereby prompting us to support the birth of another type of chemistry, already called the "chemistry of reincarnation".

This is a chemistry focused on recycling and designed to give a second life to chemical elements of which the reserves are on their way to depletion. Recycling may not be a fashionable word for our community, which all too often functions in reaction to fads and announcement effects. Yet this activity will become essential in the coming decades. It is important for chemists to remain humble and creative, and to be the messenger and guardian of a code of ethics with regard to our society. The International Year of Chemistry will be so much more meaningful if that is the case.



Production according to the "precepts of green chemistry"

Current research scenarios of cycles of conversion and storage of energy with minimal CO_2 imprints.

Prof. Jean-Marie TARASCON
Sustainable Development-Environment, Energy and Society

Chemistry at the Collège de France

From Analysis to Synthesis, a Science in Constant Evolution

Jacques Livage

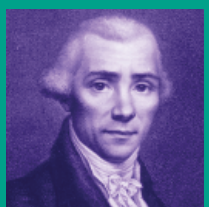
The 19 successive Chairs of Chemistry at the Collège de France since the end of the 18th century mark out the path of this discipline's history. The birth of chemistry as a science was a key event in the 18th century which prompted the Collège de France, more than two centuries after its foundation, to create the first Chair of Chemistry and Natural History, in 1774.

This new Chair, resulting from the transformation of a Chair of Medicine, was attributed to Jean Darcet, who had been a medical doctor before dedicating himself to chemistry under the influence of Guillaume-François Rouelle, a chemist at the Jardin du Roy. For close to a century, chemists at the Collège devoted themselves essentially to the analysis of mineral compounds. The controversy over the "vital" origin of organic substances was not over, yet the chemists, often doctors or pharmacists by training, sometimes also studied organic chemistry and even biology. Jean Darcet, for example, discovered how to extract gelatine from bones, and Nicolas Vauquelin discovered the first amino acid, asparagine. It was however not until the late 19th century, with Marcelin Berthelot, that "synthetic organic chemistry" acquired its letters of nobility and that a second Chair was created for it.

Prof. Jacques LIVAGE
Chair of Condensed Matter Chemistry from 2001 to 2009

1789
"Leblanc" process
Process for extracting artificial sodium triggered the development of the chemicals industry in France. Developed by Nicolas Leblanc in Jean Darcet's laboratory.

1797 **Chrome**
1798 **Beryllium**
Discovered by Nicolas Vauquelin



1802
Thénard's blue
Pigment made from cobalt oxide, used to colour porcelain. Discovered by Louis-Jacques Thénard in 1802.

1826
Bromine
Discovered by Antoine-Jérôme Balard

From the analysis of minerals to chemical laws

Jean Darcet (1774-1801), private tutor of Montesquieu's sons, was the first to deliver an inaugural lecture in French and without his doctoral robe. The topic, "On the current state of the Pyrenees and the causes of their deterioration," was only distantly related to chemistry as we conceive of it today. Director of the Manufacture de Sèvres, Jean Darcet laid the foundations of modern chemical analysis.

> He showed that the combustible diamond was not of the same nature as the ruby or emerald, and introduced the production of porcelain in France.

It was in his laboratory that **Nicolas Leblanc**, the surgeon of the Duke of Orleans, developed the process for the extraction of sodium that bears his name. This process was at the origin of the development of the chemicals industry before being ousted a hundred years later by the "Solvay" process.

Today, with hindsight, we wonder why Antoine-Laurent Lavoisier, who was unquestionably the precursor of modern chemistry, never joined the Collège de France. He was only 30 when the Chair of Chemistry was created, and therefore probably too young. Sadly, by the time the Chair was vacant, in 1801, he was no longer alive. The Revolution needed neither scholars nor chemists!

The Chair of Mineral Chemistry was attributed to **Nicolas Vauquelin** (1801-1804), to whom we owe the discovery of chrome and beryllium. The Collège de France has probably not yet earned the prestige that it has today, since Nicolas Vauquelin left the institution three years later for a Chair of Chemistry Applied to the Arts, at the Jardin du Roy. He wanted to be closer to his mentor, Antoine-François Fourcroy who had initiated him into chemistry in his youth.

His successor, **Louis-Jacques Thénard** (1803-1845), had a much longer career at the Collège de France. Appointed at the age of 28, he held the Chair of Mineral Chemistry for 40 years. He is known for his discovery of boron, the synthesis of hydrogen peroxide and especially for "bleu de Thénard," a pigment from cobalt salts still used to colour porcelain. He also initiated a new way of teaching chemistry, based on experience.

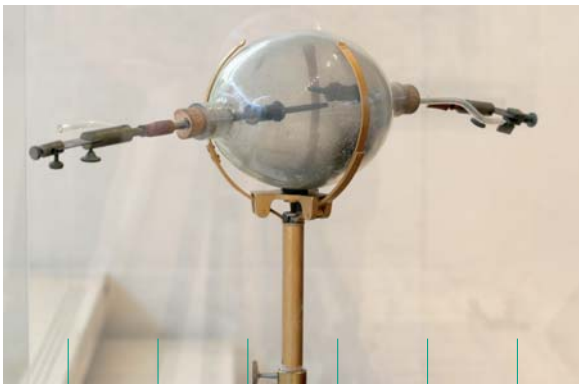
A pharmacist by training, **Théophile-Jules Pelouze** was with the Collège de France for only a few years (1845-1850). His work covered a wide range of subjects, including nitro-sulphuric acid, glycerine, hippuric acid, products decomposed by cyanogens in water and the dehydration of citrates. The most noteworthy was however unquestionably the discovery of nitriles. He was one of the 72 scholars whose name is inscribed on the Eiffel Tower.

Antoine-Jérôme Balard is known above all for the discovery of bromine. At the time he was a pharmacy student and only 22 years old! Struck by the similarities between this new element and chlorine and iodine, he was one of the first to introduce the notion of a "chemical family" that Mendeleev was to use later to establish his periodic tables. He occupied his Chair for a quarter of a century (1851-1876) and showed particular interest in substances dissolved in sea water. He thus contributed to the development of a new industry based on the extraction of potassium chloride and sodium sulphate from sea water mother liquids of saltern brine.

After studying medicine, **Paul Schützenberger** turned to chemistry and became the assistant of Antoine-Jérôme Balard, whom he succeeded at the Collège de France (1876-1897). He was essentially an experimenter. Like his predecessors, his work concerned both organic compounds (cellulose acetate) and inorganic compounds. He thus discovered sodium hydrosulphite ($Na_2S_2O_4$), which was to play an important role as a reducing agent in the production of indigo.

The Languedoc region in France was to make a fortune from indigo plant farming, until the appearance of synthetic colours

1862
Synthesis of acetylene
By Marceline Berthelot in his "electric egg".
This put an end to the vital force concept and showed that it was possible to synthesize an organic compound from its elements, carbon and hydrogen.



1884
"Le Chatelier's" principle
Law governing chemical equilibrium: published by Henri Le Chatelier in 1884 at the Académie des Sciences.

resulting from Perkin's work. Within a few years, chemical dyes replaced plant dyes, leading to plant dye farmers' ruin.

Henri Le Chatelier (1898-1907) is known above all for his work in general chemistry, although his main interests were chemical mechanics and industrial chemistry. In 1884 he presented a four-page thesis to the Science Academy, describing the law governing chemical balances and which now bears his name (Le Chatelier's law). After graduating from the prestigious Ecole Polytechnique—where he came first in his year—, he attended the École des Mines and frequented the Sainte-Claire Deville laboratory at the École Normale Supérieure, which explains his role in the development of metallurgy. He gave his name to the Portevin-Le Chatelier effect describing the deformation of alloys.

Camille Matignon (1908 to 1934) was a student of Berthelot and his assistant at the Collège de France. He participated in most of the thermo-chemical work carried out using the bomb calorimeter. His research covered too many subjects for his name to be attached to any particular discovery. Camille Matignon died suddenly during a general assembly of the professors of the Collège de France. His death marked the end of a line of inorganic chemists that would not be revived until the end of the 20th century, with the nomination of Jean Rouxel.

Synthetic organic chemistry

Organic chemistry did not really exist as such until the 19th century, with the synthesis of urea by Friedrich Wöhler in 1828 and that of Perkin's violet by Henry Perkin in 1856, which triggered the rapid growth of the chemicals industry. The Collège de France, whose mission was *to develop science in the making*, could not ignore this revolution and a second Chair of Chemistry, devoted to organic chemistry, was created in 1865. This generated intense controversy, especially by Louis Pasteur who wanted the creation of a Chair of Physiology for Claude Bernard, rather than a Chair of Organic Chemistry for Marcelin Berthelot. He argued that if such a Chair were created, he would apply for it. For this reason, the Collège de France initially set up only *a course in organic chemistry*, in 1863, followed two years later, on 8 August 1865, by the Chair of Organic Chemistry. This Chair was held by Marcelin Berthelot for 42 years (1865-1907)—a record at the Collège de France!

Marcelin Berthelot joined the Collège de France in 1851 as Balard's assistant. He was to play a fundamental and often controversial role in the institution. With his book *La chimie organique fondée sur la synthèse* he revolutionized chemistry, which until then had been limited to analysis. The synthesis of acetylene in the *electric egg* that is still on display in the lobby of the Collège de France has remained famous.

> It showed, for the first time, that an organic compound, C_2H_2, could be synthesized from its elements, carbon and hydrogen, without the aid of a vital force.

Marcelin Berthelot's scientific work was not limited to organic synthesis; it covered almost all aspects of late 19th century chemistry.

In organic chemistry he showed the reversible character of esterification reactions leading to an equilibrium that could be shifted by adjusting the experimental conditions. This finding was to lead Gudberg and Waage to establish the famous *law of mass action*. In physical chemistry, his measurement of heat generated by a chemical reaction, using his bomb calorimeter, led him to formulate the principle of maximum work that was subsequently impugned by Pierre Duhem. His work, described in the book *Essai de mécanique chimique fondée sur la thermochimie* published in 1879, was to lay the foundations of a new discipline, thermochemistry.

During his studies on plants, Marcelin Berthelot endeavoured to show the role of micro-organisms present in the soil. This work was to generate stormy debates between Louis Pasteur and himself. Pasteur argued that the fermentation of glucose required the presence of micro-organisms, *saccharomyces cerevisiae* yeasts. Marcelin Berthelot and Claude Bernard believed that the transformation of glucose into alcohol was due to a non-living ferment secreted by the yeasts. We now know that enzymes catalyze the reaction.

This controversy was not the only one in Marcelin Berthelot's career. The most intense of all was against the atomists. As an advocate of the theory of equivalents, based on the measurement of masses and volumes, he did not want to acknowledge the existence of atoms.

A man of power, Marcelin Berthelot was a cabinet minister, director of higher education and senator for life. This earned

Fermentation
Pasteur demonstrated the role of micro-organisms such as yeasts in the fermentation of glucose. Based on the work of Claude Bernard, Marcelin Berthelot contended that this was a reaction due to the action of a ferment (enzyme) secreted by yeasts. This triggered one of the major controversies in the history of science, in the late 19th century.

1914-1918
Anti-oxidants
Discovered by Charles Moureu and Charles Dufraisse when studying the auto-oxidation of poison gasses.

1947
Synthesis of the first hormone marked with iodine 131 (^{131}I)
With this process, discovered by Alain Horeau, it was possible to monitor the hormone throughout the body.

him many honours—he was buried in the Pantheon with his wife—but also much jealousy!

Marcelin Berthelot introduced organic chemistry into the Collège de France. The discipline did not disappear on his death; on the contrary, his Chair has been occupied continuously by eminent organic chemists who were all trained pharmacists.

Emile Jungfleisch (Chair of Organic Chemistry, 1908-1916) was the student and successor of Marcelin Berthelot, with whom he wrote *Traité élémentaire de chimie organique*. He is known above all for his work on molecular dissymmetry. His endeavour to synthesize all the optically active bodies engaged him in intense debates with contemporary scholars such as Pasteur. He was able to prepare several hundred grams of inactive tartric acid and then break it down into its optically active components, thus showing that optical rotation could develop without the intervention of living matter.

Charles Moureu (1917-1929) was known above all for his discovery, with his student **Charles Dufraisse** (1942-1955), of the phenomenon of autoxidation and anti-oxidants. The history of this discovery is original. It was during the Great War of 1914-1918, when they were working on poison gas and seeking a means to stabilize acrolein, tear gas, which became liquid while polymerizing. They noticed that this polymerization was always preceded by oxidation, and thus defined the phenomenon of autoxidation. They also found that certain compounds such as hydroquinone stabilized a gaseous state by counteracting autoxidation.

> The *anti-oxigens* that would later be called *anti-oxidants* were thus discovered. Today they play an important part in industry and especially in medicine, in the fight against ageing.

For the purpose of networking chemists throughout the world, Charles Moureux created the International Union of Pure and Applied Chemistry (IUPAC) which still plays a significant role in scientific life.

Before being nominated to the Collège de France Chair of Organic Chemistry (1930-1941), **Marcel Delépine** held the Chair of Mineralogy and Hydrology at the Faculty of Paris. As Marcelin Berthelot's assistant, he contributed to the development of thermochemistry. He was scientific adviser to the firm Poulenc and then Director of Pharmaceutical Research at Rhône-Poulenc.

This clearly shows the universal nature of this scientist who contributed meaningfully to all areas of chemistry: mineral, organic and general.

In inorganic chemistry, Marcel Delépine studied the phenomenon of complex formation . Continuing Werner's work, he studied the complexes of platinum, iridium and rhodium. He developed an original process for producing metallic tungsten which was subsequently adapted to the industrial manufacturing of the filaments used in incandescent bulbs.

Trained as a pharmacist, Marcel Delépine studied a drug that was very fashionable at the time, urotropine (hexamethylenetetramine) obtained by the action of ammonia on formaldehyde. He consequently published seminal work in the field of the organic chemistry of aldehydes, and it was during his work on sulphur derivatives that he discovered the phenomenon of oxiluminescence.

As noted above, it is difficult to separate the name of Charles Dufraisse (Chair of Organic Chemistry, 1942-1955) from that of Charles Moureu with whom he collaborated at the École de Pharmacie and then at the Collège de France, from 1911. Together they discovered autoxidation and anti-oxidants.

With **Alain Horeau**, Chair of Organic Chemistry of Hormones (1956-1980), organic chemistry opened onto biology. Horeau worked essentially on the synthesis of natural and artificial hormones, and on problems of stereochemistry. In 1944, at the Collège de France and with Frédéric Joliot, Robert Courrier and Pierre Sue, Alain Horeau was the first to synthesize a hormone, thyroxin, marked by an artificial radioelement, iodine 131. This radioactive marker made it possible to monitor molecules, even those present in very low concentrations, from their place of production up to that of their action. It was thus possible to isolate the receptors and to study the transmission of the message from within the cells.

CHEMISTRY AT THE COLLÈGE DE FRANCE

1979
Supramolecular chemistry
Developed by Jean-Marie Lehn, Nobel Prize in chemistry in 1987.

1997
Soft chemistry
The two initiators of soft chemistry, Jean Rouxel (soft chemistry with solid state precursors) and Jacques Livage (soft chemistry with molecular precursors) were professors at the Collège de France.

Towards a multidisciplinary chemistry where barriers disappear

The former antagonism that had separated inorganic chemistry and organic chemistry disappeared at the end of the 20th century. The boundaries between disciplines collapsed and the Chairs opened to neighbouring disciplines: physics and biology. This characteristic was shared with the Chair of the Chemistry of Molecular Interactions held by **Jean-Marie Lehn** (1979-2011) (Nobel laureate, 1987), which paved the way for a chemistry in which the molecules self assemble to form Supramolecular structures.

> The focus had thus shifted from the properties of single molecules to the synergies generated by combinations of molecules.

This is how cages (cryptates) are formed, whose shape and size are adapted to the object to be imprisoned. This new chemistry involves processes of molecular recognition that explain how chemistry enabled the evolution from the single molecule to the self-organised assemblages that spawned living organisms. The opening onto biology was recently concretized (2009) with the Chair of the Chemistry of Biological Processes held by **Marc Fontecave**, who has shown the role of metallic ions in the biological activity of metal proteins.

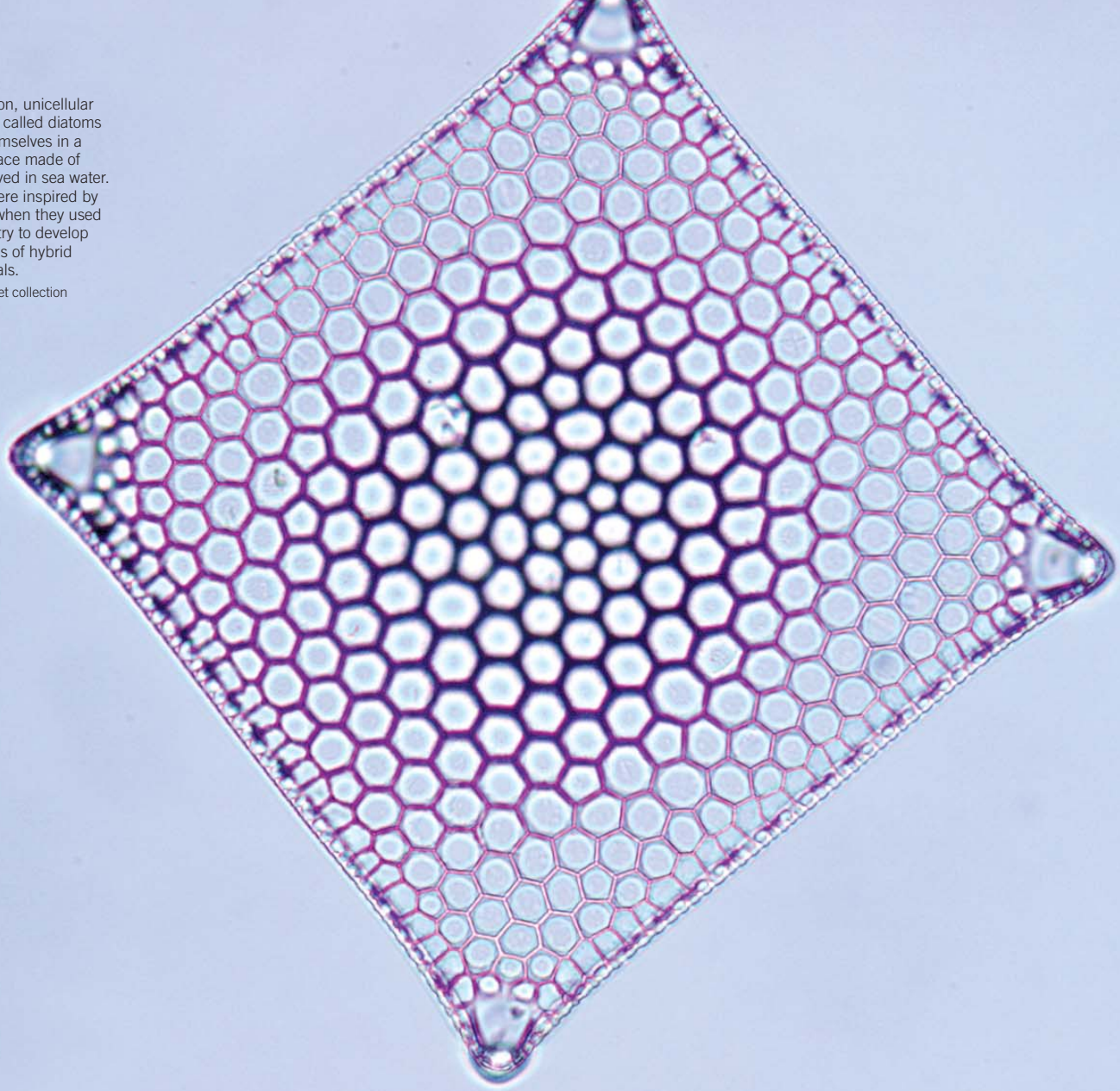
With **Jean Rouxel** (1997-1998) a Chair of Solid State Chemistry entered the Collège de France. This was fair recognition for the progress accomplished by this discipline in the latter half of the 20th century, with researchers like Paul Hagenmuller and Robert Collongues. Here too, barriers are falling away. inorganic solids have become carriers of physical properties and structure-property correlations serve as a basis for the development of new materials. Lamellar solids combine with organic molecules to form intercalation compounds. These solids, of which clay is the best-known example, are formed by weakly bound inorganic sheets.

These sheets can be separated to insert inorganic, organic or even biological species. This has allowed for the development of new lithium batteries, the understanding of the exceptional properties of Maya blue, and the description of the role of minerals in the processes of the formation of life. Jean Rouxel's career at the Collège de France was unfortunately very short, but the spirit of his research was preserved with the creation of a Chair of Condensed Matter Chemistry, held by **Jacques Livage** (2001-2010). This new Chair has bridged the gap between solid state chemistry and Pierre-Gilles de Gennes' *soft matter chemistry*. Materials chemistry in the 21st century is becoming bio-inspired and is interfacing more extensively with physics, biology and engineering.

> This "integrative" chemistry, in which customized inorganic components can be effectively combined with organic, or biological molecules or macromolecules on all scales, leads to the formation of hybrid materials with multifunctional hierarchical structures.

New perspectives have opened up and have been concretized with the Chair of the Chemistry of Hybrid Materials, held by **Clément Sanchez** (2011).

Finally, note that 2011, The Year of Chemistry, is a great year for this discipline since the annual Chair of Sustainable Development—Environment, Energy and Society was held by **Jean-Marie Tarascon** who is suggesting promising solutions to problems of energy and climate change by developing batteries for the future.



For protection, unicellular micro-algae called diatoms envelop themselves in a glass carapace made of silica dissolved in sea water. Chemists were inspired by this model when they used soft chemistry to develop the synthesis of hybrid nanomaterials.

HISTORY OF THE CHAIRS OF CHEMISTRY AT THE COLLEGE DE FRANCE

1774 – 1801	**Jean Darcet**	Chemistry and Natural History
1801 – 1804	**Nicolas Vauquelin**	Mineral Chemistry
1804 – 1845	**Louis-Jacques Thénard**	Mineral Chemistry
1845 – 1850	**Théophile-Jules Pelouze**	Mineral Chemistry
1851 – 1876	**Antoine-Jérôme Balard**	Mineral Chemistry
1865 – 1907	**Marcelin Berthelot**	Organic Chemistry
1876 – 1897	**Paul Schützenberger**	Mineral Chemistry
1898 – 1907	**Henri Le Chatelier**	Mineral Chemistry
1908 – 1934	**Camille Matignon**	Mineral Chemistry
1908 – 1916	**Émile-Clément Jungfleisch**	Organic Chemistry
1917 – 1929	**Charles Moureu**	Organic Chemistry
1930 – 1941	**Marcel Delépine**	Organic Chemistry
1942 – 1955	**Charles Dufraisse**	Organic Chemistry
1956 – 1980	**Alain Horeau**	Organic Chemistry of Hormones
1979 – 2010	**Jean-Marie Lehn**	Chemistry of Molecular Interactions
1997 – 1998	**Jean Rouxel**	Solid State Chemistry
2001 – 2009	**Jacques Livage**	Condensed Matter Chemistry
2008	**Marc Fontecave**	Chemistry of Biological Processes
2010	**Clément Sanchez**	Chemistry of Hybrid Materials

Creation of the Centre for Interdisciplinary Research in Biology—CIRB

Alain Prochiantz

Biological research at the Collège de France is distributed across several sites in France and abroad. This geographical distribution varies depending on the holders of the Chairs.

Significant biological research is also carried out on the Marcelin Berthelot campus in Paris, and in recent years has been the responsibility of the Chairs of Experimental Medicine, of the Physiology of Perception and Action, and of Neuropharmacology. The respective holders of these Chairs were (and, in some cases, still are) Professors Pierre Corvol, Alain Berthoz and Jacques Glowinski. Additionally, outside teams, usually INSERM or CNRS units, are invited to carry out research, for a limited duration of four or eight years, independently of the Professors of the Chairs. This organizational strategy has made it possible to attract a body of top level researchers to the Marcelin Berthelot campus. The opening of several thousand square metres of laboratories (Building C), followed by the nomination of the Chair of Morphogenetic Processes (author of this text), has led to changes in the organization of biological research on this site. In fact, it has afforded the opportunity to make those changes, necessitated by upheavals in the conditions of research over the past few years, especially in this scientific field. More and more research nowadays is undertaken by small independent teams working together in research centres, departments or institutes, and users of shared technology platforms. This has become so prevalent that financiers—whether private or public, regional, national or international—often require this type of organization as a condition for granting funds. This is the context in which the administrator of the Collège de France asked me to set up a research centre on the Marcelin Berthelot campus. But the Collège de France is not a common institution and this change could not disregard certain constraints and particularities. The first of these was to ensure the creation of a multidisciplinary environment that could host any team led by a professor who, once appointed, would assert his right to work on the site. This did not pose a problem, because I am convinced that multidisciplinary institutes are immensely rich, indeed I prefer places where the objects have been brought in one by one, following an aesthetic choice, rather than places designed by a decorator. Biology is defined by its diversity and I was very happy to be able to encourage this. Of course, it is necessary to be careful to maintain intellectual life and to ensure that the tools are shared. Having experienced this situation as the director of the department of biology at the Ecole Normale Supérieure, I felt at home with the concept.

Moreover, it is desirable that, within this interdisciplinary biological research centre (CIRB and, perhaps in the future, the Claude Bernard Centre), this diversity should apply beyond the realm of biology. We would like to see teams of chemists and physicists hosted, and close relations fostered with researchers in these two disciplines, both of which are already on the Marcelin Berthelot campus or are going to move in once the laboratories have been renovated. Interaction with these disciplines is important. Chemistry is part of a vibrant tradition initiated at the Collège de France by collaboration between Claude Bernard, Charles Barreswil (of Théophile Pelouze's Chair) and, naturally, Marcelin Berthelot. As regards physics, interaction has been more recent and is illustrated by the physicists of "soft matter," a highly active school in our country, of which Pierre-Gilles de Gennes was one of the most eminent representatives. Of course, we have not forgotten the mathematicians and their modelling. At the end of 2010, the CIRB will recruit one or two teams in this discipline.

This brings me to the question of governance and recruitment. The CIRB was initiated by the merging of existing teams but will gradually be completed by new teams. Three have just been recruited and one or two others, in the mathematics field, will be recruited in 2011. The mode of recruitment is very important to guarantee a high scientific standard.

Prof. Alain PROCHIANTZ
Morphogenetic processes

Image caption. The Centre has just opened a fish house that enables the teams to have access to an increasingly sought-after experimental model.

Following an international call for proposals, published in the appropriate media (Science, Nature, etc.), the candidates are auditioned by an international scientific committee, including representatives of the supervising authorities. All the CIRB members can attend the presentations, but the deliberations and decisions are reserved exclusively for the committee, which proposes a ranking. The CIRB opened in January 2011. All the teams, with the exception of those of the Chair, are recruited for a period of four years, which can be renewed once. As regards its governance, the usual rules apply: total independence of the teams, pooling of resources, and strategic and budgetary decisions taken jointly with the CIRB Board , according to the procedures legally applying to a joint Collège de France, CNRS and INSERM research unit. The presentation of this new research facility would not be complete without reference to the fact that the Collège de France is not alone on the Montagne Sainte-Geneviève. That is why the Institut de Biologie de l'Ecole Normale Supérieure (IBENS), run by Antoine Triller, and the CIRB have combined their proteomic, imaging and functional genomic technical platforms, the latter two of which have received the IBISA label. We trust that this initial sharing will be followed by others, as the CIRB and IBENS, along with a few teams of the Ecole Supérieure de Physique et Chimie Industrielle (ESPCI), have recently been recognised as a Labex. Additionally, our relations with the Institut Curie are excellent, and I am pleased to announce that on 4 March 2011 we will have the pleasure of hearing talks by the heads of young teams recently recruited by the Ecole Normale Supérieure, the Institut Curie and the CIRB.

Last but not least, a reminder that the CIRB will open in January 2011 but will not be officially inaugurated until May. We have decided to make this inauguration a prominent scientific event, at which speeches will be made by professors of the Collège de France, members of the international scientific committee of the CIRB, eminent representatives of related institutions, and the heads of the CIRB teams. We trust that the presence of many colleagues will ensure the success of these inaugural days on 16 and 17 May 2011 and will augur well for the interdisciplinary biological research centre. I therefore urge everyone to take note of this date and to join us in celebrating the birth of the CIRB.

Image caption. Between the Collège de France and Notre-Dame de Paris, the channels and photons of the imaging platform.

Source: *La lettre du Collège de France*, no. 30, December 2010.

The host-microbiota relationship: how deep goes the symbiosis?

Philippe Sansonetti

The human-microbe interface is often studied from the angle of infectious diseases and understandably so, given their importance in public health.

In spite of its potential severity, the infectious accident is nevertheless anecdotal in a life, and the number of pathogenic microbial species that may be responsible is minute compared to our constant interaction with the infinite number of symbiotic microbes colonizing our mucosal and cutaneous surfaces and constituting the microbiota. Cutaneous, oral, respiratory, vaginal, digestive flora: 10^{14} types of bacteria inhabit our body. They belong to thousands of species, many of which cannot be cultivated. Most of them are found in the lumen of the distal small intestine and the colon.

Thus, humans are "microbe-mammal hybrids," "super-organisms". Our microbiota exceed the number of somatic and germinal cells composing our body by a factor of 10, and the number of active genes composing our genome by a factor of 150. This situation of microbial symbiosis is, moreover, common to the entire animal and plant world. It was therefore necessary, in the course of evolution, to develop a complex, refined, diversified eukaryotic-prokaryotic relationship rendered even more complex by reciprocal selective pressures. If we consider the intestinal microbiota, which have been the subject of most research until now, its role seems multiple: barrier effect against colonization by pathogenic agents; effect of maturation not only on the systemic and mucosal immune system but also on the intestinal mucosa itself and its vessels; and major metabolic and nutritional contribution by creating a capacity that did not previously exist in mammals, for the hydrolysis of complex plant sugars and the production of nutrients such as short-chain fatty acids and certain vitamins. Overall, this represents the equivalent of the metabolic activity of the liver. Would we, as higher primate, have survived the planet's major climatic crises and their alimentary consequences without our microbiota? A germ-free mouse (i.e. without a microbiota) requires 30-50% more food than a so-called conventional one (i.e. with a microbiota). Symbiosis, commensalism, mutualism: the human-microbe interface developed at several levels of integration, and our immune system was probably shaped by the dual necessity of tolerating this microbiota and in parallel of perceiving, recognizing and eradicating pathogenic microbes.

> Would we have survived our planet's major climatic crises and their alimentary consequences without our microbiota?

After years of this subject eliciting only limited interest compared to the attention paid to the world of pathogenic microbes, we are currently witnessing a proliferation of research on the microbiota. The reasons for this interest are numerous. The spectacular advances in microbial genome sequencing and the possibility afforded by the latest generation of instruments and bio-informatics for identifying metagenomes—that is, the exhaustive sequencing of the genomes of complex flora—have made previously inconceivable global analyses possible. These analyses have a high resolution allowing for the study of stages in the development of the intestinal microbiota after birth, the nature of the main balances during a person's life, the loss of those balances in cases of pathological conditions, etc. In parallel, experimental studies and the study of human genetic diseases have shown that disruptions of homeostasis of the host-microbiota interface could lead to severe chronic pathologies such as inflammatory diseases of the intestines (Crohn's disease, ulcerative colitis). Finally, it has been recognized that the intestinal microbiota functions as a relay between nutritional imbalance (diet too rich in sugar and fats) and the establishment of a resistance to insulin, responsible for obesity and type-2 diabetes. This has convinced doctors and scientists that entire sections of physiology and pathology are determined at the interface between the host and the microbiota, and that studies on this subject are likely to yield fruitful results for prevention and treatment. This concerns far more than the "classical" field of probiotic micro-organisms. Finally, if the

Prof. Philippe SANSONETTI
Microbiology and infectious diseases

International symposium organised 23-23 May 2011

Image caption. Fluorescent In Situ Hybridization (FISH) showing the presence of bacteria in the colonic crypts—the regenerating zone of the intestines.
Blue= DAPI: marking of the nuclei of the intestinal crypt cells.
Red= fluorescent bacteria.
© Céline Mulet, Thierry Pédron, Philippe Sansonetti, Institut Pasteur.

role of the microbiota is so important, then it is becoming even more essential to be circumspect and parsimonious in our use of antibiotics.

Entire sections of physiology and pathology are determined at the interface between the host and the microbiota

The international symposium on "The commensal microbiota: from homeostasis to disease," held at the Collège de France in the Marguerite de Navarre Amphitheatre on 23 and 24 May 2011, was intended to provide an opportunity for multi-disciplinary comparison of approaches and concepts currently being developed at the cutting edge of scientific work in this field. Organised by Prof. Philippe Sansonetti of the Collège de France (Chair of Microbiology and Infectious Diseases) and Prof. Brett Finlay of the PWIA (see p. 60; University of British Columbia, Vancouver, Canada), it brought together these two institutions as well as TORNADO, a network funded by the European Union FP7 (Framework Programme 7), devoted to the study of the role of the intestinal microbiota in health. The PWIAS and the Collège de France have now established a high level of interaction allowing for ambitious projects, as this symposium illustrates.

This symposium enabled the audience to review current methods for analyzing the microbiota and the microbiological and immunological mechanisms of tolerance and disruption of tolerance to the micro-organisms of which it is composed. It confirmed the extent to which the microbiota plays an essential part in the regulation of our nutritional and metabolic condition. One of the highlights was probably the realization that the depth of our symbiosis with the microbial world is far greater than we imagined. Fascinating perspectives are currently opening up, such as the role of the microbiota in the late stages of cerebral development, as well as in the growing incidence of inflammatory and allergic pathologies.

PWIAS
PETER WALL INSTITUTE
FOR ADVANCED STUDIES
THE UNIVERSITY OF BRITISH COLUMBIA | VANCOUVER

The PWIAS, founded in 1991, is a University of British Columbia (UBC) research institute. Inspired by the model of the Princeton Institute for Advanced Studies, its aim is to facilitate interaction and collaboration between the university's academic researchers and renowned foreign experts, on high-level, multidisciplinary and innovative programmes in the hard sciences and the social sciences and humanities.

The institute proposes:
- residencies enabling top-level researchers to work without a constraining thematic framework
- programmes for young UBC researchers
- thematic programmes in which specialists from different disciplines collaborate on topics of common interest
- the funding of exploratory workshops that bring together UBC researchers and outside experts, with a view to preparing a collective book, a special issue of a journal, or an application for additional funding
- colloquia (most of which are available as audio podcasts on the Institute's website)
- international partnerships within the network of institutes for advanced study, and notably with the Collège de France, the precursor of all these institutes.

The Institute is financed by a donation from Peter Wall.

Source: *La lettre du Collège de France*, no. 32, October 2011.

Impact of literacy on the Brain

Stanislas Dehaene

On 11 November 2010 the journal *Science* published online the results of a study undertaken by an international team coordinated by Stanislas Dehaene (Collège de France, Inserm-CEA Cognitive Neuroimaging Unit, Saclay) and Laurent Cohen (Inserm, AP-HP), in collaboration with Brazilian, Portuguese and Belgian researchers.

This team was the first to obtain detailed images of the effect on the brain of learning to read. By comparing the cerebral activity of illiterate adults with that of people who had learned to read and write as children or adults, they showed the huge impact of reading both on the visual areas of the brain and on those used for spoken language.

The acquisition of reading raises several important scientific questions regarding its influence on the functioning of the brain. Writing was invented too recently to have influenced human genetic evolution. Therefore, its learning necessarily relies on the "recycling" of existing areas of the brain devoted to other functions but which are sufficiently plastic to be reoriented towards the identification of written signs and their link with spoken language. It is in this framework that researchers are trying to understand the impact that learning to read has on the brain.

For that purpose they used functional MRI to measure, with a resolution of a few millimetres, the cerebral activity in the entire cortex of adult volunteers with variable literacy levels, while presenting them with a battery of stimuli: spoken and written sentences, spoken words and pseudo-words, faces, houses, objects, checkerboards, etc. A total of 63 adults participated in the study: 10 were illiterate, 22 had no schooling but had learned to read and write as adults, and 31 had been to school as children. Research was undertaken simultaneously in Portugal and Brazil, where, until a few decades ago, it was still relatively possible for children not to attend school, due, simply, to their social environment (relative isolation, rural areas). All the volunteers were well integrated socially, in good health, and most had a job. The studies were carried out with 3-Tesla MRI scanners at the NeuroSpin centre (CEA Saclay), in the case of the Portuguese volunteers, and at the Sarah Lago Norte hospital neuroscience research centre in Brasilia,[1] in the case of the Brazilian volunteers. This research has enabled the team to provide partial answers to several essential questions.

How do the areas of the brain involved in reading change under the influence of education?

By directly comparing the evolution of cerebral activation in relation to the volunteers' reading skills, the researchers showed that the impact of literacy is greater than previously expected.

- Learning to read increases the responses of the visual areas of the cortex, not only in the region specialized in processing letters in their written form (previously identified as "the brain's mailbox"), but also in the primary visual area.

- Learning also increases the responses to spoken language in the auditory cortex, in a region involved in the coding of phonemes (the smallest significant elements of meaning in spoken language, like "b" or "ch"). This result could correspond to the fact that illiterate people are not capable of language games such as deletion of the first sound of a word (e.g. Paris / aris).

- Reading also induces an extension of the areas of language and bidirectional communication between the networks of spoken and written language: in a good reader, seeing a written sentence activates all the areas of spoken language in the brain, and hearing a spoken word rapidly reactivates its written code in the visual areas. With people who have not learned to read, the treatment of language is less flexible and is strictly limited to the auditory parts of the brain.

What is the purpose of the areas of the brain involved in reading, before a person learns to read? Does learning to read always involve a functional gain, or is the increase in responses to words accompanied by reduced responses to other types of knowledge?

With illiterate people, the visual area of the left hemisphere—which in readers decodes written words—has a similar function: the visual recognition of objects and faces. In this

1.The Sarah hospitals are a chain of private hospitals under contract to the Brazilian state, and specialized in neurological rehabilitation.

Prof. Stanislas DEHAENE
Experimental cognitive Psychology

Source: *La lettre du Collège de France*, no. 30, December 2010.

region, during learning, the response to faces decreases slightly as the reading skills improve, and the activation evoked by faces partially shifts to the right hemisphere. The visual cortex is thus partially reorganized by competition between the new activity of reading and the older activities of recognizing faces and objects. At present, we do not know whether this competition has functional consequences on recognizing or remembering faces.

Can changes in the brain related to learning to read and write take place in adults? Or is there a "critical period" for this learning during early childhood?

The vast majority of the effects of literacy on the cortex are equally visible in people who attended school during childhood and those who learned to read and write as adults. Naturally, the latter rarely attain the same reading proficiency, but this difference could be due to the lack of practice. For the same reading skills, there is virtually no measurable difference between the cerebral activity of people who had learned to read as children and those who had learned as adults. The circuits of reading therefore remain plastic throughout life.

These results emphasize the massive impact of education on the human brain. They also remind us that the vast majority of MRI experiments on the brain are on educated brains. How the human brain is organized in the absence of education constitutes an immense uncharted territory.

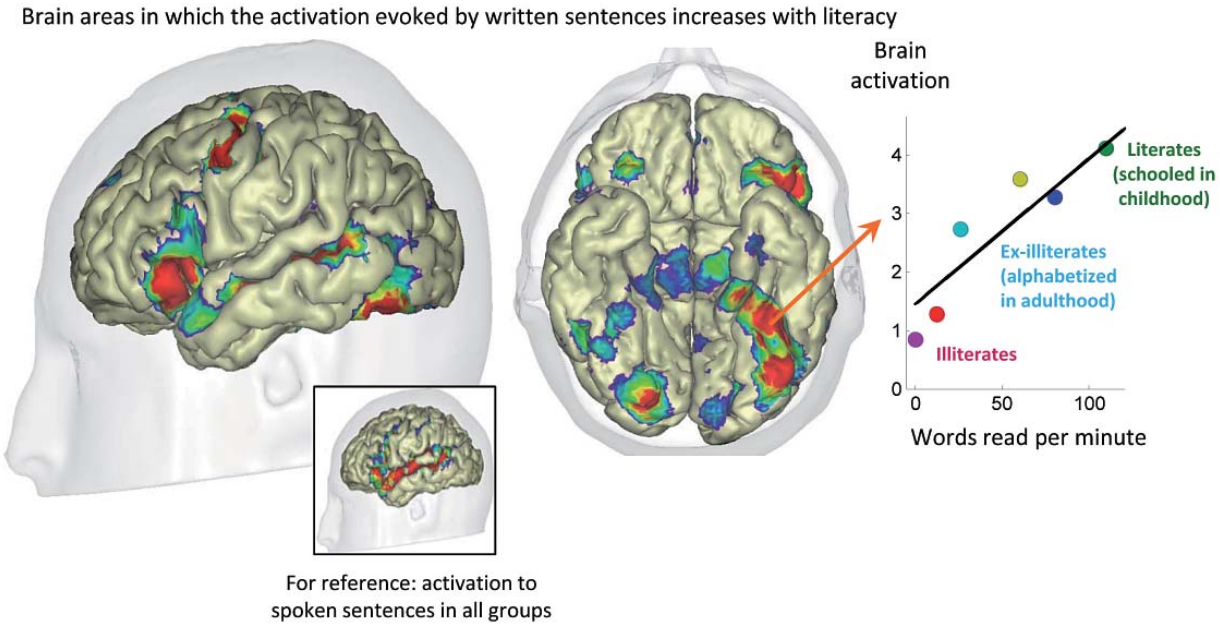


Image caption. A view of the vast cerebral networks, whose activation in response to written sentences increases with reading skills. As soon as a person can read, the response to written words increases rapidly in various visual areas of the brain, one of which is specialized in the analysis of letter strings (graph on the right). All the regions of the left hemisphere involved in processing spoken language (inset) become susceptible to activation also in response to written language.
Credit: CEA

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Teams:
- NeuroSpin/I2BM/DSV/CEA, Saclay, Cognitive Neuro-imagery Unit (Inserm/CEA) - Université Paris-Sud 11, Orsay
- Collège de France, Paris
- Université Pierre et Marie Curie, Pitié-Salpêtrière, Paris
- AP-HP, Pitié-Salpêtrière Hospital, Department of Neurology, Paris.

Uses and Abuses of the *Great Learning* (China, Korea, Japan)

Anne Cheng

Within the corpus of the Confucian scriptural canon, the *Great Learning* (*Daxue* in Chinese, *Taehak* in Korean, *Daigaku* in Japanese, usually translated into French as *La Grande Étude*) is certainly one of the most frequently and widely commented text, both in time (over a whole millennium, roughly from the early 11th century down to the modern era) and in space (it was the subject-matter of numerous and important commentaries in Korea, Japan and Vietnam).

One cannot help wondering, however, how such a short text (a mere double page in a printed edition) could achieve such a broad and enduring success.

The initial choice of this conference of focusing on the *Great Learning* as a single text is far from being neutral, since one may ask whether it can be read independently from a cluster of other textual sources. The *Great Learning* is from the very start a most intriguing item, since it was originally a mere chapter of the *Liji (Record of Rites)*, a large ritual compendium presumably compiled at some stage after the foundation of the Han empire around the 2nd century B.C., while offering a self-contained and incantatory aspect which would tend to link it up with a number of texts dating back to the immediately pre-imperial period, some of them in their recently excavated versions.

The very terseness of the text may be an explanation for its long-lasting fortune, but its sorite constructions *(i.e.* concatenated constructions of the type A then B, B then C, etc.) make it sound most pedestrian and repetitive : "Once one knows where to stop, then one secures stability. Once one secures stability, then one can stand still. Once one stands still, then one achieves serenity …" Such a construction, which is characteristic of immediately pre-imperial and early imperial rhetoric and probably served mnemotechnic purposes, is meant to convey a sense of *continuity* combined with a sense of what comes first and what comes next. The introductory part of the text presents the Way of the Great Learning as a gradual progression up and down the scale through differentiated steps or stages of personal self-cultivation and diffusing throughout family, country and eventually the whole world. This obviously aims at producing a *continuity* effect between the political dimension of ruling the world and the moral dimension of ruling oneself, which has come down as the chief paradigm of the text.

We have grown into the habit of reading the Great Learning retrospectively, that is, paired with the *Zhongyong* (usually translated as *The Mean*), because they have been grouped together with the *Confucian Analects* and the *Mencius* by Zhu Xi (1130-1200) in the 12th century in a new corpus known as the Four Books. There is indeed a *before* and an *after* Zhu Xi, who was responsible for the version of the *Great Learning* which has come down to us through the second millennium and *via* very different cultures. After Zhu Xi submitted the text to a drastic surgery, shifting around the order of sections, and even going as far as inventing new portions of the canon, the *Great Learning* can be said to have become a new text with an autonomous status which gave rise to numerous reactions, especially in Ming times when prominent thinkers like Wang Yangming (1472-1529) claimed to revert to an original (*i.e.* pre-Zhu Xi) version, but also in Korea and Japan. With its inclusion, together with the rest of the Four Books, by the Mongol Yuan dynasty in the 13th century into the compulsory curriculum of the imperial examination system, the *Great Learning* acquired the specific status of a portable handbook dedicated to political management, while the other three Books were supposed to deal with other aspects of what it meant to be an accomplished servant of the imperial state.

It is probably this major transformation which accounts for the endurable prominence of the *Great Learning*, which by the 17th-18th centuries did not escape the attention of the Jesuits who brought it to the forefront of their presentation of China to the European elites within what could already be called a globalization process. And it is also probably the reason why the text resurfaced in debates tightly linked with the question of Chinese modernity from the early 20th century up to now, which is the focus of the conference closing session. The *Great Learning* reappears in modern times in an incredible variety of modes and fields of action, ranging from political theories to religious practices, but the probable common denominator of all these forms of revivals is the highly problematic *continuity* that this unique text purports to convey through time and space.

Prof. Anne CHENG
Intellectual History of China

International symposium organised 23-24 June 2011

Source: *La lettre du Collège de France*, no. 32, October 2011.

BOOKS & IDEAS

La Vie des Idées

Florent Guénard, Editor in Chief

For three years, *La Vie des Idées (www.laviedesidees.fr)*, under the supervision of Pierre Rosanvallon, has endeavoured to present intellectual debates in France and abroad through readable quality articles.

Over this period of time, *La Vie des Idées* has established itself in France as a major place for academic debates and a highly respected network of expertise in the social and human sciences thanks to the diversity of its publications, the notoriety of its authors and its rigorous editing process.

Last December, with the standing support of the Collège de France, an English version of the French website was launched: *Books & Ideas (www.booksandideas.net)*, so that French scholarship and texts could be better known abroad.

Books & Ideas includes hitherto unpublished articles and book reviews written in English, but also translations of a selection of the texts published in French on laviedesidees.fr. The site's purpose is to provide quality information about current intellectual life and publications in France and internationally, as well as discussions of major contemporary issues, in the form of in-depth essays, interviews and public debates. The consultation of the website and subscription to the newsletter are free of charge.

Booksandideas.net intends to give all fields of scholarship a wide exposure thanks to the resources of the Internet. The journal aims at disseminating knowledge and investigations beyond their sphere of production, and to lift the barriers that exist between academic disciplines.

To reach such an objective, we have adopted three principles:

1. to bring together in the same place, and in equal numbers, essays and book reviews, written by the best specialists. Videos and podcasts of conversations with key figures in the intellectual world; dialogues and debates on controversial issues; and thematic dossiers are also already online.

2. to do this with a view to pluri- and trans-disciplinarity: to recognize all of the separate components of knowledge, but at the same time to encourage dialogue.

3. to embrace an international scope by taking an interest in the debates and books at the centre of intellectual life on every continents, and by drawing on a worldwide network of correspondents.

Books & Ideas relies on a network of correspondents from various disciplines scattered all around the globe and on partnerships with English-speaking websites and journals. To rapidly reach a vast readership, a network of academics based in major foreign universities is to relay our publications and allow *Books & Ideas* to durably establish itself.

Books & Ideas therefore is the natural extension of La Vie des Idées and of the project that has animated it since its very beginning; that is, to go beyond narrow disciplines and borders, build an intellectual cooperative reconciling different skills and, as a result, to offer the learned community and the enlightened public in France and abroad a library of carefully written texts.

Source: *La lettre du Collège de France*, no. 31, June 2011.

Prof. Pierre ROSANVALLON
Modern and Contemporary History of Politics

Politics, Religion and Secularism: Theoretical Perspectives and Contemporary Debate

Pierre Rosanvallon

The Princeton Institute for Advanced Study (IAS) and the Collège de France have agreed to organize an annual closed seminar centred on a topic of mutual interest. The two institutions will take turns to be the organizer, and members of other institutions will also be invited.

The first of these seminars, organised in June 2011 by Pierre Rosanvallon and Didier Fassin, Professor at the School of Social Science of the IAS, was on "Politics, Religion and Secularism". Not only is this subject of current political interest reaching far beyond the European context; it has also been of particular scientific interest to the participants since 2010-2011 when Joan Scott organised a seminar at the IAS on secularism, which some of them also attended. The aim of the June 2011 seminar, consisting of three half-day sessions, was to open up the debate to include other places, times and issues. The organizers wanted as much time as possible to be devoted to discussion in both French and English.

It was first a matter of revisiting issues that are overlooked and of questioning automatisms linked to religions, essentially from a historical and theoretical standpoint. John Scheid's talk on Roman religions afforded an opportunity to look at immanentist religions and to challenge the erroneous contemporary assumption which equates religion with the religions of the Book. It also focused on the transformation of religions, a fact essential to contemporary reflection on the subject. John Scheid highlighted the fact that Roman religions were private, free of state interference, and that in Rome religious practice guaranteed freedom of thought. When 19th century historians, influenced by the Judeo-Christian religions, spoke of "political religion" with regard to Rome, they were mistaken—and that misinterpretation is still prevalent today. Roman religion is still wrongly used as an example of secularism before its time. John Scheid pointed out that the Romans were not afraid of living alongside groups practicing other religions, provided they respected the unity of the city and their religions were not exclusive. The discussion highlighted the fact that, by contrast, it is the loss of the nation's identity that is feared today when groups with different religions arrive.

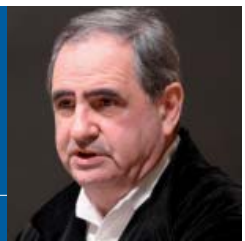
Religion, the state and secularism from a theoretical perspective

Within the framework of discussions on "Religion, the state and secularism from a theoretical perspective," Cécile Laborde explored the question of whether religion could be considered as a political object like any other and, more precisely, whether it was possible to apply egalitarian theories of religious freedom to the concepts of pluralism and diversity. She showed that reducing religion to other political categories does not work, primarily because egalitarian theories do not allow for departure from the law for secular reasons. In the ensuing discussions, Charles Taylor stressed his conviction that reflection should lead to a shift in "zones of discomfort" but that these zones never completely disappear.

Universality then appeared as a notion to accept as a local norm. Thus, the use of the argument of constraint by the state was denounced as discriminatory, notably with regard to equality of the sexes, defended by the state only when Islam is involved (see the controversy over women wearing headscarves). In this respect, it was pointed out that those who want to defend their rights against the state often rely on categories of justification considered to carry the most weight in that society (for instance, wearing a headscarf is defended in terms of rights, in France, whereas in the US it is based on the First Amendment).

Politics and secularism

In the second half-day of the seminar, devoted to "Politics and secularism," Jean Baubérot emphasized the extent of erroneous interpretations of secularism intended to strengthen it, within the French context. Defended by two historically militant traditions (secular and Catholic), the history of secularism is unquestionably tainted with ideology. To de-ideologize the debate, Jean Baubérot argued for the need to work on representations and to adopt an ideal-type approach in order to identify different modalities of secularism in relation to geographical areas and time periods (in particular the "new secularism" that overlaps with French historical secularism but is linked to the history of decolonization). In the discussion, participants agreed that, in France, Republican values are always invoked to limit the extent of the expression of Islam. In this debate on the place of Islam in France, confusion between religious and ethnic groups seems to be deliberately maintained. Didier Fassin argued that bad faith and denial are the source of the instrumentalization of this issue.



Prof. Pierre ROSANVALLON
Modern and Contemporary History of Politics

Seminar organised by the Chair of Modern and Contemporary History of Politics (Prof. P. Rosanvallon) and the Institute for Advanced Study (Princeton)
6-7 June 2011

Fuld Hall. IAS, Princeton, New Jersey.

Institute for Advanced Study - IAS

The Princeton Institute for Advanced Study (IAS) was founded in 1930 by philanthropists Louis and Caroline Bamberger, to promote original and ambitious research. It is, in a sense, the prototype of other institutes for advanced studies subsequently created throughout the world.

Every year the IAS hosts 200 research fellows from all disciplines, offering them the possibility of freely conducting their research (they have no teaching responsibilities or degrees to deliver) in an interdisciplinary and convivial atmosphere. It also hosts writers and artists. Close to twenty professors of the Collège de France have been members of the IAS at some stage of their career.

It is natural for the Collège de France to have affinities with this institution, as the IAS' designer and first director, Abraham Flexner, listed two European institutions among his sources of inspiration: All Souls College at Oxford and the Collège de France.

Pierre Rosanvallon pointed out that, historically, secularism has sought a way to reduce religious practices to a secondary level. In his view, the solution to conciliation between pluralism and coexistence is to be found not in a new form of "secondarization", but rather in a return to equality as the basis for transcending diversity, especially religious diversity.

The links between politics and secularism were then examined from an international perspective, with a focus on the Turkish case. Elizabeth Hurd pointed out the interest of Turkey for reflection on this subject, as Muslims make up a majority of the country's population. She described the shifting boundaries between religion and secularism as a result of on-going negotiations between the state and Islam at local, regional and international level. It would therefore be a mistake to conceive of the Turkish situation in terms of an alternative between separation and Kemalist democracy, on the one hand, and a return to Islamic rigidity, on the other. Moreover, the narrative of Islamic conquest conveyed abroad is nothing more than a justification to support an autocratic regime. The discussions revealed just how crucial the Turkish case—deemed to be irrelevant until recently—actually is. It is an illustration of the interlinking between historical nationalism and renegotiated secularism, under the influence not only of extremists but also of reformed parties. Joan Scott highlighted the importance of adding the gender dimension to the analysis of relations between Islam and secularism, and of remembering that secularism is not necessarily synonymous with progress in equal rights for women. In fact, seeing secularism as the only guarantee of emancipation has proved to be a serious mistake.

Politics and religion

The last half-day was an opportunity to examine relations between politics and religion, based on a talk by Jonathan Benthall on Islamic philanthropy. In order to analyze the role of religion in our political systems, Didier Fassin proposed reflection on the underpinnings of "humanitarian reason" in French law: the idea that everyone is equal because they belong to the human species and because human suffering is taken into consideration. Yet, is this humanitarian policy not also based on religious and particularly Christian justifications? And if we have lost sight of the Christian dimension of this policy, is it not because Christianity is considered neutral by our societies? More broadly, in what respect does politics require religious legitimization?

To conclude the seminar, the group tried to find a satisfactory definition of secularism, one that was neither centred on a country nor simply a form of management of religion by the state. Cécile Laborde proposed to define it as a mechanism guaranteeing a two-way protection: protection of the state with regard to the interference of religion and vice versa, protection of religion from interference by the state. Didier Fassin stressed the risks of a retrospective reading of the religious, which could cause misinterpretations and anachronisms. Moreover, several participants argued for a "present-day approach" to religion, in which current practices and the discourses accompanying them are taken into account more adequately. Geographical and cultural shifts also appeared necessary for recognizing our epistemic biases and ethnocentrism. Pierre Rosanvallon emphasized that, after this seminar, the analysis of religion cannot and should not be limited to that of secularization. The centrality of the religious must also be seen as something that sheds light on the relationship between the individual and the collective, between particular identities and common identities. Religion ought to be considered as one of the issues in debate concerning our contemporary societies and not as a generic issue.

Participants

Jean BAUBÉROT (École Pratique des Hautes Études)
Jonathan BENTHALL (University College, London)
John BOWEN (University of Washington, Saint Louis)
Philippe DESCOLA (Collège de France)
Didier FASSIN (Institute for Advanced Study)
Mayanthi FERNANDO (University of California, Santa Cruz)
Nilüfer GÖLE (École des Hautes Études en Sciences Sociales)
Elizabeth HURD (Northwestern University)
Cécile LABORDE (University College London)
Henry LAURENS (Collège de France)
Jean-Claude MONOD (École Normale Supérieure)
Pierre ROSANVALLON (Collège de France)
John SCHEID (Collège de France)
Joan SCOTT (Institute for Advanced Study)
Charles TAYLOR (McGill University)

Source: *La lettre du Collège de France*, no. 32, October 2011.

Robert Badinter and Stephen Breyer

Paris in America

Mireille Delmas-Marty

Paris in America is the title of the English version of a novel, published in 1863 by Édouard Laboulaye, in which the author argues in favour of the US model of government.

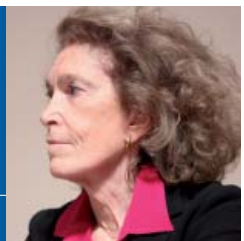
As Pierre Corvol and Mireille Delmas-Marty noted at the opening of the symposium, E. Laboulaye, Professor at the Collège de France, deeply attached to freedom, was fascinated by the democracy and constitutional system of the United States. When he became administrator he contributed actively to the realization of the Statue of Liberty. Borrowing the symposium title from him was therefore a way both of paying him homage in the year of the bicentenary of his birth (1811-1883) and of celebrating the continuity of Franco-American exchange on democracy and legal systems.

The first session, chaired by Olivier Dutheillet de Lamothe (State Councillor, former member of the Constitutional Council) was devoted to **American democracy and comparative law**. Jean-Louis Halpérin (ENS) showed how, with a political reading of legal systems and by ascribing particular importance to judicial revolutions, Laboulaye was one of the first to call for reflection on the circulation of rights and institutions. Bénédicte Fauvarque-Cosson (Paris 2) then spoke of changes in the comparative method, from a scientific approach to a utilitarian vision, finally subjected to a classification based on the imperative of the economic efficiency of law. Used to "enforce one's rights," this type of comparison accelerates the cycle of reforms but increases legal insecurity. As Laboulaye had clearly understood, comparison must transcend legal positivism, in all its dimensions: regional, national and global. Vivian Curran (Pittsburg) pointed out that, from this point of view, "no system can overcome or get round the dynamics of mutual interdependence between the institutions of a society and the human beings that inhabit it". One of the current challenges of globalization for the comparatists is to "know how to penetrate this blank space which is the right margin of appraisal for judges to translate well, as our function is one of translation". This is what we have endeavoured to do, after a transition preparing for the shift from the 19th to the 21st century (George Bermann, Columbia).

The second session, **The constitutional judge and democracy**, chaired by Robert Badinter (former President of the Constitutional Council) was organised around Stephen Breyer, a US Supreme Court judge, on the occasion of the publication in France of his book *La Cour suprême, l'Amérique et son histoire* (Paris, O. Jacob, 2011) . As the nine judges of the Supreme Court have the power to veto laws passed by the elected representatives of the people, where do they derive their legitimacy from?

The key to the book is probably in the dialogue borrowed from Shakespeare in *Henry the Fourth*, between Owen Glendower, who boasted his power to call up spirits, and Hotspur, who mocked him: "Hotspur: Why, so can I, or so can any man; But will they come when you do call for them?" (*Henry the Fourth*, Part I Act 3, scene 1, 52-58). What should be done to ensure that the people follow the Court, especially when it protects the rights of individuals "for whom the public has little sympathy" (a euphemism when it comes to prisoners sentenced to death or inmates of Guantanamo)?

As Guy Canivet (Constitutional Council) explained, this question also haunts French judges. In the US, one of the answers is paradoxically the judges' relative powerlessness. Having "neither the purse nor the sword," they are the weakest branch of government, and therefore the least dangerous. Moreover, their independence is guaranteed by their status of irremovability (hence, Jefferson's quip that "they never retire, and rarely die"). The status of French judges is different, and their methods to reconcile stability and changing interpretations are the subject of less stormy debate in France than in the US. This may be because, as Antoine Garapon (magistrate) pointed out, unlike US judges who can "can tell the whole story," French judges can only "speak the law". Finally, it was noted, as Laboulaye had already observed, that the US constitution has stood the test of time, whereas in France revolutions have multiplied the number of constitutions and amendments are becoming regular occurrences.



Prof. Mireille DELMAS-MARTY
Comparative Legal Studies and Internationalization of Law

Colloquium organised 7 March 2011
Programme and videos online: www.college-de-france.fr

Source: *La lettre du Collège de France*, no. 32, October 2011.

From left to right: Noha Adly (Alexandria Library), Sophie Grandsire (Collège de France), Mario Forteus, Aboubakar Cissé, Yaya Koloma, Ismaïl Serageldin, Rachida Maouche (AUF), Misrine Saadé, George Malamoud (AUF), Lara El Mallakh, Olivier Guillaume and Marie Chéron (Collège de France)

Hosting Young Researchers from Abroad

Olivier Guillaume, International Relations

The topics addressed by the Chair of Knowledge against Poverty correspond to the concerns of many students and academic researchers in the global South.

This was the case of the lecture series on "Hunger in the world and food security," delivered from 5 to 21 January 2011 by the current holder of the Chair, Professor Ismaïl Serageldin. The Collège de France, in liaison with the Agence Française de Développement (AFD) and the Agence Universitaire de la Francophonie (AUF), therefore took the initiative to invite the following young researchers from the South to Paris to attend Professor Serageldin's lectures:

. Nisrine Saadé, Lebanese, lecturer in the Faculty of Economics, Saint-Joseph University, Beirut
. Lara El Mallakh, Egyptian, senior research specialist at the Alexandria library and PhD student
. Aboukabar Cissé, Malian, PhD in development economics
. Yaya Koloma, Malian, PhD in development economics
. Mario Forteus, Haitian, PhD student at the University of the Antilles and Guyana

During their stay, these young researchers attended the full series of Prof. Serageldin's lectures (18 hours). They met various development experts and visited institutions working on food security issues, both at a policy level (Ministry of Foreign and European Affairs) and an operational level (AFD and NGOs such as Action Against Hunger and the Catholic Committee Against Hunger). They also visited the Poverty Action Lab of Prof. Esther Duflo, holder of the Chair of Knowledge against Poverty in 2008/2009, and the AUF. Finally, they participated in Prof. Serageldin's workshops, in the presence of representatives of the AFD and the AUF, to define follow-up to the operation. The aim was to foster the dynamics created during this training session and to create a network of scientific interaction and cooperation.

At the end of this period, each researcher submitted a detailed report on their visit, together with a field research project on poverty and development. These projects are currently under examination and will receive support from the Collège de France Foundation and partner institutions in this operation.

The initiative has already yielded positive results: on Mrs Saadé's return to Beirut, the Faculty of Economics at Saint-Joseph University entrusted her with the facilitation of a two-month seminar on hunger and food security.

In view of the success of this first experience, the Collège de France, the AFD and the AUF have decided to repeat the operation next year, on a bigger scale:

Eventually, we envisage the creation of a real 'school' devoted to this theme, along the lines of a summer school.

To promote the dissemination to developing countries of the teaching of the Chair of Knowledge against Poverty, the Collège de France, the AUF and the AFD have also taken the initiative of organizing a video-conference debate after each inaugural lecture, between the professors and the audiences on the digital campuses of universities of the South. The training session organised this year is an additional step in the scientific activities organised around this Chair.

Source: *La lettre du Collège de France*, no. 31, June 2011.

Prof. Ismail SERAGELDIN
Knowledge against Poverty, 2010-2011

Abolishing Hunger in the World

Ismail Serageldin

Hunger in the world is not due to a lack of food.

Condorcet, unlike Malthus, believed that human ingeniousness would be capable of satisfying the food needs of a growing population and that humanity would no longer be subjected to the infernal cycle of famines. And he was right, although at the time no one imagined that our planet would one day be capable of satisfying the needs of six billion human beings.

An international conference on the topic "Abolishing Hunger" was held on the 19 and 20 May 2011, in the run-up of the G8/G20 summit, in order to find answers to the crucial challenges of food and especially hunger in the world. The conference was organised by the Chair of "Knowledge Against Hunger," supported by the AFD (Agence Française de Développement), and was lead by Prof. Ismail Serageldin. Specialists on the topic from around the world participated.

Political and climatic conditions

The fact that a billion people are still suffering from hunger is primarily the result of inappropriate policies. The regions of the world plagued by malnutrition are those where war prevails, and where the state is weak. Moreover, climate change is increasing the vulnerability of small farmers. As the frequency of natural disasters increases, so do their economic, social and environmental impacts. In addition to emergency measures, essential to help victims, food security requires more profound and comprehensive long-term reforms affecting the production, distribution and prices of food, as well as research and development.

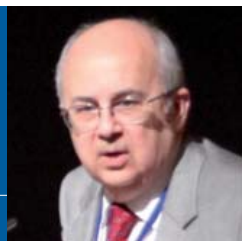
Food prices often rise suddenly and unpredictably, and generally the poorest populations have neither the organizational capacities nor the financial means to anticipate such fluctuations. It is therefore essential that mechanisms for stabilizing the prices of raw materials be set up at international level. This would need to include the creation of grain reserves. As rich countries' policies of subsidizing their own farmers create market distortions, it would also be necessary to adopt fairer trade policies with regard to the poorest countries.

Necessary political, economic and social change

Faced with the new challenges of climate change, agronomic research warrants consideration as a world public good. Its benefits must above all be for those who use it, and those who produce food. More research needs to be carried out in the South to support small farmers in those regions of the world. New rules of regulation must be applied to end the monopoly of the big agri-food companies and allow for the emergence of local firms capable of producing generics and seed for the local market.

Knowledge and the sharing thereof, is also essential for combating hunger. Throughout the world, farmers and entrepreneurs are inventing new agricultural practices and generating new knowledge that make it possible to alleviate poverty. However, by no means is all of this knowledge being transferred and disseminated. The system of intensification of rice cultivation first introduced in Madagascar and with which yields can be doubled, could be exported to other African countries. For that to happen, the practice needs to be made known. The creation of digital platforms for exchanging best practices should be encouraged.

The fight against hunger will not be won if losses and wastage of food throughout the supply chain are not reduced to a minimum. This would require better storage, preservation and transport. The food-producing agriculture of the poorest countries must be reinvigorated, and must become complementary to, and a priority over, agriculture for export.



Prof. Ismail SERAGELDIN
Knowledge against Poverty
2010-2011

Colloquium organised 19-20 May 2011
The Chair receives support from AFD

Programme and videos online (French and English): www.college-de-france.fr

Finally, the improvement of the productivity of small family farms, the only sustainable solution to alleviate the poverty of hundreds of millions of farmers, will require changes to the agricultural policies of many countries. Agriculture cannot become a priority unless the developed countries honour their international aid commitments.

The eradication of hunger is not a utopia. Solutions do exist. This subject must be put at the top of the international agenda, for it is, more than ever, a matter of universal importance.

Participants

Klaus AMMAN, Editor, Environmental Biosafety Research

David BECKMANN, Chairman, Bread of the World

Partha DASGUPTA, Professor of Economics, University of Cambridge

Peter DOHERTY, Nobel Laureate in Physiology or Medicine

Adel EL BELTAGY, Professor, Faculty of Agriculture, Ain Shams University

Nina FEDOROFF, Science and Technology Former Adviser to the U.S. Secretary of State

Michel GRIFFON, President, Science committee, French Global Environment Facility (FFEM), Paris

Pierre JACQUET, Chief Economist, AFD

Yolanda KAKABADSE, Chairman, WWF International

Ashok KHOSLA, President, IUCN

Philippe KOURILSKY, Professor at the Collège de France

Uma LELE, Expert in international economic development

Jeffrey McNEELY, Chief Scientist, International Union for the Conservation of Nature (IUCN), Switzerland

Kanayo NWANZE, President, International Fund for Agricultural Development (IFAD)

Phillip PARDEV, Professor of Science and Technology Policy, University of Minnesota

Prabhu L. PINGALI, Deputy Director of the Agriculture Development Programme, Bill and Melinda Gates Foundation

Ingo POTRYKUS, Chairman, Golden Rice Humanitarian Board

Roelof RABBINGE, Professor of Sustainable Development and Food Security, Chairman of University of Wageningen, Netherlands

Bunker ROY, Founder-Director, Barefoot College (Social Work and Research Center), India

Nicéphore SOGLO, Former Président of Benin, Mayor of Cotonou

Mahmoud SOLH, Director General, International Center for Agricultural Research in the Dry Areas (ICARDA), Syria

Wole SOYINKA, Nigerian Writer, Nobel Laureate in Literature

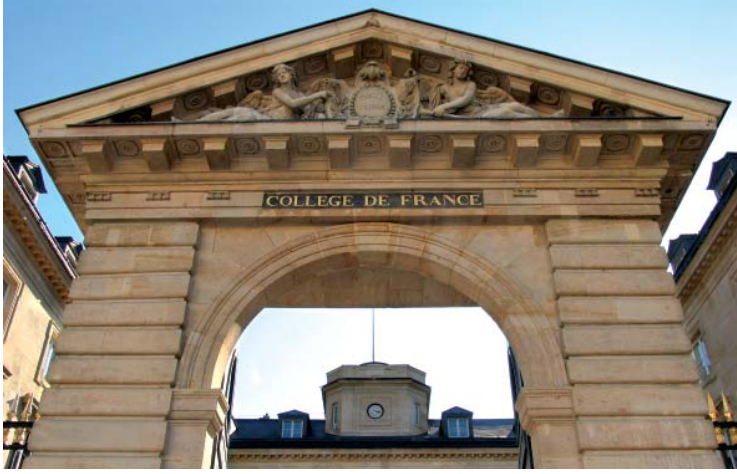
Norman UPHOFF, Professor of Government and International Agriculture, Cornell University

Marc VAN MONTAGU, Chairman, European Federation of Biotechnology (EFB), Belgium

Florence WAMBUGU, Director and CEO, Africa Harvest Biotech Foundation International

Dov ZERAH, Chief Executice Officer, Agence Française de Développement (AFD)

Source: *La lettre du Collège de France*, no. 32, October 2011.



The Collège de France: an Exportable Model?

Pierre Corvol

The Collège de France has signed 17 agreements with foreign institutions. What is special about the partnership with Belgium?

One of the Collège de France's missions is to promote French research and thinking, and to participate in the main intellectual debates and scientific life worldwide. It is therefore engaged in international exchanges, especially through partnerships which enable it to create Chairs in foreign institutions, where professors from the Collège can be hosted. Initially, by signing an agreement in June 2007 with the Free University of Brussels (Université Libre de Bruxelles, ULB), the Collège engaged in a partnership similar to those that it had with other research and higher education institutions. It was agreed with the ULB and other Belgian francophone universities that two or three four-hour sessions would be held at the Royal Academy of Belgium in Brussels every year, by professors of the Collège de France. The professors would be chosen by a steering committee consisting of representatives of the universities of the French Community of Belgium, under the chairmanship of Jacques Reisse, Professor Emeritus at ULB, who—with Professors Jean-Pierre Changeux and John Scheid of the Collège de France—initiated this collaboration.

This partnership proved to be highly fruitful and in 2008 Mr Hervé Hasquin, permanent secretary of the Royal Academy of Belgium, requested the patronage of the Collège de France for a new institution that was being founded, the Collège Belgique. This new institution was based on most of the principles underpinning the functioning of the Collège de France. Our relations consequently became far more than an ordinary partnership. In a sense they triggered the creation of a new academic institution, the Collège Belgique, officially founded in 2009.

Is the model of the Collège de France exportable?

The Collège Belgique is unquestionably a Belgian institution, but has borrowed the basic characteristics of the Collège de France: it offers lectures open to anyone, free of charge, on subjects which are preferably cross-cutting and not taught in universities. These lectures are both in the humanities and the hard sciences and present the professors' own research.

The lecture series is delivered only once by members of the Academy or by guest professors, and there are no examinations or degrees, although they can be incorporated into PhD curricula. The lectures are broadcast widely via digital networks. They are currently available on the website of the Académie Royale de Belgique and will also be accessible in the form of podcasts this year.

In view of these similarities, the professors of the Collège de France enthusiastically agreed to sponsor this project. They have participated actively in it, especially during the annual opening sessions at the Collège Belgique, which take place in two cities: Brussels and Namur.

The lectures of the Collège de France in Brussels are now integrated into the programme of the Collège Belgique. When it is renewed in 2011, the partnership agreement will be amended: it will be signed this time by the Collège de France and the Belgian Royal Academy, one of the leading players in the partnership.

The Collège de France is particularly pleased to see that it is a source of inspiration to similar institutions in other countries. Note moreover that Abraham Flexner, who inspired the creation of the Princeton Institute for Advanced Study, also mentioned the Collège de France as one of his models. Recently, during a visit to Paris, the Chairman of the Korea Research Council of Fundamental Science and Technology showed his interest in the Collège's structure and mode of functioning.

Is this a step towards a European model?

We would naturally be pleased to see the spreading of a model inspired by the humanism of the Renaissance, which profoundly marked European history and identity and which, in a world that often seems disoriented, constitutes a valuable milestone for the future.

The idea of promoting free research and endeavouring to make it universally accessible is more relevant than ever.

The best proof of that is the success of our institutions in France and Belgium, with audiences that largely transcend national borders, thanks to digital media.

Prof. Pierre CORVOL
Administrator of the Collège de France
Chair of Experimental Medicine

Source: *La lettre du Collège de France*, no. 31, June 2011.

Two thirds of the lectures are held at the Palais des Académies in Brussels

The Collège Belgique

Hervé Hasquin

The history of an Academy as old as the Académie Royale des Sciences, des Lettres et des Beaux-Arts, founded in 1772, is necessarily punctuated by key events: its closure by the French in 1794; its reopening by the Dutch in 1816; the creation of a fine arts section in 1845 alongside the science section and the literature, humanities and political science sections, and the establishment of a system in which the classes were separated, signalling the beginning of the fragmentation of knowledge. In 2009 an attempt was made to reunify knowledge, to synthesize and globalize it with the creation of a fourth section, technology and society, consisting of engineers, financiers, corporate people, jurists, economists, philosophers, etc. This initiative was based on the simple fact that controlling technologies is everyone's business.

The creation of the Collège Belgique, which came into being on 20 January 2009, is partially based on these objectives, with an underlying aim of reviving a new academic spirit and making this institution a citizens' academy. From the outset, the Collège Belgique benefited from the prestigious patronage of the Collège de France.

What are the founding principles and mode of functioning of the Collège?

It offers the general public and specialized researchers a lecture series of a high standard in various disciplines, delivered by eminent speakers and focused on topics that have received little attention. Two-thirds of the lectures are given at the Palais des Académies in Brussels and the rest at the Palais Provincial de Namur (the capital of Wallonia). They are accessible free of charge, without prior registration.

> The Collège Belgique's objective is to disseminate knowledge that seldom leaves the confines of universities and other research institutions, in order to make it accessible to all citizens.

The Académie's website (www.academieroyale.be) publishes abstracts of the lectures as well as other documents. It also proposes an audiothèque for free access to recordings of the lessons, via streaming or downloading. Podcasts will be available from May 2011.

The lectures are classified according to three categories: science and technologies; society, literature and art; and biological and medical sciences.

Every annual cycle starts with two opening sessions, one in Brussels and one in Namur.

The Collège de France's sponsorship was honoured in January 2009, 2010 and 2011 when Michel Zink and Jacques Livage, followed by Pierre Corvol and Antoine Compagnon and, this year, Stanislas Dehaene and Henry Laurens gave their lectures.

Some of the lectures are grouped together in special sessions, for example *Geosphere and hydrosphere*, *The Antarctic in all its states , Revolutionary Enlightenment, Justice in truth, Invariants and objective limits of energy for sustainable development, societal and political aspects, and Perspectives on nuclear energy*. A session will also be devoted to the professors of the Collège de France: this year Edouard Bard (*Global warming, sun or greenhouse gasses?*) and Philippe Descola (*The forms of the visible*).

A total of 119 lectures were delivered in 2009, 129 in 2010 and 148 in 2011, in addition to various conferences, e.g. *Music and the intellectual sciences* in 2010, and *Arts of live shows* in 2011. With 5,120 participants in 2010, attendance increased 60% compared to 2009, and in seven months the audiothèque had over 7,500 visitors.

Initially the Collège Belgique undertaking was highly risky. What public would be interested? Would the Académie receive support from the academic world and researchers?

Would it be able to mobilize people and to transmit its message outside highly specialized circles, to reach a broader segment of the population in Belgium and abroad? Judging by the exponential growth in the number of visitors to the Académie's new website and the audiothèque, the answer is clearly positive. The honour bestowed on us by the Collège de France is certainly not unrelated to this success.

Source: *La lettre du Collège de France*, no. 31, June 2011.

Hervé HASQUIN
Permanent Secretary of the Académie Royale de Belgique

GUEST LECTURERS
PROF. SUSAN S. TAYLOR - LECTURES
MAY 2010

cAMP-dependent Protein Kinase & the Regulation of Cell Signaling by Protein Phosphorylation

The protein kinases represent one of the largest super families encoded for by the human genome. They serve as molecular switches that turn on and off most biological processes such as memory, differentiation, cell division, metabolism, and cell death. Many diseases such as cancer are associated with defects in specific protein kinases. Thus the protein kinases are critical for the survival and regulation of every cell. cAMP-dependent protein kinase, ubiquitous in every mammalian cell, serves as a prototype for this large family of essential signaling proteins.

Protein kinase structure and function

This lecture will review the history of protein phosphorylation and then will describe the critical features of active protein kinases. cAMP-dependent protein kinase (PKA), discovered in 1968 and crystallized in 1991, serves as a prototype for understanding the structure, function, and regulation of this enzyme family as well as its evolution from prokaryotic kinases. In addition to describing the functional motifs that are embedded within the conserved protein kinase core, the overall architecture of the protein will be described as well as the complex and dynamic mechanism for regulating the kinase conformation by phosphorylation.

Allosteric regulation of PKA by cAMP

In this lecture the fundamental allosteric mechanism for regulation of PKA by cAMP will be described. Cyclic AMP serves as a universal intracellular second messenger that translates an extracellular signal into a biological response. The cAMP binding domain also has been conserved throughout biology, and this highly dynamic module serves as the docking site for cAMP. The subdomains of this module define the two allosteric states that mediate the cAMP signal. Two cAMP binding domains are contained within the PKA regulatory subunits, and these serve as the major receptors for cAMP in every eukaryotc cell. In the absence of cAMP the dimeric regulatory subunit is bound to two catalytic subunits, and this generates an inactive tetrameric holoenzyme complex. Binding of cAMP to the regulatory subunit causes a major conformational change that leads to dissociation of the regulatory subunit and activation of the catalytic activity. The transition between these two states defines the allosteric basis for PKA signaling.

Assembly of tetrameric holoenzymes

To understand how any molecule works requires an understanding of its full-length structure and how it is regulated by other molecules. To achieve this goal requires a variety of techniques that include not only Xray crystallography but also solution methods such as small angle Xray and neutron scattering, NMR, fluorescence analyses, and mapping of surfaces by H/D mass spectrometry. All of these approaches have been used to recreate for the first time the structure of a full length tetrameric PKA holoenzyme, and it is only this structure that allows one to begin to fully appreciate the highly allosteric physiological process that leads to the inhibition and activation of PKA.

Signaling in time and space: localizing PKA to macromolecular signaling complexes

A major mechanism for achieving specificity in PKA signaling is through localization to specific sites in the cell. One of the most important mechanisms for localizing PKA is through A Kinase Anchoring Proteins (AKAPs) that bind to the dimerization domain of the PKA regulatory subunits. We show how an amphipathic helix in the AKAP docks with high affinity to the helical dimerization domain of the regulatory subunit and then targets it to different sites such as a channel, a transporter, or the mitochondria. There the docked PKA functions as part of a large and dynamic macromolecular complex that regulates events such channel opening or closing, Internalization of the transporter, or fission/fusion of the mitochondria.

Prof. Susan S. Taylor, University of California, San Diego (USA), invited by the assembly of the Professors on the proposition of Prof. Marc Fontecave.

Source: *La lettre du Collège de France*, no. 30, December 2010.

Susan S. TAYLOR (b. 1942) explores the structures of enzymes that control the bodily changes taking place over a person's lifetime, such as the enzymes that stimulate memory and growth. Taylor is well known for having determined the molecular structure of a particular enzyme called protein kinase C. Her research group at the University of California, San Diego, studies molecules called signals, which interact with protein kinases. Taylor's group hopes to learn how to control the interaction between signals and protein kinases because malfunctioning protein kinases are thought to play a role in cancer, diabetes, and Alzheimer's disease. (Source: Chemical Heritage Foundation)

The Roles of Latin in Early Modern Europe

During the 17th and the 18th centuries, the status of Latin was gradually transformed, and the roles of the ancient Roman language changed in a radical way. I shall try to give a picture of that metamorphosis in my lecture.

Up to the 18th century educated people learnt *nearly everything they knew* by means of literature written in Latin. This holds true for all disciplines, including the sciences. In Early Modern Europe, the Latin texts reflect the rise of the nation states, the geographical discoveries, the Protestant movement, the Counter-Reformation and the scientific revolution. Latin was the vehicle of all the new ideas, beliefs and insights generated by these processes, from Early Renaissance up to the end of the 18th century. This is a long period of dynamic innovations, and the world of 15th century Italian scholars is very different from the conditions of the baroque *theatrum mundi* of the mid-17th century, and these in turn are utterly dissimilar to the Age of Reason that was to follow. In addition to scholarly and scientific works, learned men produced an enormous quantity of epic and panegyric works in Latin, to a large part occasional literature, extolling the virtues of their Sovereigns in their struggle for the True Religion, often in close imitation of the tributes that Virgil, Horace and Ovid had paid to Augustus.

Of all the publications mentioned in *Bibliothèque raisonnée des ouvrages des savants de l'Europe* (1728-1740), 31% were still in Latin.[1] In many European countries, academic dissertations were normally written in Latin at least up to the beginning of the 19th century.

There are geographical differences to take into account, between various countries and regions of Europe, but the general pattern for Western Europe seems to be remarkably uniform, and the changing roles of Latin can be seen and explained as an expression of a general cultural and mental development that mirrors the European transition from the Baroque world of Religious Orthodoxy and Royal absolutism to the Enlightenment.

1. The statistical material taken from Françoise Waquet, *Le Latin ou l'empire d'un signe,* 1998, p. 105.

At the beginning of the 18th century, the basic conditions for works in Latin change. In the course of one or two decades, the world seems to have become different. The spirit of the early Enlightenment had for some decades gradually transformed Europe, and the scholars that were born and brought up during the latter part of the 17th century were necessarily influenced by these new ideas. In this new world there is suddenly little need of Latin epic works and panegyrics in honour of warrior Kings. Religious zeal and obscurantism slowly but gradually abate. The Muses string their lyres to new tunes, the humanists start praising their Sovereigns in the vernaculars, in French or other languages, and the shift in outlook and focus witnesses to the changes that the Enlightenment brought about in the European conception of the world

The changing roles of Latin, and the use of Latin in the sciences, were frequently discussed by leading European scholars. This was a most important issue, of immediate concern for all *respublica literaria*.

One of the best-known expressions of the new attitudes can be found in the Preface of the French *Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers* (to the first edition of 1751) d'Alembert declares that it is ridiculous to write Latin verse and Latin panegyrics. That is literature that decidedly belongs to the past. However, says d'Alembert, Latin well deserves to be the main language of the sciences. The famous French philosopher thus makes a clear difference between literary Latin and the pragmatic and technical language of the various scientific disciplines.

To sum up: Occasional Latin literature died at the beginning of the 18th century, whereas scientific and scholarly Latin continued to thrive under the extremely prosperous period of the sciences which dominated the European intellectual scene during the 18th century, and the scientists themselves were throughout the century enthusiastic supporters of the use of Latin. It is worthwhile to say a few words about some typical features of this scientific and scholarly Neo-Latin that lived a real and vital life so much longer than literary Latin: The Latin language used during these centuries was subject to

Prof. Hans Helander, University of Uppsala (Sweden), invited by the assembly of the Professors on the proposition of Prof. John Scheid.

Hans HELANDER, Emeritus professor in Latin, Uppsala University. Born in Kungsör 27 July 1942.

Among other publications, Prof. Helander is the author of:
- *Neo-latin Literature in Sweden in the Period 1620-1720: Stylistics, Vocabulary & Characteristic Ideas*, Uppsala Universitet, 2004.
- *On the Function of Abstract Nouns in Latin*, University Publishers, 1977.

GUEST LECTURERS
PROF. HANS HELANDER - LECTURES
OCTOBER 2010

change, as all other living languages. The general vocabulary was firmly—and of course programmatically—rooted in ancient Latin, but it was nevertheless all the time affected by small semantic changes and the vicissitudes of fashion. And, above all—the progress of the sciences necessarily promoted neologism in order to provide the disciplines with new terminology and new nomenclature.

Words were consequently coined all the time. This was inevitable given the enormous growth of knowledge. Scholars who comment on the actual usage sometimes feel themselves obliged to refer to Cicero's famous words in *De finibus* 3,3: *Imponenda nova novis rebus nomina*, which may be translated, in a slightly modernized way, as "New words must be invented for new concepts".

A great many new Latin words were thus formed, as technical terms, by means of new derivations based on existing stems. Especially in the biological sciences hundreds of new compound adjectives were formed to describe the properties of various species. The Latin vocabulary was often felt to be insufficient. Instead, the resources of Greek were systematically exploited in a creative process that has generated hundreds of technical terms from the Renaissance up to our own time. The Greek element is so important that it requires a special treatment.

The study of Latin scholarly and scientific prose has not attracted many Neo-Latin scholars. Modern Latinists will often be surprised at the occurrence of words and expressions that do belong to ancient Latin but are rare there, or seem to have changed their sense in an unexpected way. It is remarkable that several of the words that belong to the categories just mentioned actually turn out to be *key-words* in the dissertational discourse and part of the academic jargon, words that refer to the very nucleus and core of a treatise, that is: the *aim* and purpose of the work, *delimitations, definitions*, and the *classification* and subdivisions of the material, the *focus* and emphasis of the investigation and the outcome of the investigation.

We find phrases like *proponere sibi scopum* (aim at); *ad id collimare* (strive for; aim at); *haec consideranda veniunt* (these things should be taken into account); *de rebus haec concernentibus* (about things that have to do with these matters); *intuitu primae originis* (with special regard to the first origin of …); *qua animum, qua corpus* (with regard to the soul, with regard to the body); *in quinque libros illam dispescit historiam* (he divides his narrative into five books).

Scientific and scholarly Latin bears witness to the rapidly growing knowledge in all fields and disciplines, from the 15th century and onwards. New words were taken into use to express new concepts, and those neologisms were regularly formed from Latin—and not the least—from Greek stems. This language was a living language with characteristic features and with its own typical jargon, expressions and phrases.

Source: *La lettre du Collège de France*, no. 30, December 2010.

Making a Name for Oneself:
Procreation, Martial Prowess and Heroic Death

Wright began by citing a letter that the Assyrian king Shamshi-Adad (18th cent. BCE) sent to his son Yasmah-Adad in Mari, petitioning him to "be a man" and to "make a name" for himself by conquering the city of Qatna:

> Here your brother won a victory, but there you lie among women! Now, when you march with your army to Qatna, be a man. As your brother has 'established a great name' [*šumam rabêm ištaknu*] you also in your region 'establish a great name.'

The expression "to make/establish a name for oneself" refers here to military conquest, if not also to the physical act of setting up a physical victory monument bearing the name of the conqueror and laying claim to the territory of Qatna.

Similar to the idiom in modern European languages, the Semitic expression conveys often the sense of personal achievement. Discussing aspects of social mobility in ancient Mesopotamian societies, Wright pointed to a wide variety of texts and images in which individual soldiers, who performed great military feats, were rewarded with personal adornments (e.g., bracelets or golden bees/flies) that accompanied a new rank and title (i.e., a more honorable "name").

The desire for a great and enduring name could induce individuals to seek opportunities not only to demonstrate martial prowess but also even to sacrifice their life. Such "noble death" on the battlefield is attested richly in antiquity in Greco-Roman sources, but it also appears in texts from the ancient Near East. The most prominent example is found in the Gilgamesh Epic. In one episode, this hero from Uruk sets off to fight the giant Huwawa. Although he stood very little chance of victory, his heroic willingness to engage in battle ensured him a name that would survive his death:

> "If I should *fall* in battle, I will nonetheless have made my name to *stand*!"

A similar sentiment is expressed in a letter that a commander sent to the Neo-Assyrian king Ashurbanipal from the frontline. His military unit was far outnumbered by the enemy and faced imminent death. Yet the commander assures the king that he and his men remained steadfast in their allegiance and were prepared to die bravely: "If we die, we will do so with an excellent name!"

Turning to the Hebrew Bible and rabbinic sources, Wright pointed out that this corpus of literature surprisingly does not glorify noble death on the battlefield. Israel's heroes die "in a good old age," while those who fall in battle (e.g. King Saul) are given a bad name. Likewise, this literature assigns primacy to *progeny* (one's "namesake") as the means of making an enduring name. (In Semitic languages, one could refer to a "child" as one's "name.") An abundance of texts, both in the Bible and in later Jewish commentaries, show how the nation of Israel depends on procreation more than on a willingness to die in battle.

In the final part of his lecture, Wright showed how this distinctive feature of biblical and rabbinic literature provides an important clue into what prompted and sustained its formation.

The glorification of heroic death is an expression of statehood. Thus, resting beneath the Arc de Triomphe de l'Étoile in Paris—a momentous expression of statehood—is the Tomb to the Unknown Soldier. Such monuments witness to the extent that states depend upon the willingness of it members to die or to send others to die for them. The line from the Odes of Horace, *Dulce et decorum est pro patria mori* ("How sweet and beautiful it is to die for one's fatherland") is repeated in various forms in the birth narratives of many states, whether it be Nathan Hale in the USA or Joseph Trumpeldor in modern Israel. In ancient Athens, the annual funeral oration for the war dead (*epitaphios logos*) was an occasion to celebrate —or at least affirm— what made the city great. (The most famous example is the Funeral Oration that Thucydides ascribes to Pericles after the first year of the Peloponnesian War.)

While many of the sources transmitted in the Bible emerged in a context of statehood and in response to statist concerns, what elicited the collection and redaction of these sources in the making of the Bible itself was military defeat and the loss of statehood. The biblical authors and rabbis undertook their work at a time when military triumph was no longer achievable and the willingness to die in wars against the empire —whether it be Babylon or Rome— promised to bring only more pain and suffering. They therefore set forth procreation (and with it, education), rather than martial valor and heroic death, as the most basic means of making a name. For a people far outnumbered by enemy armies, such was a more reliable strategy of ensuring the perpetuity of the name of the nation and its constituent families.

Jacob L. Wright, Emory University (Atlanta, USA), invited by the assembly of the Professors on the proposition of Prof. Thomas Römer.

Source: *La lettre du Collège de France*, no. 31, June 2011.

Jacob L. WRIGHT is Assistant Professor of Hebrew Bible in the Candler School of Theology at Emory University (USA). He completed his doctorate in Göttingen (Germany), and his first book, *Rebuilding Identity: The Nehemiah Memoir and Its Earliest Readers* (2004), was awarded the Templeton Prize for first books in religion. His current research focuses on war and society in ancient Israel.

GUEST LECTURERS
PROF. LUIZ DAVIDOVICH - LECTURES
FEBRUARY-MARCH 2011

Entanglement, Decoherence and Quantum Metrology

Since the seminal paper published by Albert Einstein, Boris Podolski, and Nathan Rosen in 1935, and the famous series of papers published by Erwin Schrödinger in the years 1935 and 1936, entanglement has occupied a central position in quantum physics. This peculiar phenomenon has posed formidable challenges to several generations of physicists. In fact, it took about 30 years since the 1935 papers for the first mathematical consequence of this property to be demonstrated by John S. Bell. And about 30 years more for entanglement to be recognized as a possible resource for quantum communication and quantum computation.

Evolving from a daunting concept to a useful resource, entanglement is at the heart of many suggested applications, involving the efficient transmission of information through dense coding or teleportation, the security of transmitted data through quantum cryptography, the efficient solution of the factorization problem, a speedier data search protocol, efficient measurement of parameters in quantum metrology, and quantum simulations of problems with exponential demand of resources in classical computers.

Motivated by these suggested applications, and also by the fundamental role played by entanglement in quantum mechanics, important experimental results have been obtained in the last few years, concerning the generation and analysis of multiparty entangled states, the transfer of entanglement between two systems, macroscopic signatures of entanglement, and the dynamics of entangled states under the action of the environment.

And yet many fundamental problems remain unsolved. Among them, the characterization of entanglement for multiparticle systems, the role of entanglement in quantum metrology under decoherence, the dynamics of entanglement for a system in contact with its environment. This last problem is directly related to a practical question: the assessment of the robustness of the applications mentioned above. It also concerns a fundamental problem in physics: the subtle relation between the classical and the quantum world.

> One knows nowadays that decoherence plays a fundamental role in the emergence of the classical world from quantum physics.

Theoretical and experimental work have demonstrated that a coherent superposition of two macroscopically distinguishable states decays to a mixture of the same states with a characteristic time that is inversely proportional to some macroscopicity parameter. The decay law is, within a very good approximation, exponential.

For multiparty entangled states, the environment may affect local properties, like the excitation and the coherences of each part, and also global properties, like the entanglement of the state. The above-mentioned studies on decoherence lead to natural questions regarding the dynamics of entanglement:

Luiz Davidovich, professor at Universidade Federal do Rio de Janeiro—UFRJ (Brésil), invited by the assembly of the Professors on the proposition of Prof. Serge Haroche.

Luiz DAVIDOVICH is leading a research group in quantum optics and quantum information. His theoretical work on decoherence and quantum entanglement, recognized by many international awards, make him one of the pioneers of this physics.

His work as theorist has always remained in close contact with experience. He has worked with many teams of experimenters in the world, particularly in France where his collaboration with several teams Kastler-Brossel Laboratory of the ENS has been very fruitful.

His research group now at UFRJ is an example of harmonious blend of theoretical and experimental activities.

What is the decay law? Is it possible to introduce a decay rate, in this case? How does the decay of entanglement scale with the number of entangled parts? How robust is the entanglement of different classes of entangled states? How does the dynamics of entanglement under the influence of the environment affect applications like teleportation and quantum metrology?

These are some of the questions to be discussed in this series of lectures. The organization of the four lectures is as follows:

- Review of the concept of entanglement. Characterization of entanglement. Quantification of entanglement. Methods for increasing the amount of entanglement; filtering, distillation. Bound entanglement.

- Open system dynamics, quantum channels, and filtering operations. Dynamics of entanglement for two-qubit systems: theoretical and experimental results.

- Dynamics of entanglement for multipartite systems. Introduction to quantum metrology: Cramér-Rao bound, Fisher information, distinguishability of states, role of entanglement in quantum-enhanced metrology.

- Noisy quantum-enhanced metrology: General framework for evaluating the ultimate precision limit in the estimation of parameters. Application to optical interferometers and atomic spectroscopy.

Source: *La lettre du Collège de France*, no. 31, June 2011.

The André Lichnérowicz Prize in Poisson Geometry

2010 Laureats **Marco Gualtieri** and **Xiang Tang**

This prize was created in homage to André Lichnérowicz, Chair of Mathematical Physics from 1952 to 1986.

Marco Gualtieri obtained his PhD in mathematics at the University of Oxford in 2004 under the direction of Nigel Hitchin. After positions as a post-doctoral researcher at the MSRI, Berkeley, at the Fields Institute in Toronto, and then at MIT, he was appointed as Assistant Professor at the University of Toronto. His pioneering work on generalized geometry has been the source of inspiration for many publications on the subject.

In his PhD thesis Marco Gualtieri had already developed the basic structure theory of generalized complex geometry as well as of generalized Kahler geometry. He then studied generalized geometry and its applications to physics, independently and in collaboration with Gil Cavalcanti, Henrique Bursztyn and Vestislav Apostolov. More recently, he has studied D-branes in generalized complex manifolds and their relations to non-commutative geometry, as well as further generalizations of classical geometries.

Xiang Tang obtained a PhD in mathematics from the University of California, Berkeley, in 2004, under the direction of Alan Weinstein. He then carried out post-doctoral research at the University of California, Davis, before becoming Assistant Professor at the University of Washington, Saint-Louis. His research has focused primarily on index theorems on singular spaces, where he uses the tools of non-cummutative geometry (cyclic cohomology, K-theory, the general index theorems of Connes-Moscovici and Nest-Tsygan) in combination with the structures of Poisson geometry. One of his significant contributions, obtained independently and in collaboration, is a new demonstration of the Atiyah-Weinstein conjecture on the index of Fourier integral operators and the relative index of CR structures, the study of non-commutative Poisson structures on orbifolds, the study of diverse Hopf-like structures, and the index theory on orbifolds.

GUEST LECTURERS
PROF. MARTIN KERN - LECTURES
FEBRUARY-MARCH 2011

Authorship and the *Shijing*

The production and reception of traditional Chinese literature have been marked by strong assumptions about authorship. Literature, especially poetry, has been understood as fundamentally autobiographic and "expressive," that is, as a manifestation of an individual author's personal ideas, emotions, and intentions in response to particular experiences. While this is largely true for the poetry especially from the early third century onward, it does not apply to the songs from the pre-imperial period, in particular the 305 songs canonized in the *Classic of Poetry (Shijing)*. Despite the efforts of Han dynasty and later commentators to assign specific historical circumstances and authors to the composition of the *Shijing* songs, traces of authorship within this canonical anthology are extremely scarce, appearing in just a handful of the 305 songs.

Curiously, the most visible statements on authorship in these songs are not in the "Airs of the States" (*guofeng*) that speak intensely, and often emotionally, of personal experience. Instead, they are found mostly in the "Major Court Hymns" (*daya*) that arose within the ritual institutions of the Zhou royal court. In particular, songs 259 ("Song gao") and 260 ("Zheng min") both conclude with a statement that "Jifu made a recitation" in order to influence a named historical figure. These two songs are understood as compositions by Yin Jifu ("Overseer Jifu"), a high Western Zhou official and military leader from around 900 BC who is briefly mentioned also in other sources. In each song, the final quatrain that mentions Jifu as the "reciter" is taken to define the entire text as Jifu's personal expression. In addition, since Han times the next two songs in the *Shijing*—261 ("The Jiang and the Han") and 262 ("Han yi")—have been likewise attributed to him. While the authorship of songs 261 and 262 was questioned by later imperial scholars, that of "Song gao" and "Zheng min" remains universally accepted.

A close analysis of the four texts raises doubts about Jifu as the author of any of the four songs. With regard to "Song gao" and "Zheng min," one observes: first, in both songs, the concluding claim about Jifu is formally distinct from the preceding text, separated by a different rhyme; second, in each song, the concluding claim about Jifu as "reciter" (not to mention author) is not related to anything else in the preceding lyrics; third, the songs have no coherent voice but are composite structures of different voices and idioms, including direct royal speech, proverbs, language from administrative documents, poetic phrases found elsewhere in the *Shijing*, and narrative prose; fourth, while each text is a composite structure of such different voices, the two texts are also considerably different in nature and do not suggest a common author; fifth, both songs show a number of parallels especially to "The Jiang and the Han" and "Han yi," two texts that are even more densely modeled on administrative documents; sixth, while quotations of "Song gao" and "Zheng min" abound in early texts, these quotations never include the final quatrains; seventh, no early reference to the texts mentions Jifu as author; eighth, when Jifu is mentioned in other sources, he appears as a military leader but never as an author of texts; and ninth, self-referential notions of authorship are exceedingly rare in *Shijing*—and in pre-imperial sources altogether—suggesting that authorship was not an integral property of such poetry.

Taken together, these observations make a compelling case against Jifu as the author of "Song gao" and "Zheng min," not to mention "The Jiang and the Han" and "Han yi." But what do they tell us about the *raison d'être* for the final quatrains in "Song gao" and "Zheng min?" First, it may be that "Jifu has made a recitation" does not refer at all to authorship but to the mere recitation (*song*) of the text. Second, the final quatrains are most likely later (if still pre-imperial) additions to the two songs: instead of marking authorship, they merely connect exemplary—and highly non-individual—court compositions with the voice of an exemplary official of high status. As such, the final quatrains of the two songs are retrospective constructions of remembrance and interpretation; they reveal how a later audience imagined the performance of ritual communication at the Western Zhou royal court.

Prof. Martin Kern, Princeton University (USA), invited by the assembly of the Professors on the proposition of Prof. Anne Cheng

Martin KERN (Ph.D. Cologne University, 1996) is professor of East Asian Studies at Princeton University. In his books and numerous articles, he has studied the performance of ancient Chinese poetry in political and religious ritual; the early formation of cultural memory and identity; ancient poetics and hermeneutics; and the question of authorship in early China. Among his publications is *The Stele Inscriptions of Ch'in Shih-huang: Text and Ritual in Early Chinese Imperial Representation* (2000).

Fate and Heroism in Early Chinese Poetry

In his "Letter in Response to Ren Shaoqing" and in his autobiography, Sima Qian (ca. 145-ca. 85 BC) places himself at the end of a genealogy of heroic authors: given the fateful choice to commit suicide or undergo castration, he chooses the latter in order to complete his work. However, different versions of Sima Qian's story show a different sequence of events: either Sima Qian was punished because he wrote the *Shiji*, or he completed the *Shiji* after, and in response to, his punishment. The same question surrounds the two heroes from the past Sima Qian appropriates most closely as his models: Confucius and Qu Yuan (ca. 340-ca. 287 BC?). For each, we face two or more conflicting accounts regarding the date of authorship of their central texts relative to their timeline of suffering. It is the work that leads to the author's physical suffering, and it is the author's body, and the punishment it receives, that enables the work.

With Sima Qian, Qu Yuan, and Confucius, we encounter the figure of the author-hero who finally, with the early empire, replaces the culture heroes of antiquity. As the ancient sages had "created" (*zuo*) civilization, authors now "created" their texts. Yet with the sage kings gone, such creation had to occur in opposition to the state. What distinguishes Qu Yuan from both Sima Qian and Confucius is that his story was told in both prose and poetry. Where the narratives speak about Qu Yuan, the poems speak in his own voice. His *Shiji* biography, patched together from several sources, reveals different narratives of his legend; meanwhile, the poems that Han editors and commentators attributed to him show diverging poetic versions of his story.

Yet the two figures of poetic hero and heroic poet do not match: where the narrated hero ends his fate in noble solitude, the singing hero wants to be heard, creating and staging the lyric self out of the fated self, and autobiography out of demise. Here, the tragic fate of his life is replaced by the heroic feat of his text. Qu Yuan's key poems—"Encountering Sorrow" (*Li sao*), "Embracing Sand" (*Huai sha*), and "Grieving Recitation" (*Xi song*) all contain linguistic markers that address an audience and are performative in nature. If Qu Yuan was alone when drowning himself, he was not alone when composing and reciting "Embracing Sand" moments earlier.

None of the different versions of the Qu Yuan legend, poetic or narrative, is truer than the others; all must have evolved from continuous retelling and re-performance within the fertile literary imagination of the south. The result is a dazzling array of religious, political, mythological, and erotic imagery, a proliferation of meaning (Foucault) that could only be tamed by Han editors and commentators who reduced the text—the many texts within it—to a single purpose and meaning. For this, the Qu Yuan *mis en scene* in performative poetry had to become the author of this poetry: not poetic creation but poetic creator.

The fusion of poetic hero and heroic poet echoes across the Chinese tradition. In Han historiography, historical protagonists on the verge of demise suddenly burst into extemporized song. Centuries later, Du Fu (712-770), displaced from his homeland and civilization, gazes over the mythological landscape of the south and recreates the persona of the author-hero. In one of his last poems, "Reflected Sunlight" (*Fan zhao*), he points back to Qu Yuan but integrates both himself and the earlier model into a larger history of author-heroes. Remembering Qu Yuan, he also recalls Wang Can (177-217) who in "Seven Sorrows" (*Qi ai shi*) had staged himself among the ravages of his own time—and who in turn had remembered a poet even more ancient than Qu Yuan, namely, the anonymous author of a song in the Classic of Poetry (*Shiji*).

Du Fu recreates the history of trauma as the history of literature, aligning Tang dynasty Chang'an with the capitals of both the Han and the Zhou dynasties some one and two thousand years back, and continuing the voices of poetry past. At the same time, this history of poetry is one of displaced and also involuntary authorship where Du Fu, Wang Can, and Qu Yuan stage themselves not as the sovereign masters of their texts but as voices of the inevitable: in the moment of fate, they cannot but speak the way they speak. Their poetry is heroic because it is the only thing left to them, and ultimately by them.

Source: *La lettre du Collège de France*, no. 32, October 2011.

GUEST LECTURERS
PROF. BRETT FINLAY - LECTURES
MAY 2011

The Microbial Menace in Infectious Diseases

Battling the bugs: confronting the microbial menace

Microbial diseases continue to cause significant morbidity and mortality worldwide, and drug resistance is increasing in many pathogens. By understanding basic pathogenic mechanisms, this information can be exploited to develop novel therapeutics and preventatives. Work in our lab has been focused on understanding the molecular mechanisms of pathogenic E. coli and *Salmonella*. These pathogens have sophisticated mechanisms to drive bacterial molecules into host cells to reprogram infected cells and neutralize host defenses. A general overview of the mechanisms used by these pathogens will be presented, as will approaches that have been developed to counter them. As well, approaches to develop a SARS vaccine will be discussed in the context of emerging infectious diseases, including H1N1 influenza.

The interdisciplinarity of enteric infectious diseases

Microbial diseases continue to cause significant morbidity and mortality worldwide, and drug resistance is increasing in many pathogens. However, to study their mechanisms of disease, one has to approach the problem from many different aspects. Traditional microbiologists have studied the microbial pathogen, focusing especially on factors that cause disease (virulence factors). Immunologists and cell biologists have studied the host cellular response to these pathogens, and most recently it has been recognized that the third major player in these interactions are the microbiota. Hence studies on host—pathogen interactions require many different techniques and knowledge from different disciplines of studies. Examples will be drawn from enteric pathogens to illustrate the many varied approaches and techniques used to study these bacterial diseases, and more importantly, use this knowledge to prevent or treat them.

The role of the microbiota in infectious enteric diseases

Traditionally, when one considers "host-pathogen" interactions, one normally means the actual host. However, recently it has been recognized that the indigenous microbiota play a major role in the infectious process. We have been studying the role of the microbiota in enteric infectious diseases using pathogenic E. coli and *Salmonella* murine models. It is becoming apparent that the microbiota plays a critical role in immune development and host responses, and the establishment and outcome of infectious enteric diseases. The microbiome also impacts on host susceptibility to disease, and even affects the host metabolome during infection. Results probing these aspects will be discussed in the context of these infectious agents, and how this affects host-pathogen interactions.

Salmonella: From diarrhea to typhoid fever

Salmonella interacts extensively with several host cells and tissues, as well as the intestinal microbiome during the infectious process. Systemic salmonellosis (typhoid-like) has been extensively characterized, but only recently have murine models that produce gastroenteritis been developed. Using a variety of murine models, we have been studying various aspects of salmonellosis. These include development of a new chronic model of fibrosis induced by *Salmonella* in a chronic infection model. We have also been studying how *Salmonella* reside within the gall bladder epithelium, a process essential for carriage and shedding in bile associated with spread of typhoid fever, yet very poorly characterized. We have also been examining the effect of *Salmonella* on the microbiota, and how this contributes to intestinal colonization and gastroenteritis. Various aspects of these interactions will be discussed in light of their contribution to salmonellosis.

The invitation of Prof. Brett Finlay lies within the scope of a cooperation agreement signed in 2008 between the Collège de France and the Peter Wall Institute for Advanced Studies (PWIAS) in Vancouver.

This convention has planned regular exchanges and the organization, each year, of a research seminar, cofinanced by the PWIAS and the Hugot Foundation of the Collège de France. Thus, last May 23rd and 24th, the Collège de France hosted a seminar co-organised by Prof. Brett Finlay and Philippe Sansonetti, entitled "The table companion Microbiota: from Homeostasis to Disease" (see p. 38-39).

Prof. Brett Finlay, University of British Columbia, Vancouver (Canada), invited by the assembly of the Professors on the proposition of Prof. Philippe Sansonetti

Brett FINLAY is professor at Michael Smith Laboratories and the university of British Columbia (UBC), faculty of biochemistry and molecular biology, and faculty of microbiology and immunology. He studied the invasion of host cells by the salmonella at Stanford University. At UBC, he works on the host-pathogen interactions at the molecular level. By combining cellular biology and microbiology, he was one of the pioneers of cellular microbiology.

Videos online:
www.college-de-france.fr

Source: *La lettre du Collège de France*, no. 32, October 2011.

Dynamic Interplay between Nature and Nurture in Brain Wiring

In this series of three lectures, I will consider examples of how neural activity, initially spontaneously-generated and at later ages driven by sensory experience, contributes to the shaping and tuning of neural circuits during critical periods of brain development. The lectures focus on the development of the mammalian visual system and specifically consider the connections from retina to lateral geniculate nucleus to primary visual cortex. These connections begin to form early in life-in utero in many species and well before the onset of vision. Initially, a basic wiring plan from eye to brain is established using strictly determined axon guidance cues. This period is followed by a prolonged phase of activity-dependent development in which initially diffuse synaptic connections are fine-tuned to yield finally the highly precise circuits present in the adult brain. This tuning process is thought to occur throughout the brain during development, endowing it with a vast capacity to adapt to the environment and also underlying the brain's ability to learn throughout life.

In the visual system, retinal ganglion cells from each eye connect to LGN neurons in adjacent eye-specific layers. LGN neurons representing each eye, in turn, connect to neurons in layer 4 of primary visual cortex to form the alternating system of ocular dominance (OD) columns. But during development, eye inputs are intermixed; the adult LGN layering or cortical OD columns then form as connections remodel. Remodeling requires ganglion cell signaling: blocking action potentials prevents eye-specific layering (Shatz and Stryker, 1988; Sretavan *et al.,* 1988) and also alters the patterning of OD columns. The first lecture, "Brain Waves and Synapse Remodeling in the Developing Visual System," will present the discovery that the retina generates its own spontaneous activity long before vision starts. Ganglion cells in the eye fire synchronously in "waves" that sweep across retinal domains. (Meister *et al.,* 1991; Wong *et al.*,1993; Feller *et al.,* 1996). Moreover, these retinal waves are needed for ganglion cell axons to segregate into eye-specific layers in the LGN: blocking them prevents segregation, while altering the spatio-temporal pattern of waves perturbs segregation (Penn *et al.*, 1998; Stellwagen and Shatz, 2001). It is as if the eye is running "test patterns" on the brain to check for correct connections weeks before the onset of vision. Thus, the brain internally generates highly coordinated patterns of neural activity early in development even before sensory input.

The second lecture, "A Transient Scaffold for Circuit Construction: Subplate Neurons and the Cerebral Cortex," considers the concept that the development of connections between thalamus and cortex involves an intermediate step in which an entire neural circuit in the subplate is first constructed, then functions synaptically, and finally is dismantled, leaving little trace in the adult brain. Prior to the formation of adult connections between LGN axons and layer 4 neurons of visual cortex, there is a protracted period of development in which thalamic axons interact with a transient set of neurons called subplate neurons. Subplate neurons are the first postmitotic neurons of the neocortex and their axons pioneer the pathway from cortex towards thalamus (McConnell *et al.,* 1989). Subplate neurons then serve as temporary targets for ingrowing thalamocortical connections and finally they are eliminated by cell death. Ablation studies, in which subplate neurons are deleted at various times in fetal development and consequences for formation of connections between thalamus and cortex are examined, have indicated a crucial role for subplate neurons in proper patterning and functioning of cerebral cortex. Early deletion of subplate neurons causes a complete failure of LGN axons to invade visual cortex, implying that subplate neurons are required for normal target selection and ingrowth (Ghosh *et al.*, 1990). Deletion of subplate neurons at later ages prevents segregation of LGN axons into OD columns (Ghosh and Shatz, 1992 and alters the expression of plasticity genes, such as BDNF, known to be required for synaptic plasticity during the formation of OD columns (Lein *et al.,* 1999). More recent experiments show that subplate neurons are essential for the functional strengthening of synaptic connections needed to establish the columnar organization of cerebral cortex (Kanold *et al.,* 2003) as well as to regulate the proper sign of synaptic plasticity following monocular eye closure (Kanold and Shatz, 2006). These experiments indicate that subplate neurons play crucial roles in directing distinct steps early in the formation of connections between thalamus and cortex. It is now hypothesized that insults to the fetal brain leading to the destruction of subplate neurons may be responsible for postnatal problems in children such as cerebral palsy, autism and other learning disabilities.

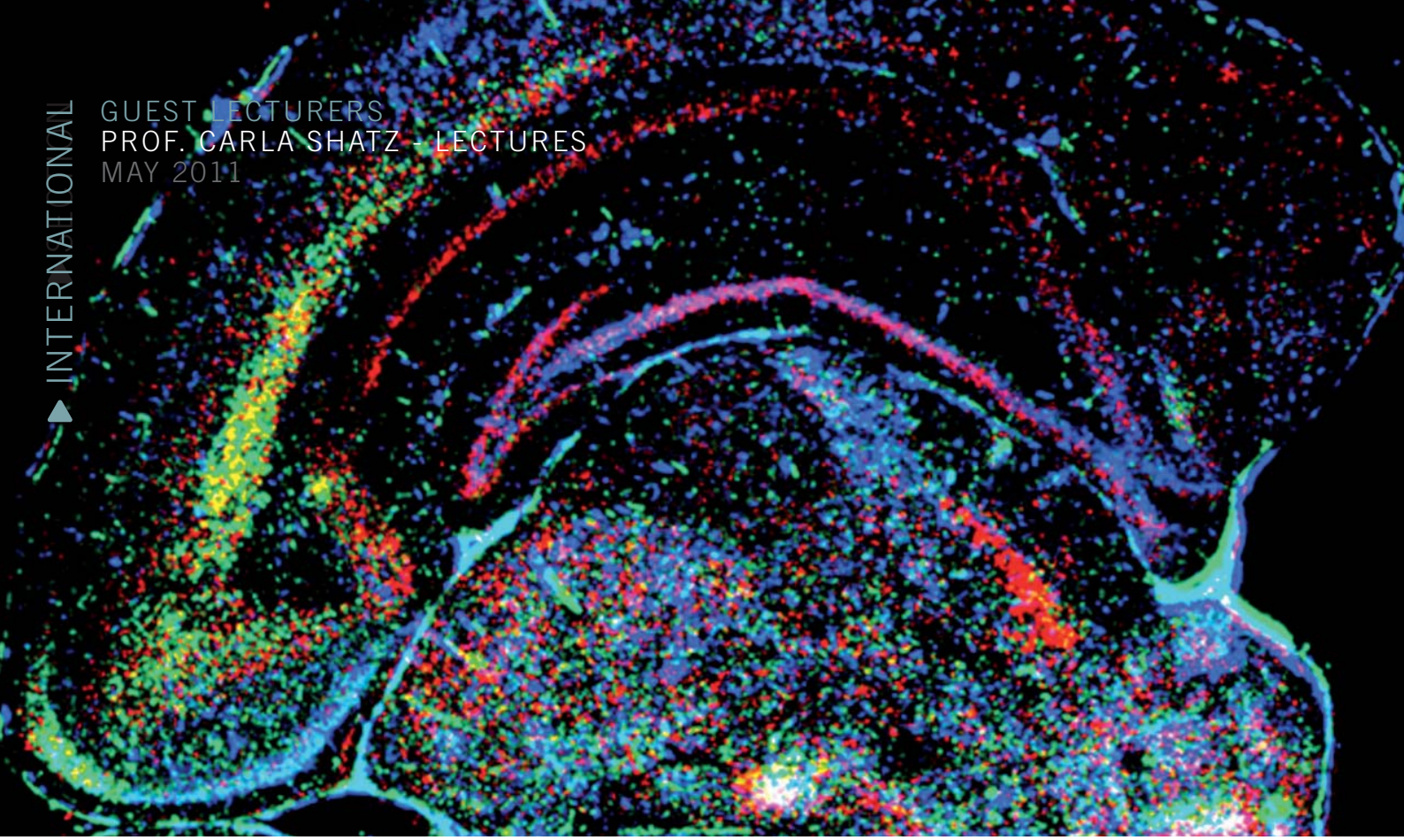
The final lecture, "Releasing the Brake on Synaptic Plasticity: Immune System Genes Moonlighting in the Brain," will present the idea that there are signaling pathways that oppose or "brake" synaptic plasticity, in addition to well-known molecular pathways such as MAP Kinase signaling and CREB mediated

Prof. Carla Shatz, Stanford University, invited by the assembly of the Professors on the proposition of Profs Christine Petit and Alain Prochiantz

Experiments described here have been funded by NIH Grants EY02858, MH071666, the Mathers Charitable Foundation and the Ellison Medical Foundation.

Carla SHATZ's work aimed at understanding how neural circuits early brain circuits become "adults" during critical periods of development. Since 1989 she is a professor of neurobiology at Stanford University, where she directs the innovative Bio-X Programme since 2007.

GUEST LECTURERS
PROF. CARLA SHATZ - LECTURES
MAY 2011



transcription that enable activity-dependent plasticity. One such "brake" was uncovered in an unbiased PCR-based differential screen searching for genes in the LGN regulated by the endogenous activity driven by retinal waves. Unexpectedly, members of the MHC Class I gene family (the HLA genes in humans) were found to be expressed in neurons and regulated by neural activity and visual experience (Corriveau *et al.,* 1998; Goddard *et al.,* 2007). The discovery was especially surprising because it was thought previously that neurons do not express MHC Class I under normal conditions due to the brain's "immune-privilege" (reviewed in Boulanger and Shatz, 2004). To assess requirements for MHCI in the CNS, the LGN was examined in mice lacking MHCI: eye-specific layers do not form, and synapse regression fails to occur. What's more, contrary to the usual situation following gene knockout in which synaptic plasticity is abolished, in the MHCI mutant mice, there is greater synaptic strengthening than normal. In particular, OD plasticity is enhanced in visual cortex (Datwani *et al.*, 2009) and in adult hippocampus LTP is 150% larger than wild type and LTD is absent (Huh *et al.,* 2000). These observations suggest that MHCI molecules might act as negative regulators of synaptic plasticity- rather like a "molecular brake".

In the immune system, certain MHCI family members function in cell-mediated immunity by interacting with a variety of receptors on immune cells, the most famous of which is T-cell receptor (TCR). Similar receptors on neurons could interact with neuronal MHCI and carry out activity-dependent synaptic processes. In a systematic search for receptors known to bind MHC Class I (MHCI) proteins in the innate immune system, we found that mRNA for PirB, an Ig-like transmembrane receptor, is highly expressed in neurons in many regions of mouse CNS, particularly in cerebral cortex, olfactory bulb and cerebellum. We generated mutant mice lacking PirB function and discovered that the extent of OD plasticity in visual cortex is increased (Syken *et al.,* 2006). Thus, PirB, like its MHCI ligands, appears to function to limit the extent of synaptic plasticity in the CNS. Together, experiments imply that this family of immune molecules, thought previously to function only in the immune system, may also work at neuronal synapses to limit how much—or perhaps how quickly—synapse strength changes in response to new experience (Shatz, 2009). These molecules may be crucial for controlling circuit excitability and stability in developing as well as adult brain, and changes in their function may contribute to developmental disorders such as Autism and Schizophrenia.

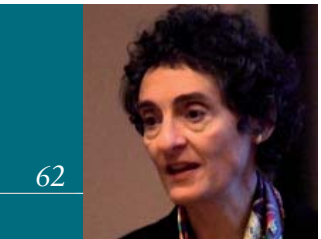


Image caption. Class I MHC molecules are expressed in the whole brain (mouse). In situ hybridization of 3 different class I MHC mRNAs (H2-D: blue; T22: red; Qal: green).

Source: *La lettre du Collège de France*, no. 32, October 2011.

Social Cognitive Neuroscience

Mechanisms of theory of mind

Theory of Mind or Mentalising is the ability to make inferences about the mental states of others: their intentions, desires and beliefs. Many studies have used brain imaging to explore the neural basis of this ability and the results are remarkably consistent. Activity is seen in medial prefrontal cortex (mPFC), in the superior temporal sulcus at the junction with the parietal lobe (STS/TPJ), and also in the temporal poles and the posterior cingulate cortex. But before we can make sense of this circumscribed brain system we need some idea of the mechanisms that underlie mentalising.

A major clue to the intentions of others comes from the movements that they make. One proposal is that, by covertly simulating these movements using the brain's mirror system, we can directly infer the intention behind them. However, this bottom-up mechanism cannot cope with the problem that the same movement may reflect different intentions. We have suggested that this problem is solved using the same mechanism, predictive coding, that is used to resolve ambiguities in sensory perception. This is a top-down mechanism which starts with a prior hypothesis about the likely intention of the actor given the current context. The brain's mirror system is then used to predict the most likely movement given this prior hypothesis. Any discrepancy between the predicted and the actual movement observed provides a prediction error that can be used to update the hypothesis about the intentions of the actor. A number of studies suggest that activity in STS/TPJ reflects the magnitude of this prediction error. This seems to be the case even when intentions are inferred from cues other than movements.

This mechanism is a one-way process in which an observer infers the intentions of an actor. In most human interactions, however, there is a two-way process in which two actors infer each other's intentions. We refer to this as 'closing the loop'. In this setting it is not enough for actor A to infer the intentions of actor B. Actor A must also infer what actor B has inferred about actor A. Such recursive inferences are particularly important for collaborative endeavours captured in games such as J-J Rousseau's stag hunt. In this game a large reward can be obtained if both players choose to hunt the stag. However, this cooperation depends on player A believing that player B believes that player A will cooperate, etc. Thus, cooperation depends upon a depth of recursion sufficient to generate common knowledge that cooperation will occur. Brain imaging studies suggest that activity in mPFC may reflect prediction errors relating to inferences about the depth of recursion in social interactions. This places mPFC at the apex of a Bayesian hierarchy of top-down control of social cognition.

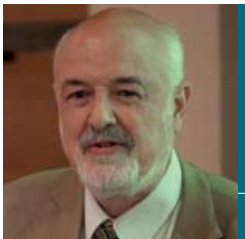
Understanding the symptoms of schizophrenia

Schizophrenia is severe disorder affecting about 1% of the population and causing much distress to sufferers and their carers. Although there is strong evidence for a biological basis for the disorder, the diagnosis is still made on the basis of symptoms, which typically include hallucinations

Prof. Chris Frith, University of Aarhus (Danemark), invited by the assembly of the Professors on the proposition of Prof. Stanislas Dehaene

Video online:
www.college-de-france.fr

Chris FRITH worked on the biological basis of schizophrenia at Northwick Park Hospital, then on Brain Imaging in the Cyclotron Unit, Hammersmith Hospital. In 1994 he helped to found the Functional Imaging Laboratory at the Institute of Neurology in Queen Square. From 2007 he has been Emeritus Professor in Neuropsychology at UCL and Niels Bohr Visiting Professor at the University of Aarhus.



GUEST LECTURERS
PROF. CHRIS FRITH - LECTURES
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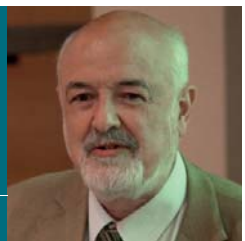
(false perceptions) and delusions (false beliefs). Over the last several years my aim has been to try and understands these symptoms at the cognitive, at the neural and also at the experiential level: what is it like to experience such symptoms.

Many of the first rank symptoms of schizophrenia seem to reflect confusion between effects caused by the self as agent and effects caused by external agents. Examples are hearing one's own thoughts being spoken aloud, or believing that alien forces are causing one's actions. This latter experience, labelled a delusion of control, has been extensively studied. This symptom is not primarily a disorder of the control of action, but a disorder in the awareness of action, in particular in the sense of agency. An early idea was that this is a problem of self-monitoring. The patient is unaware of his intentions due to a failure of the corollary discharge (or re-afference copy) indicating that a movement is about to occur. As a result the movement is experienced as caused by external forces.

More recently this idea has been expressed in terms of a forward model. When we perform an action, we predict the consequences of the action in terms of its behavioural and sensory effects. There are many experiments giving results consistent with the idea that patients with delusions of control are failing to make such predictions. At the neural level this is associated with failure to damp down neural activity reflecting the sensory consequences of self generated movements. The implication of these observations is that, for a patient with delusions of control, an active movement does genuinely feel like a passive movement.

In the last few years there have been new developments in our understanding of the basis of the sense of agency for action. This depends in part on prediction and in part on the outcomes of action. Patients with delusions of control seem to be excessively influenced by outcomes, presumably because of failures of prediction. All these ideas about the symptoms of schizophrenia fit nicely into a Bayesian framework in which perceptions are generated through prediction and different sources of information are weighted on the basis of their reliability. I shall consider whether we can use this framework to construct a more general account of the symptoms of schizophrenia. In a Bayesian system there is no genuine distinction between delusions and hallucinations since both perceptions and beliefs are generated from the combination of prior hypotheses and new evidence. Prediction errors play a key role in this system. In relation to schizophrenia, one possibility is that the problem lies in the generation of prediction errors. If the prediction errors were false then the updating of perceptions and beliefs would no longer lead to models with a better fit to reality. Instead discrepancies would increase and this would lead to more and more radical reconceptualisations of what the world was really like. Perhaps this is what it is like to experience the symptoms of schizophrenia.



Source: *La lettre du Collège de France*, no. 32, October 2011.

Social Cognitive Neuroscience

Similarities and differences between social species

It has often been observed that human beings are intensely social creatures, but at the same time it is often ignored that there are many other animals, who are also exquisitely adapted to social learning and interaction. Comparative studies of social cognition in diverse species are still relatively new, and this comparison shows that learning from conspecifics is pervasive. I will briefly review examples of learning from others through copying, and learning about others, for instance, how dominant they are and how reliable. This learning plays an important role in the construction and negotiation of complex social systems, whether in fish, in bees or in mammals. The cognitive abilities that underlie this type of social learning do not presuppose conscious awareness. Instead, the implicit processes that enable and regulate most social behaviour are automatically triggered by the presence of conspecifics. This applies to humans as much as to other social animals. However, there are also explicit forms of these processes, which do need conscious awareness and these are probably unique to humans. They are slow to develop and slow in their application.

I will use the example of imitation and overimitation as well as mentalising to demonstrate the differences between implicit and explicit forms. The phenomenon of overimitation has been studied in 4-year olds and in adults and experiments demonstrate that people copy irrational actions "because this is the way we do it". It can be argued that this process is crucial for building up human culture and group identity. Interestingly, overimitation is not found in chimpanzees. As regards the implicit form of mentalising, the ability to track the intention of others to predict what they are going to do next is present in many species and can also be observed in very young human infants. In contrast, the explicit form of mental state attribution, which involves justification of the behaviour that is explained and predicted, is only found in humans after the age of four. Thus, human beings do not only track others' mental states unconsciously, but they can use mentalising to manipulate others. Humans excel in explicit social abilities, and do not necessarily use them to achieve pro-social goals. Instead they are often used selfishly, as in Machiavellianism. Instead, pro-social ends are often achieved with the automatic forms of imitation and alignment. This is demonstrated in the chameleon effect and in experiments that employ subtle imitation with surprising effects of increased altruism.

Understanding the symptoms of autism

Autism is a neuro-developmental disorder affecting about 1% of the population. It starts before birth and has its effects on the brain and mind throughout life. Autism is defined by behaviour and is usually recognised in early childhood. Autism comes in many degrees of severity and there is a whole autism spectrum from mild to severe. Although with development and with good education and support, the behavioural problems can improve, people with autism at all stages of their lives have highly characteristic impairments of social interaction and communication. They cannot engage in true reciprocal interaction. This makes it difficult for them to build relationships and keep friends. Typically they fail to understand very common social behaviour such as teasing, lying, persuading or joking. This has been explained by a failure of mentalising. Recent research has suggested that it is only the spontaneous ability to attribute mental states, which is affected, but not explicit form of mentalising, which involves attributing mental states off-line. The former seems to be missing in autism, while the latter can be acquired. Able individuals with autism are impaired in spontaneous mentalising, but they are not necessarily impaired in explicit mentalising.

Besides severe and characteristic impairment of social interaction and communication there are other features of cognition, which characterise autism. They result on the one hand in cognitive disabilities, and on the other hand, in superior cognitive abilities. Different theories have addressed this uneven pattern. One theory suggests that a processing style with attentional focus on detail can explain both cognitive strengths and weaknesses in autism. I will present some evidence for this theory. It has the advantage of also addressing the presence of superior talent. Such talent is found in at least 10% and possibly in as many 30% of autistic individuals. I will suggest that a constellation of three factors in autism is conducive to the development of superior talents. First, lack of spontaneous mentalising frees the individual from conventional thought and standard practice of skills. Second, absence of strong executive control allows the attainment of 'flow' in the unconscious perceptual-motor systems. Third, detail focussed attention is conducive to novel segmentation of perceptual input. Together these factors may explain talent in such diverse but typical areas as calendar classification, musical performance and artistic productions.

Prof. Uta Frith, University of Aarhus (Denmark), invited by the assembly of the Professors on the proposition of Prof. Stanislas Dehaene.

Videos online:
www.college-de-france.fr

Source: *La lettre du Collège de France*, no. 32, October 2011.

Uta FRITH is a developmental psychologist, Emeritus Professor at University College London. She was a pioneer in the use of neuro-cognitive approaches for the study of developmental disorders, especially dyslexia and autism. She investigates the cognitive causes of these disorders in order to link them to both behavioral symptoms and brain systems. Thus, she aims to contribute to the education and quality of life of people with these conditions.

ASSOCIATE RESEARCHERS AND PHD STUDENTS OF THE COLLÈGE DE FRANCE

ChADoC

Matthieu Vernet

The ChADoC[1] is an association of the assistant lecturers, ATERs[2] (temporary lecturers and researchers) and PhD students and post-docs working in the Collège de France's three campuses in Paris (Marcelin Berthelot, Ulm, and Cardinal Lemoine) for a Chair and in a laboratory or hosted team, irrespective of the source of their funding.

In total, this covers close to 170 researchers annually in both the human sciences and the experimental sciences. The association's committee, re-elected each year at the general assembly, respects this strict parity and strives to meet the demands and needs of as many of its members as possible.

170 researchers, in the human sciences and the experimental sciences

In 2008, the Collège de France decided to create an organization to promote conviviality between young researchers at the Collège, through cultural and recreational events, and to support them in scientific projects transcending the confines of the Chairs and laboratories to which they were affiliated. The ChADoC was therefore founded with the dual ambition of fostering young researchers' sociability and supporting trans-disciplinary initiatives.

The association uses the budget granted by the Collège de France—which it has been managing autonomously since the beginning of the 2010-2011 Academic Year—to organize events for young researchers throughout the year. These may for instance be recreational events, training in bibliographic and digital documentation, visits to laboratories, or the ChADoC gala, held for the first time in July 2011.

One of the association's highlights is the science festival which takes place every year in October. Young researchers, and especially chemists from the Chemistry of Hybrid Materials Laboratory, organize a three-day event for school pupils. Visitors are given the opportunity to run small chemistry experiments themselves. Thus the young researchers can promote their discipline by "teaching research in the making"—the Collège's creed.

Apart from these activities, the association's objective is also to support many individual and collective projects enabling young researchers to develop a scientific activity in addition to their Chair of affiliation. The financial and logistic support that it provides allows for several seminars and study days to be held throughout the year.

The ChADoC also encourages inter-disciplinary initiatives, bringing together researchers from different backgrounds and initiating epistemological, critical and scientific exchange. Additionally, and in the same spirit, it plans to organize a summer school in collaboration with PSL, where lectures will given on new topics at the interface of various disciplines.

The ChADoC thus strives to develop and constantly associate research activities with the life of the institution. In doing so, it participates in what makes the Collège de France's singularity and strength: the combination of collegiality with the passion for research.

In addition, the association recently launched its own website: http://chadoc-cdf.fr. The website presents the ChADoC's activities and, more importantly, offers the services of a directory that is bound to become a rallying point for members and former members, enabling them to maintain ties with one another and with the institution. This will allow for the creation of a network that will grow with time, promising rich and fertile interactions and thus abundantly benefiting—we hope—both research and the Collège de France.

ChADoC Committee:

Chairman: Matthieu Vernet (Modern and Contemporary French Literature)
Vice-Chairman: Thomas Fontecave (Condensed Matter Chemistry)
Secretary (Newsletter): Katia Juhel (Institute for Indian Civilization)
Secretary (Minutes): Céline Redard (Indo-Iranian Language and Religion)
Treasurer: Guillaume Muller (Condensed Matter Chemistry)

1. *Chercheurs associés et doctorants du Collège de France.*
2. *Attaché temporaire d'enseignement et de recherche.*

Matthieu VERNET
Temporary Lecturer and Researcher (ATER) at the Collège de France, Chair of Modern and Contemporary French Literature, and President of the ChADoC association.

Image caption.
Members of the ChADoC committee:
Front row from left to right (seated): Emilie Frenkiel, Thomas Grillot, Guillaume Muller and Matthieu Vernet.
Back row from left to right (standing): Thomas Fontecave, Katia Juhel, Céline Redard, and Benjamin Le Ouay.

Source: *La lettre du Collège de France*, no. 32, October 2011.

Interview with Jacques Bouveresse

Marc Kirsch How do you analyze your career as a philosopher? At the Collège de France, starting from logic and philosophy of language, in 1995 (with a seminar on colours and the theory of perception) you worked on the authors of the late 19th and early 20th centuries, the Vienna Circle and Wittgenstein. You regularly reverted to the topics of perception, reality, time, language, logic and mathematics, and you looked at philosophical systems. Finally, you ended with a long study on Leibniz. What does this return to Leibniz mean?

I don't know if one can actually call it a return. Leibniz as an author has always interested me and in a sense I've never completely lost sight of him. I think my interest in him was initially related to a large extent to my reading of Yvon Belaval's thesis, *Leibniz critique de Descartes* (1960) which, for me, is still today a core reference in Leibnizian studies. In the confrontation between Leibniz and Descartes, I tended from the start to clearly prefer the former, mainly due to his relationship to logic and the determining role that he grants it in the conception and construction of his system (he said that logic was the foundation of his metaphysics). This situates him more or less diametrically opposite Descartes as well as Locke, who maintained that logic actually serves no purpose, especially when it comes to the most important thing of all: discovery. Leibniz believed in the importance and fecundity of logic, for philosophy as well as for mathematics and science in general. In a way that probably wouldn't surprise you, I really discovered Leibniz at about the same time that I started to take an interest in modern logic, of which he is sometimes considered as the real father and which is a discipline that I taught to philosophy students for many years. Correlatively, I was probably inclined to be somewhat unfair to Descartes (I remember having been reprimanded for this by Jules Vuillemin—and rightly so).

Jacques BOUVERESSE
Philosophy of Language and Knowledge from 1995 to 2010

- Is your attitude towards Descartes still the same today?

No, I changed my attitude when I really started reading him again, especially in 1996 when, for the celebration of the fourth centenary of his birth, I had to give several lectures on him. In fact I had the same kind of experience with several other philosophers, for example Nietzsche, Husserl and even, in a sense, Heidegger. When you're able to read their own writings and more or less totally forget what you've been taught—or what others tried to teach you—and especially what the behaviour of bigots and idolaters have sometimes done to make them unattractive and even downright unpleasant, they suddenly become far more interesting. Today there are virtually no traditional or contemporary philosophers from whom I have the impression that I can't learn something significant that I may have missed until now. Of course, to me some of them have been and still are far more important than others.

Leibniz argued that the future is as determined as the past and that even our freest actions are as determined as the others, which does not prevent them from remaining free and us from being responsible for them.

- For example, Leibniz?

Yes, for sure. In fact when I joined the Collège de France in 1995, I had already decided to devote my last year or two of lectures to him. There was, in particular, a problem that I'd been pondering for a long time and that I wanted to examine more closely through him: the compatibility of determinism and freedom. I'm one of those people who, unlike Popper (and many other philosophers), thinks that freedom is not necessarily easier or less impossible to reconcile with indeterminism than with determinism.

Leibniz argued that the future is as determined as the past and that even our freest actions are as determined as the others, which does not prevent them from remaining free and us from being responsible for them.

In fact in the past two years I have endeavoured to accomplish the project that I've had for years, to study not only the theory of necessity and contingency upheld by Leibniz, as it is currently understood and argued, but also his moral philosophy. It is far more subtle and profound than it is generally believed to be and definitely deserves to be taken seriously, even after the revolution that Kant is supposed to have brought about. Leibniz is not only an exceptional theoretician; his practical philosophy is also of the greatest interest and he is, in my opinion, in addition to everything else, a great moral philosopher and moralist.

As regards your question on the judgement that I'm inclined to express on my own philosophical career, especially since I joined the Collège de France, I think that I have accomplished more or less what I set out to do, with one exception: I was so busy with other things that I never found the time to revert to a subject that I'd started to explore in depth years ago: the theory and philosophy of probabilities. I must say that preparing a lecture at the Collège de France requires a considerable amount of work and if, like me, you decide to devote several years of teaching to thinkers whose work is as difficult and unknown as that of Boltzmann or Gödel, there's very little time left for anything else.

- Would you say that over the years your interest in the history of philosophy has grown?

Yes, in a sense. The fact that I ended my years of teaching at the Collège de France with a lecture on Leibniz could give the impression that I ended up where I was trying not to go, that is, the history of philosophy. To understand what happened, one has to remember that at the beginning of my career I was involved in a rather fierce battle for the recognition of the existence and importance of analytical philosophy. Those were times when one often heard very serious people denying outright that there could be any philosophy worthy of the name in Anglo-Saxon countries. And one of the most serious shortcomings that the analytical tradition in philosophy was accused of was the a-historical nature of its approach, and its real or supposed tendency to deem it unnecessary to start by closely studying philosophy's past in order to philosophize seriously. Initially I spent years discovering the real state of the philosophy of our period and working mainly on contemporary or relatively recent authors who were hardly even mentioned in France. As a result, I probably tended to overlook the classical philosophers and to consider that, while the analytical philosophers certainly did not grant enough importance to the history of philosophy, French philosophy, of which it was unquestionably the strong point, as was the history of science, granted it far too much importance—to the extent that philosophy could give the impression, in the academic world at least, of amounting to little more than the history of philosophy.

When we talk of the history of philosophy, we have to bear in mind that, despite the considerable interest shown in it in France, the history of 20th century philosophy has, to this day, remained extraordinarily poorly known and written very partially, in both senses of the word.

That is one of the reasons why I was led to becoming more of a historian than I'd initially intended to be.

- So, in short, you find that the history of philosophy bears far too much weight and is by no means able to meet our expectations?

Yes, one could put it like that. At the time that we're talking about, I couldn't bear the idea that we had to resign ourselves

to implicitly or explicitly replacing philosophy, whose impending end was being announced from all sides, by its history (or, in a different but no less historical genre, by the deconstruction of the tradition in which it was embodied). And I refused the idea of giving up the philosophy of science, as some were also proposing, for the history of science, irrespective of how important the latter may be. To my mind this was a disastrous way of dropping all forms of purely philosophical ambition. To sum up, one of the things that I had against French philosophy, and that has by no means disappeared today, was the impression that it gave all too often, that the appropriate way of approaching a philosophical problem was essentially via its history, and not by asking whether it could be solved and how. I, on the other hand, was naturally drawn to the attitude of the analytical philosophers, who seemed convinced that philosophical problems had to be able to be solved and that today one could hope to have more appropriate means to do so. From this point of view, it was they, and not the "continental" philosophers, as they are called, who seemed to be the most loyal heirs of this tradition. They, at least, were not haunted by the spectre of a possible end to philosophy or one that had perhaps already arrived, and by philosophy's inevitable replacement by successors such as the human sciences, literature, poetry and who knows what else. One has to remember that it was a time when competition was stiff to secure the status of a dominant and leading disciple that philosophy was supposed to have lost. Linguistics, anthropology, psychoanalysis and history have all, at one stage or another, been likely winners. Of course all of this seems rather ridiculous today, as what matters now is only the revival of philosophy, its again and more than ever flourisching situation, and its more or less limitless possibilities of growth. Philosophy as a commodity, along with its various imitations and forgeries, has probably never sold as well as it has in the past few years.

But to get back to my past and present relationship with the analytical tradition in philosophy, I don't consider it shocking that one can consider philosophical problems there to be solved, if possible, and not there primarily to give work to historians; or that even the greatest philosophers in the tradition have made mistakes and uttered meaningless statements (which does not imply that they have done only that); or that there is no reason to totally exclude the fact that, compared to them, we can be in a position enabling us to see more clearly into the real nature of philosophical problems and the ways in which we can hope to solve them—or into why we're not managing to do so.

- In philosophy you have always emphasized the idea that one should seek to tackle specific problems as directly as possible, with the intention to solve them, and not only to discuss them indefinitely.

Wittgenstein even went so far as to say, in the early thirties, that in philosophy itself, one had to be *business-like*, that something had to be done, to be *settled*. This is of course the kind of statement that can only arouse the indignation of traditional philosophers who see precise results as just about the last thing that can be expected from a discipline like philosophy. On this point I'm sure that I wouldn't go as far as Wittgenstein sometimes gave the impression of going, but I think that there is indeed a sharp contrast that one can call, as it has sometimes been called, that of the "philosophy of systems" and the "philosophy of problems". Philosophy, said Wittgenstein, is above all philosophical problems. But, for philosophers like Martial Gueroult and Jules Vuillemin who was his student, the reality of philosophy is above all that of doctrines and systems. And there is an irreducible plurality of systems and therefore, for the questions asked, of answers that we can't hope to break down with rational arguments. In my opinion that is a way of conceding that philosophical problems cannot be solved in the way that they have been considered most of the time as being supposed to be solved.

I must admit that it took me a long time to understand the crucial importance of the issue of philosophical pluralism for Vuillemin. Pluralism is a requirement which, in his opinion, was not sufficiently respected, not only by analytical philosophy but also by contemporary philosophy as a whole. In his interview for the daily *Le Monde* in 1984, as he was about to publish a book that personally I see as a masterpiece, *Nécessité ou contingence. L'aporie de Diodore et les systems philosophiques*, he said that: "Nothing, from either the scientific point of view or the moral point of view, forces us to opt for one class of system. Every class has its pros and cons, and therefore its limits. We have to choose, but our choice remains free. Once we have chosen, we have to accept the consequences and inevitable difficulties".[1]

> The question that one has to ask oneself is whether the only serious reason for having accepted a philosophy is its assumed truth, or whether it becomes true essentially because it has been accepted and only for those who have accepted it.

- As I understand it, you consider that this conception leaves a number of problems unsolved.

Yes, indeed. First there's the following question: if it is not reason, in the form of rational arguments, which decides the choice between systems, then what exactly does it? When we

1. Didier Eribon, "L'effet Bachelard chez Jules Vuillemin," *Le Monde aujourd'hui*, 4-5 March 1984, p. XV.

reach a conclusion like Vuillemin's, I think that we have to say a bit more than he does about this type of question. And one might well find oneself obliged, sooner or later, to bring in elements and aspects that are no longer philosophical but probably essentially psychological, psychoanalytical, sociological, and so on. Which is effectively not very satisfying for people who, like Gueroult and Vuillemin, are so bent on preserving the autonomy of philosophy, in relation to the various scientific disciplines and in general. And then there is also the risk of being forced to admit, in the case of philosophy, a form of relativism and even of radical subjectivism, if there are really no objective reasons that can justify one's choice.

The question that one has to ask oneself is whether the only serious reason for having accepted a philosophy is its assumed truth, or whether it becomes true essentially because it has been accepted and only for those who have accepted it.

In other words, is it possible or not to apply to philosophy the notion of truth in a sense that is sufficiently close to its usual meaning? If we adopt a point of view like that of Guéroult, we basically have no choice, it seems, between saying that all philosophy is true (although with a restriction such as "true in its own sphere") and saying that none of it is. Vuillemin and Granger, who both defend a non-relativist conception of truth, conclude that philosophy has a form of intrinsic plurality, that there is nothing accidental or temporary about it, and that it is probably best to give up trying to apply the notion of truth to philosophical statements.

This is a conclusion that does not really satisfy me, but that will obviously not bother those who think—and there seem to be more and more people who do—that truth is in any case not what matters, even in science, and that it would actually be in our interests to jettison such concepts. As I have so often said, I don't believe any of this and unfortunately I'm not convinced by any of the arguments used to support this type of assertion—that is, when it is supported by arguments. Many of them are even based on pretty obvious confusions. But, to realize that, one probably has to agree to move a little further out of the limited world of French Theory and to take really seriously books as remarkable as the most recent of those published by Bernard Williams[2] or those of Michael Dummett,[3] where the question of the "indispensability of truth" is treated in a way that is by no means rhetorical, one sees that the reputation of analytical philosophy has not actually been usurped to the extent that some have been seeking to have us believe once again. Talking of "rhetoric," I wish to point out that if the question of truth was really as important to Foucault as he said it himself, it is nevertheless surprising not to find any trace in what he says about the considerable work of clarification and analysis that logicians and analytic philosophers since Frege carried out on this question. When I read *Leçons sur la volonté de savoir*, published very recently, I unfortunately often felt compelled to agree with Jean-Marc Mandosio, who wrote that "Foucault applies the traditional recipe of essayism with a French flavour, 'brilliantly' revisiting common places, in a way that puts rhetoric over exactitude".[4] In general, I seldom share the "French flavour," but of course I'm not surprised that most of the time rhetoric is found to be more appealing than exactitude.

2. Bernard Williams, *Truth and Truthfulness. An Essay in Genealogy*, Princeton University Press, Princeton and Oxford, 2002.
3. See for example Michael Dummett, *Truth and the Past*, Columbia University Press, New York, 2004.

4. Jean-Marc Mandosio, *Longévité d'une imposture, Michel Foucault*, Paris Éditions de l'Encyclopédie des nuisances, 2010, p. 23.

Source: *La lettre du Collège de France*, no. 31, June 2011.

Online publications and e-books at the Collège de France

Emmanuelle Fleury
Patricia Llegou
Jean-Jacques Rosat
Céline Vautrin

The broadcasting of the Collège de France's lectures in recent years has been far more successful than expected:[1] an average of over one million hours of audio recordings are downloaded every month, and between 30,000 and 50,000 hours of video recordings. Writing nevertheless remains an unavoidable medium for imparting scientific knowledge.

This is why the Collège de France decided to publish its collections in digital form. Three of these collections are also available in a printed edition: the *Leçons inaugurales* (a collection that covers virtually all the inaugural lectures delivered by Collège de France professors since 1949[2]), the *Annuaire* (*Résumés des cours et travaux*, reflecting teaching and research since 1901), and *La lettre du Collège de France*, which for the past ten years has presented and commented on the main events at the institution, and has been available in English since 2005-2006 (*The Letter of the Collège de France* offers a selection of texts translated from the three French issues of the preceding year). A fourth collection, published only in digital form, proposes original texts from conferences and symposiums organised by the Collège de France.

1. See the survey by Henri Leridon, "Who are the audiences of the Collège de France's lectures?," *The Letter of the Collège de France*, no. 5, 2009-2010 (French issue, *La lettre du Collège de France*, no. 28, July 2010, p. 5-7).
2. The inaugural lectures have been published since 1949 in book form and have been co-published with Éditions Fayard since 2003.

In a four-month period, 9,064 inaugural lectures and 2,181 issues of *La lettre du Collège de France* have been downloaded in the form of e-books (these books were offered free-of-charge from September to December 2010).

Putting publications online as they appear or as close as possible to the event is a way of affording swifter and more far-reaching access (especially abroad) to texts of current interest.

The collections will gradually be completed by all their former issues, for many of the inaugural lectures were noteworthy—even outstanding—events in their field and their time. A large number of them can however no longer be found. These texts, like the abstracts written every year by the professors at the end of their courses and published in the *Annuaire*, are milestones in the institution's history and its scientific life. The plan is to compile a huge online corpus—freely accessible and citable—of all the texts published by the Collège for the past century at least.

Four collections online

To this end, the Collège de France created an electronic publishing platform in partnership with the Cléo,[3] in July 2010. This platform is hosted on the portal of Revues.org[4] and is accessible directly from the Collège's website.[5] The most recent publications can be found there: the last two *Annuaires* (2008-2009 and 2009-2010), eleven inaugural lectures, and nine issues of *La Lettre*, including one in English and two special issues: *Claude Lévi-Strauss* (2008) and *Le Tabac* (2010).

The *Conférences* site proposes two previously unpublished works: *La pluralité interprétative* (proceedings of a conference organised by Alain Berthoz, Carlo Ossola and Brian Stock) and *Korcula sous la domination de Venise au xv^e siècle* (three lectures by Oliver Schmitt, guest professor). This new, exclusively electronic collection will both widen the offer of publications and diversify the readership, especially abroad.

The choice of free access

Online publication

E-publication is a way of making access to online texts *freely available at no charge*. The texts are published in HTML, the standard Web format. Each article or book chapter can then be read on a page that scrolls down, comparable to the scroll or *volumen* that preceded the invention of the book in its current form (the codex), with numbered paragraphs. When it exists, correspondence with paper pagination is indicated at the top of each page. E-publication is not rivaling printed publication; it is renewing the uses of reading.

The texts put online are edited in the strict sense, which means they are prepared with the same high standards as for a printed book. The content management system (CMS[6]) and the layout are adapted to the publication of complex texts which are typographically rich and fairly long, with a highly structured editorial environment (automated contents pages with active links, management of notes, insertion of figures or media, author index and thematic index, etc.).

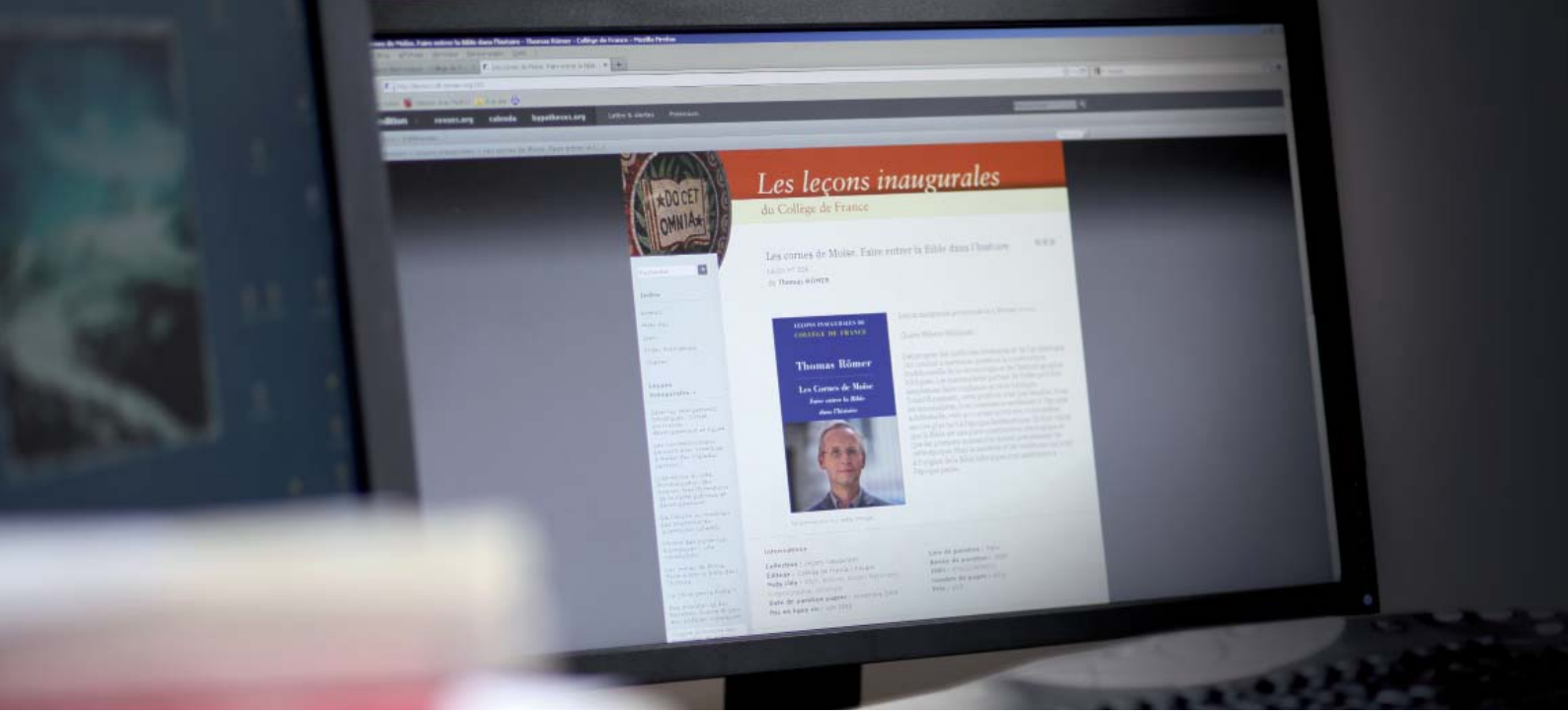
In a digital world, a wrongly referenced page is a page that does not exist.

Referencing

Publication on the Revues.org portal guarantees optimal referencing. In a digital world, a wrongly referenced page is a page that does not exist.

That is why it is important to adhere to Web standards: Dublin Core for metadata, RSS for syndication, OAI protocol[7]

3. The Cléo (Centre pour l'édition électronique ouverte) is a joint service (UMS 3287) provided by the CNRS, EHESS, the University of Avignon, and the University of Provence. Its missions are to promote the development of e-publishing in the social sciences and humanities, and to contribute to spreading related competencies.
4. http://www.revues.org. Developed by the Cléo, revues.org is the oldest portal for human and social science journals in France. It circulates close to three hundred journals.
5. From the section Publications > Online publications: http://www.college-de-france.fr/default/EN/all/pub-elec/index.htm
6. A Content Management System (CMS) is a software for dynamic designing and updating of websites. The one that we use, Lodel, is a free e-publishing software developed by the Cléo.
7. The OAI-PMH (Open Archives Initiative's Protocol for Metadata Harvesting) is an exchange protocol designed to facilitate exchanges between data suppliers and service providers, e.g. libraries, documentary centres, thematic portal, etc.



for harvesting metadata, Digital Object Identifier (DOI[8]) for referencing digital data, etc. Particular care is therefore taken in the production of metadata and their interoperability, so that they may be recognized by as many search engines as possible—whether they are general interest (like Google, Bing, etc.) or specialized (Google Scholar, Base, OAIster, Scirus)—and by directories of specialized links (Intute) and national or international scientific databases (Sudoc, WorldCat, EZB, JournalTOCs).

Citability

It is important for readers to be able to cite texts published online as rigorously as if they were printed. The reference of an electronic document is the address of the page on which it appears, that is, its URL.[9] If we don't want Internet to become a "graveyard of 404 errors" (that is, pages that can't be found because their address has changed or they have been deleted), it is essential to give documents a single, permanent URL with a guaranteed long-term accessibility. This is even truer in the world of research. Without permanent addresses, publications are automatically excluded from what the game of science is all about: reading, citation, and peer reviews.

E-books

Apart from the main version of each of the publications, accessible free-of-charge online, "detachable" formats are also available: the PDF (facsimile of the paper edition or PDF generated automatically) and ePub. These e-books are available at a charge. The contents are identical. The formats proposed for downloading (ePub and PDF) provide additional comfort and are suited to other uses and media: offline accessibility, types of files and dimensions of the page adapted to most mobile media (cell phones, IPad reader, Kindle, Sony Reader, Bookeen CyBook, etc.), as well as storage on a computer and a printout.

These e-files are proposed at a very small cost.[10] They can be bought directly online, either from the web page of each volume, via the Immaterial bookshop,[11] or on specialized content sales and delivery systems (e.g. iBookstore for iPad).

Offered and promoted by the Cléo under the name Open Edition Freemium,[12] this combination of freely available online access to the full text, with the commercialization of derived files (PDF and ePub), meets two demands: optimum accessibility and diffusion of knowledge via free access, and financing authors in the publishing chain (authors, publishers, retailers, online bookshops) through the sale of e-books.

Reception: the first analyses

The statistical tools of the Cléo can be used to estimate the frequentation of e-publications. Between July and December 2010, the entire platform (the four collections) received a total of 95,100 visits.

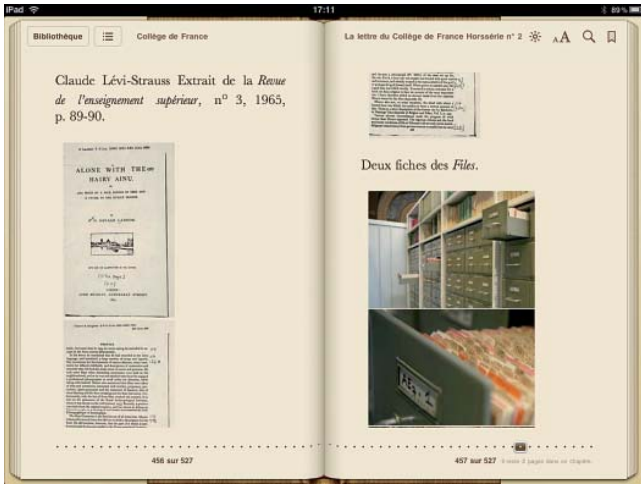
The abstract of Prof. John Scheid's lectures on "The city, the individual, and religion in Rome," published in the *Annuaire*, for example, received 667 visits between July and December 2010. That of Prof. Don Zagier, "Topology, combinatorics and modular forms" was seen 545 times during the same period. The printed version of the *Annuaire*, which groups together the abstracts of all the professors' lectures every year, is a huge volume of over 1,000 pages. The electronic version enables everyone to have direct access to the articles of interest to them.

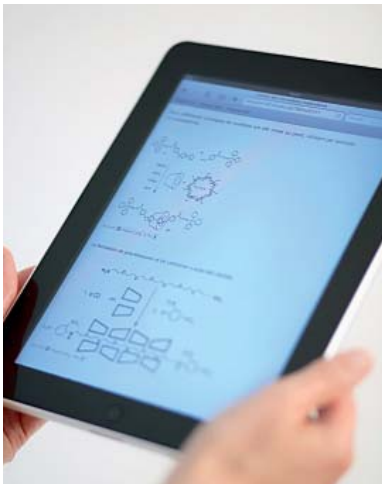
During the same period, each of the inaugural lectures put online received between 1,300 and 2,000 visits, and the special issue of *La Lettre* on tobacco, for example, received 6,475 visits—more than twice its paper circulation!

Statistics also give indications on the geographical location of Internet users who consult our collections. France is of course in the lead, but our pages are regularly visited from many other countries, both French-speaking (mainly Canada, Belgium, Morocco, Algeria, Switzerland, Ivory Coast, and Tunisia) and non-Francophone (primarily the US, Germany, Italy, Greece, Colombia and Chile).

8. Digital Object Identifier.
9. Uniform Resource Locator.
10. Currently, the inaugural lectures and *La lettre du Collège de France*. The other collections will follow suit.
11. http://librairie.immateriel.fr/fr/list/editeur-227-collège de france

12. See online (http://lettre-cdf.revues.org/1238), the article by Marin Dacos, director of Cléo, on the option "OpenEdition Freemium": free unlimited circulation online and charged for certain advanced "premium" functionalities (downloading formats and bundle of access and services for university libraries).





Examples of pages of *La lettre du Collège de* France devoted to Claude Lévi-Strauss and pages of the *Annuaire*, on iPad.

Accessibility and archiving of scientific knowledge

Internet offers tools for imparting knowledge that nobody dreamt of fifty years ago. E-publication and platforms for broadcasting via the Internet are ways of extending our lecture halls and reaching a wider audience.[13]

In addition to the wish to diffuse knowledge, there is also a question of heritage. In the coming years, e-collections are going to be enriched as older publications are progressively put on line, along with audiovisual documents and translations in English and, in some cases, other languages.

Owing to online publishing, video and audio recordings of lectures will be able to be referenced better and consequently used more, as texts are the best introduction to audiovisual documents and provide an inexhaustible supply of words for search engines. The exceptional audiovisual collection of the Collège de France will in turn enrich written documents; today, the video of each inaugural lecture already completes the e-version of texts.

> The project aims to constitute on-line archives of the entire Collège de France collection, freely available without charge.

In the medium term, the objective is for the entire collection of audiovisual documents produced or co-produced by the Collège de France to be gathered around the backbone formed by the abstracts of lectures published in the *Annuaire*.

From writing to audiovisual, from paper to digital and vice-versa: we would like to ensure that listeners also become readers, and that Internet users carry on reading books.

13. On the importance of the mission of diffusion knowledge to all, cf. the editorial by Pierre Corvol, administrator of the Collège de France, in *The Letter of the Collège de France*, no. 5, July 2010: "Whether our elders like it or not, the Collège de France's motto, *Docet Omnia*, is incomplete. *Docet Omnes Omnia* would be more accurate: it teaches everything to everyone".

Source: *La lettre du Collège de France*, no. 31, June 2011.

Electronic publications and e-books

Collection *Les Leçons inaugurales*

- Martin Abadi, *La sécurité informatique*
- Michel Brunet, *Origine et histoire des hominidés*
- Anne Cheng, *La Chine pense-t-elle ?*
- Patrick Couvreur, *Les nanotechnologies peuvent-elles contribuer à traiter des maladies sévères ?*
- Marc Fontecave, *Chimie des processus biologiques : une introduction*
- Antoine Georges, *De l'atome au matériau*
- Anselm Kiefer, *L'art survivra à ses ruines*
- Jacques Nichet, *Le théâtre n'existe pas*
- Peter Piot, *L'épidémie du sida*
- Thomas Römer, *Les Cornes de Moïse*
- Philippe Sansonetti, *Des microbes et des hommes*
- Ismail Serageldin, *Mobiliser le savoir pour éradiquer la faim*
- Nicholas Stern, *Gérer les changements climatiques*
- Jean-Marie Tarascon, *L'énergie : stockage électrochimique et développement durable*
- Claudine Tiercelin, *La connaissance métaphysique*
- Elias Zerhouni, *Les grandes tendances de l'innovation biomédicale au xxi^e siècle*

Collection *La Lettre du Collège de France*

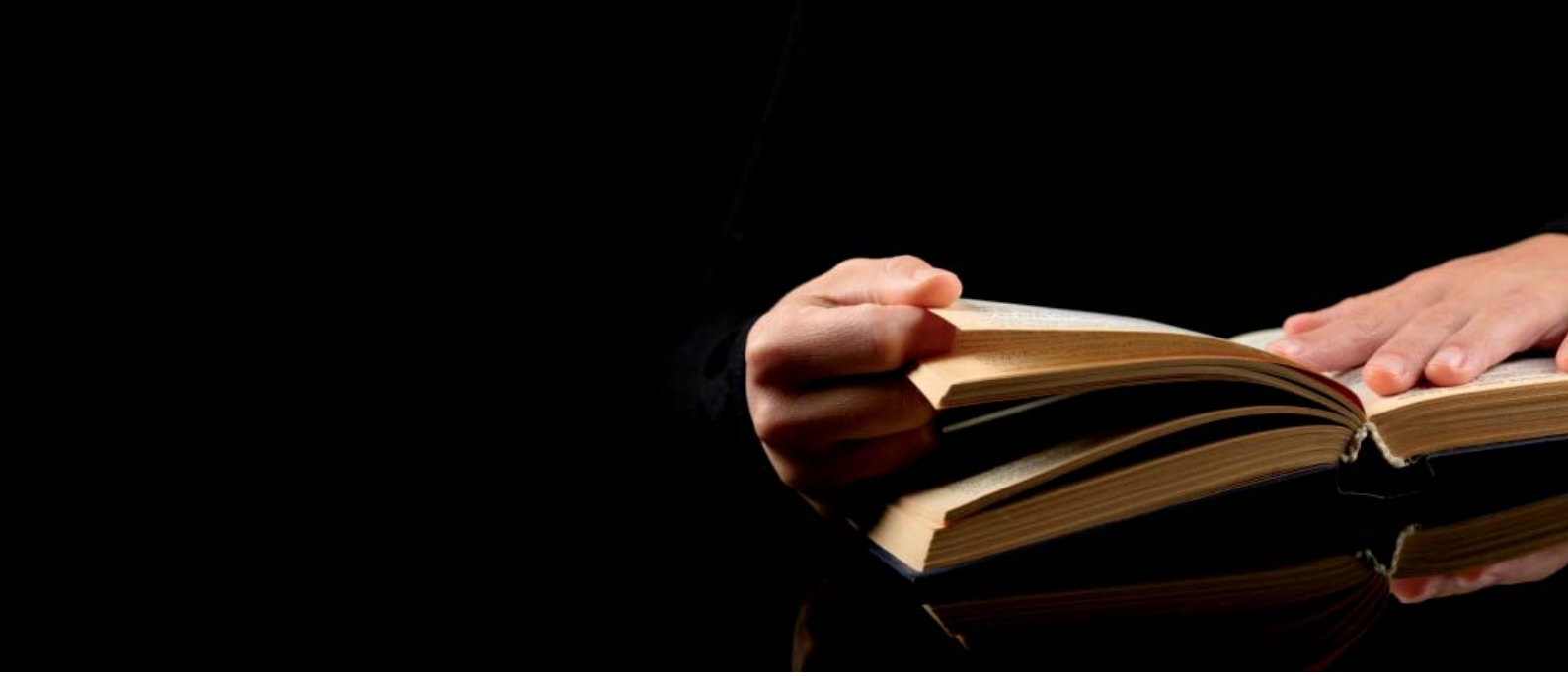
- no. 24, December 2008
- no. 25, March 2009
- no. 26, June 2009
- no. 27, December 2009
- no. 28, April 2010
- no. 29, July 2010
- no. 30, December 2010
- no. 31, June 2011
- no. 32, October 2011
- special issue no. 3: *Claude Lévi-Strauss, centième anniversaire,* 2008
- special issue no. 2: *Le Tabac,* 2010
- The Letter of the Collège de France, no. 4, Academic Year 2008-2009

Collection *L'Annuaire*

- Academic year 2007-2008, no. 108
- Academic Year 2008-2009, no. 109

Collection *Les Conférences*

- *La mondialisation de la recherche: compétition, coopérations, restructurations*, autumn symposium 2010
- *Korcula sous la domination de Venise au xv^e siècle*, Oliver Jens Schmitt
- *La pluralité interprétative*, Alain Berthoz, Carlo Ossola and Brian Stock



What is a book?

Roger Chartier

What is a book: A discourse that has coherence and unity, or an anthology of citations and extracts?

The digital conversion of written cultural objects that are still part of our world—books, journals, newspapers—compels us to re-examine this fundamental question.

Doing so is in fact essential to the constitution of the electronic collections that afford remote access to the printed matter in libraries. It would be foolish to see this extraordinary possibility offered to humanity as something useless or dangerous. "When it was proclaimed that the Library contained all books, the first impression was one of extravagant happiness" wrote Borges, and the same immediate felicity is induced by the promise of a new digital Babel. All books for every reader, irrespective of where they may be: a magnificent dream promising universal access to knowledge and beauty.

Yet we need to remain rational. This is not the first time that our written heritage has been transferred from one material form to another. In the 15th century the new technique of reproducing texts was put to the service of the prevailing genres in the manuscript culture at the time: scholastic manuals, liturgical books, encyclopaedic compilations, calendars and prophecies. In the early centuries of the Christian era, the invention of the book as we know it, the codex with its pages and indexes, provided a new medium for the holy scriptures and the works of Greek and Latin authors.

History teaches nothing, despite the commonplace claim that there are lessons to be drawn from it, but here, in both cases it shows how essential it is to our understanding of the present:

> The "same" text is no longer the same when the medium on which it is inscribed changes and, along with that, the ways of reading it and the meaning that its new readers attribute to it.

In Antiquity, reading a scroll was a continuous process. It mobilized the entire body since the reader had to hold the written object in two hands and was therefore unable to write at the same time. The codex, first hand-written and then printed, made new movement possible: the reader could page through the book organised into sections, sheets and pages, and could write while reading. As the book could be paginated and indexed, it could be cited with

Source: *La lettre du Collège de France*, no. 31, June 2011.

Prof. Roger CHARTIER
Writings and cultures in modern Europe
Chairman of the Scientific Council of the Bibliothèque Nationale de France

precision and specific passages could easily be found.

Reading facilitated in this way is discontinuous, yet the reader necessarily has a global perception of the book, owing to its materiality.

Libraries know this, even though some of them have been or still are tempted to archive in inaccessible places or even to destroy printed objects whose conservation seems to be guaranteed by their transfer onto another medium: first microfilm and microfiche, and now digital files. As an argument against this unsound policy, we need to remember that protecting, cataloging and making accessible (not only for experts in bibliographic material) texts in the successive or concurrent forms in which readers formerly read them, sometimes until very recently, is still a fundamental task—and the main justification for libraries' existence as institutions of conservation and a place for reading. Even if the technical and financial problems of digitization were solved, and the entire written heritage were converted into digital form, the conservation and communication of these earlier media would be no less necessary. Otherwise, the "extravagant happiness" promised by the Alexandria library, finally attained, would pay the high price of amnesia with regard to the histories that have made today's societies what they are.

This is especially true in so far as the digitization of objects of the written culture that is still ours today (i.e. books, journals, newspapers) is forcing them to undergo greater changes than those entailed by the migration of texts from the scroll to the codex. In my opinion, the most important aspect of this is the profound transformation of the relationship between the fragment and the whole. At least until today, in the electronic world, the same illuminated surface of the computer screen has presented all texts, irrespective of their genres and function. This has severed the relationship which, in all former written cultures, closely bound objects, genres and uses. It is this relationship that still underlies the most obvious differences between various types of printed publication and the expectations of their readers, guided in the order, or disorder, of discourses by the very materiality of the objects through which they are conveyed. And it is this relationship that makes the coherence of works visible, imposing the perception of the textual wholeness, even to someone who wants to read only a few pages. The same does not apply to the world of digital texts, since discourses are no longer inscribed in objects through which they can be classified, ranked and recognized with their own identity. This is a world of decontextualized, juxtaposed, infinitely recomposable fragments, in which there is no need to understand the relationship binding them to the work from which they have been drawn.

One might object that this has always been the case in written culture, constructed to a large extent, lastingly, from collections of excerpts, anthologies of commonplaces (in the noble sense of the Renaissance) and chosen pieces. Indeed. But in printed culture, the fragmentation of writings is accompanied by its opposite, that is, their circulation in forms that respect their integrity and that sometimes bring them together in "works," whether complete or not. Moreover, in the book itself the fragments are necessarily, materially, related to a textual whole that can be recognized as such.

This fundamental difference has several consequences. For instance, the very idea of a journal becomes obscure when the consultation of articles is related no longer to the immediate perception of an editorial logic in the composition of each issue, but to sections based on themes. Moreover, new, discontinuous and segmented ways of reading are challenging the categories that formerly governed the relationship to texts and works which had been defined, designed and appropriated as singular, coherent entities.

It is precisely these fundamental properties of digital textuality and screen reading that Google's commercial project intends to exploit. Its target is the information market. Books, like other digital resources, constitute an immense wealth of information into which it can tap, and that is the basis for the superficial and naïve idea that any book or discourse is a database providing "information" for someone seeking it. Satisfying this demand and taking advantage of it is this firm's main aim—not building a universal library available to humanity. Moreover, Google does not seem to be very well equipped to do so, judging by the multiple errors in dating, classification and identification produced by automatic extraction of data and revealed with irony by Geoffrey Nunberg in *The Chronicle of Higher Education*, in August 2009. The information market considers these blunders as secondary; of importance is the indexing and ranking of the data, keywords and sections that enable users to access the documents with the best "performance" as fast as possible.

> The discovery of a new, ever-expanding market, and the technical feats that give Google a quasi-monopoly over mass digitization, have guaranteed the overwhelming success and huge profits of this commercial logic.

It implies the digitization of millions of books, seen as an inexhaustible mine of information, and consequently requires past or future agreements with the world's biggest libraries, as well as mass digitization hardly concerned about complying with copyright. It furthermore involves the compilation of a giant data base capable of absorbing many others of all kinds, and of archiving the most personal data on those who use the multiple services proposed by Google.

All the current controversies derive from this initial project, including lawsuits by certain European publishers for illegal reproduction and dissemination of copyrighted material, and the agreement between Google on the one hand and the Association of American Publishers and the Society of American Authors on the other. This agreement will provide for the sharing of the rights for access to copyrighted books, subject to validation by the New York court which is examining its compatibility with the anti-trust laws.[1] The spectacular launch of Google Edition, a powerful digital bookshop destined to rival Amazon in the sale of e-books, is another example. Its creation

1. Editor's note: In March 2011, Denny Chin, federal judge in New York, ruled against this agreement.

was made possible by Google's seizure of five million "orphan" books, still protected by copyright but whose publishers or heirs have disappeared, and by the agreement that will legalize pirate digitization ex post.

Representatives of the US firm are travelling the world and attending conferences to proclaim their good intentions: democratize information, make unavailable books accessible, fairly remunerate authors and publishers, lobby for legislation on "orphan" books. And, of course, ensure the "eternal" conservation of books threatened by the disasters that strike libraries—as a director of Google pointed out in a recent article in *The New York Times*, where he justifies the controversial agreement by referring to the three fires that destroyed the libraries of Alexandria and, in 1851, the Library of Congress.

This public service and universal democratization rhetoric is however not enough to allay fears. In an article in *The New York Review of Books* on 12 February 2009, and in his book *The Case for Books. Past, Present and Future* (PublicAffairs, 2009), Robert Darnton points to the ideals of the Enlightenment to warn against the logic of profit governing Google's undertakings. A clear distinction is made between, on the one hand, books that have fallen into the public domain and are accessible free-of-charge on Google Books, and, on the other hand, books—whether orphan or not—that are subject to rights and are sold, including on Google Edition. But nothing guarantees us that in the future the firm, in a monopoly situation, will not charge high access or subscription fees, notwithstanding the public good and free access ideology that it currently claims to go by. A link already exists between advertising, from which Google derives huge profits, and the ranking of "information" resulting from each search on Google Search.

It is in this context that we need to situate the debates triggered by the decision of certain European libraries to entrust digitization of all or some of their collections to Google, in the framework of a convention or, occasionally, a call for tenders. In the French case, such agreements and negotiations over other agreements have until now concerned only books in the public domain—although, as we have seen, this does not necessarily protect the others, scanned en masse in US libraries. Should this approach be pursued? The temptation is strong to do so, in so far as regular budgets do not allow for fast digitization of masses of documents. To accelerate availability online, the European Commission, public authorities and certain libraries have considered it necessary to enter into partnerships with private organizations and of course with the only one that has the technical capability (which incidentally it keeps secret) to scan huge volumes rapidly. This was the reasoning behind the cautious and limited negotiations between the Bibliothèque Nationale de France and Google—negotiations that were deemed to be untimely both in France and in Switzerland, where the contract signed between the Bibliothèque Cantonale et Universitaire de Lausanne and Google triggered stormy debate (*Le Temps*, 19 September 2009).

Considering the radical difference separating the reasons, modalities and uses of digitization of the same collections by public libraries and the Californian firm, this caution is more than justified and could or should prevent decision-makers from giving in to temptation. Private appropriation of a public heritage, made available to a commercial enterprise, may in itself seem shocking. But additionally, in many cases use by libraries of their own collections digitized by Google (even where the books were in the public domain) is subject to totally unacceptable conditions, such as the prohibition on exploiting the digitized files for several decades, or on merging them with the files of other libraries. Equally unacceptable is another secret, concerning the clauses of the contracts signed with each library.

Justified reluctance with regard to such a risky partnership has two main implications: first, the need to demand that public funding of digitization programmes match up to states' commitments, needs and expectations, and that the states or the European Community do not pass on to private operators the long-term cultural investments entrusted to them; and second, the need to decide on priorities, without necessarily thinking that any "document" should be digitized, and then to build up coherent digital collections which respect the criteria for identifying those discourses that organised and still do organize written culture and printed material.

The possibly excessive and indiscriminate obsession with digitization should not mask another aspect of the "great digital conversion," as Milad Doueihi put it; that is, the new technique's ability to be a medium for original forms of writing freed from the constraints imposed by the morphology of the codex and the legal regime of copyright.

> This polyphonic and palimpsest, open and malleable, infinite and fluid writing is upsetting categories that, since the 18th century, have underpinned literary property and pervaded the practices and habits of reading.

As Antonio Rodrlguez de las Heras pointed out, in the digital space it is not the written object that is folded, as in the case of the page in the manuscript or printed book, but the text itself. Reading thus consists of "unfolding" this mobile and infinite textuality. In this way, reading on the screen constitutes multiple and singular, ephemeral textual units composed by the reader at will, and by no means pages defined once and for all. The image of navigation on the Net that has become so familiar, clearly indicates the characteristics of this new segmented, fragmented and discontinuous way of reading. It profoundly challenges the perception of books as works, and of texts as singular, original, unchanging creations, and therefore the property of their author. New writings, directly created in digital form, now raise the thorny question of their archiving and conservation. Libraries have to be attentive to this at the very time in which they develop the digitization of their heritage and question the best way of creating a new order of discourse where old concepts and original possibilities come together.

This article is based on the conclusions of a talk at the Diète Library in Tokyo, on 7 September 2010.

The Case for Books.
Past, Present and Future

"Commercial publishers have raised the price of periodicals, especially in the natural sciences, to such a height that they have created havoc in the budgets of research libraries. In order to maintain their collections of periodicals, libraries have cut back drastically in their purchases of monographs. Faced with the decline in orders from libraries, university presses have virtually ceased publishing in the least fertile fields. And scholars in those fields no longer have an adequate outlet for their research. The crisis concerns the operation of the market place, not the value of the scholarship; and it is greatest among those with the greatest need to overcome it—the next generation of academics whose careers depend upon their ability to break into print."

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"Google can make the Enlightenment dream come true.

But will it? The eighteenth-century philosophers saw monopoly as a main obstacle to the diffusion of knowledge—not merely monopolies in general, which stifled trade according to Adam Smith and the Physiocrats, but specific monopolies such as the Stationers' Company in London and the booksellers' guild in Paris, which choked off free trade in books.

Google is not a guild, and it did not set out to create a monopoly. On the contrary, it has pursued a laudable goal: promoting access to information. But the class-action character of the settlement makes Google invulnerable to competition. Most book authors and publishers who own US copyrights are automatically covered by the settlement. They can opt out of it; but whatever they do, no new digitizing enterprise can get off the ground without winning their assent one by one, a practical impossibility, or without becoming mired down in another class-action suit. If approved by the court—a process that could take as much as two years—the settlement will give Google control over the digitizing of virtually all books covered by copyright in the United States."

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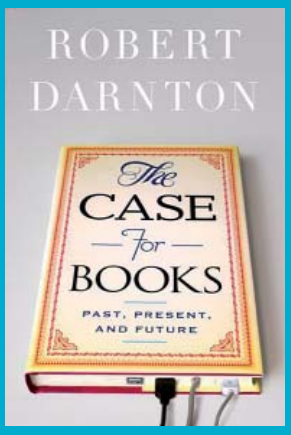

Robert DARNTON
The Case for Books. Past, Present and Future.
New York: PublicAffairs, 2009.

We are grateful to PublicAffairs Publishing for kindly granting permission to publish these excerpts.

English Website

In May 2007 an English-language website was created, partially mirroring the French one. The site has evolved since its launching. The home page offers various links to news and events, podcasts, iTunesU, and a video presentation of the Collège de France.

It features the following sections, accessible through thumbnails:

- Chairs: List of the chairs grouped by main domains, with access to each professor's institutional pages presenting their research domain, biography and bibliography. List of the annual chairs. List of guest lecturers. List of the main institutional events
- Research: Presentation of the research laboratories, Institutes, and hosted teams, and presentation of the Center for Interdisciplinary Research in Biology (CIRB)
- Calendar: Agenda of the courses, news and events
- Audio/video: Access to the audio and video files online (streaming or download), by main domains, with search engine (see below the list of English audio/video documents)
- Institution: Presentation of the institution and its functioning, interactive alphabetical list of professors and chairs. List of emeritus professors. List of previous annual chairs. Presentation of the library and the archives. Publications (with access to downloadable files of the Letter of the Collège de France). Archaeology (with a short historical account, from Roman thermae to the Collège de France). Presentation of the COSS, the College de France international committee on scientific and strategic orientation
- International: Presentation of the relations with foreign partners. Education policy (teaching abroad, guest lecturers and hosted young foreign researchers, abroad lecture series and symposia). Dissemination via Internet. Partnership agreements between the College de France and many foreign universities of institutes for advanced studies
- Contacts: Addresses and contacts. Legal notices

This site has been designed to meet an international public's expectations. The ergonomics are identical to the French one, to preserve the unity and identity of both sites. The English site is constantly enriched with new documents, especially multimedia files of courses and conferences given in English or translated.

For the Academic Year 2011-2012, nearly 30 professors will have their courses translated in English.

Videos and Audio online (free access)

Anne Cheng—Intellectual History of China: 9 lectures (2010-2011)

Antoine Compagnon—Modern and Contemporary French Literature: History, Criticism, Theory: 13 lectures (2010-2011)

Michael Detlefsen (invited by Prof. Claudine Tiercelin)—Axiomatization, Formalization and Completeness: 2 conferences (2010-2011)

Stanislas Dehaene—Experimental Cognitive Psychology: 2 lectures (2010-2011)

Mireille Delmas Marty—Comparative Legal Studies and Internationalisation: 12 lectures and 1 symposium (2010-2011)

Brett Finlay (invited by Prof. Philippe Sansonetti): 4 conference (2010-2011)

Marc Fontecave—Chemistry of Biological Processes : 6 lectures (2010-2011)

Chris and Uta Frith (invited by Prof. Stanislas Dehaene): Social Cognitive Neuroscience: 4 conferences (2010-2011)

Gabriel Kotliar (invited by Prof. Antoine Georges)—Strong correlations and high temperature superconductivity: 4 conferences (2010-2011)

Jean-Daniel Macchi (invited by Prof. Thomas Römer)—The book of Esther: A piece of Jewish literature during thew Second Temple period: 4 conferences (2010-2011)

Roland Recht—History of European Mediaeval and Modern Art: 6 lectures (2010-2011)

Pierre Rosanvallon—Modern and Contemporary History of Politics: 8 lectures (2010-2011)

Clément Sanchez—Chemistry of Hybrid Materials: 1 inaugural lecture and 5 lectures (2010-2011)

Philippe Sansonetti—Microbiology and Infectious Diseases: 18 conferences from the symposium: The commensal microbiota: from homeostasis to disease. (2010-2011)

Claudine Tiercelin—Metaphysics and Philosophy of Knowledge: 6 lectures and 1 symposium (The Epistemology of Disagreement): 13 conferences. (2010-2011)

Michel Zink—Literatures of Medieval France: 6 lectures (2010-2011)

Chair in Knowledge against Poverty
Esther Duflo—Experiments, Science, and the Fight against Poverty (2008-2009)
Peter Piot—The AIDS epidemic and the globalization of risk (2009-2010)
Ismail Serageldin—Hunger and food safety in the world (2010-2011)

Chair in Sustainable Development - Environment, Energy and Society
Henri Leridon—Demography: the end of the transition? (2008-2009)
Nicholas Stern—Managing climate change and promoting growth, development and equity (2009-2010)
Jean-Marie Tarascon—Energy: Challenges and issues facing electrochemical storage of energy in light of sustainable development (2010-2011)

Chair in Artistic Creation
Pierre-Laurent Aimard—Role and responsibilities of the performer today (2008-2009)
Anselm Kiefer—Art will survive its ruins (2010-2011)

Chair in Technological Innovation Liliane Bettencourt
Patrick Couvreur—Nanotechnology can contribute to treat severe diseases (2009-2010)
Elias Zerhouni—Major trends in biomedical innovation in the 21st century (2010-2011)

Chair in Information Technology and Digital Sciences
Martin Abadi—Computer security (2010-2011)

Collège de France autumn symposium 2011: The life of forms

Pierre Hadot, French specialist in ancient philosophy, was born on 21 February 1922 in Paris. He spent his childhood in Reims in a very Catholic family. After studying philosophy and theology, he was ordained priest, he left the priesthood in 1952. From 1949 to 1964, he worked at the CNRS. Then, from 1964 to 1985, he joined the École Pratique des Hautes Études (EPHE, Fifth Division). In 1982, he was elected professor at the College de France. He held the Chair of History of Hellenistic and Roman Thinking from 1982 to 1991.

Reflection on the Life and Work of Pierre Hadot

John Scheid

Pierre Hadot is the philosophy teacher that all of us would have liked to have had: down-to-earth, modest, always talking with a touch of irony, clear, and fiercely opposed to the kind of "affected" style that is heavy with jargon and that he denounced in his inaugural lecture.

He was able to awaken numerous callings by restoring the originality and depth of post-classical Greek philosophy. His impressive work has been valuable to historians, specialists of ancien literature and philosophers alike. Pierre Hadot's clarity and innovativeness are probably the result of his unusual career. As a *homo novus*, he liked to say, he had entered philosophy via a very personal itinerary that led him from a seminary into scientific research, via ordination as a priest, followed during the Second World War by a diploma as a fitter and turner in a workshop for dismantling and repairing train engines.

After the war Pierre Hadot studied philosophy while teaching in Charleville and Paris. He then embarked on a PhD, joined the CNRS, and attended lectures at the Institut Catholique, the Sorbonne, and the EPHE (École Pratique des Hautes Études).In 1950 he left the priesthood and the church, and devoted himself entirely to work on his PhD as a researcher at the CNRS. Like much of his former research and his degree from the EPHE, this thesis was on a neo-Platonian Christian of the 4th century AD, Marius Victorinus. Pierre Hadot worked on this author for twenty years before completing his PhD on Porphyrus and Victorinus. His thesis was published in 1972. In 1964 he was appointed to the religious science section of the EPHE as director of study (i.e. professor) on Latin patristics, with reference to the work on Marius Victorinus. This Chair, which

Prof. John SCHEID
Religion, Institutions and Society in Ancient Rome

seemed to make Pierre Hadot a specialist on Latin texts, did not however correspond to the reality of his research. His work was much closer to *Plotin ou la simplicité du regard* that he had just published, in 1963, or to the neo-Platonian philosophers, Proclus and Damascius, whom he read on the banks of the Meuse during his lunch breaks while he was teaching at a girls' boarding school in the "cold Ardennes," as he put it.

A few years later, the assembly of the religious science section of the École Pratique des Hautes Études, which in the meantime had made him its secretary in charge of schooling and administration, authorized him to change the title of his Chair to "Theologies and mysticism of Hellenistic Greece and late antiquity". This title effectively revealed the full scope of Pierre Hadot's work. It brought to the foreground of his research and teaching the Hellenistic world in its full temporal and spatial dimension, as well as the mysticism that never ceased to interest and intrigue him throughout his life. In addition to that mysticism, spiritual exercises were also at the centre of his research. In his seminars at the EPHE, he was able to freely work and teach on Plotin and Marcus Aurelius, the main aspect of his next book, *Exercices spirituels et philosophie antique*, published in 1981 (partly translated in *Philosophy as a Way of Life: Spiritual Exercises from Socrates to Foucault*, Wiley-Blackwell, 1995). But at that point Pierre Hadot's career took a new turn when he was elected to the Collège de France as the Chair of the History of Hellenistic and Roman Thinking, in 1982. This title confirmed his wish to study the philosophy of the centuries succeeding classical Athens. Even though he often alluded to Socrates, his favourite subjects were the neo-Platonians and late philosophy, the study of which he largely contributed to reviving. He wanted to escape the philosophy of academic programmes, to analyze as a historian the status of this science in Hellenistic society and the Roman world. His refusal to make any kind of distinction between the great authors and the less well-known ones who were of less interest to those who designed the programmes for national *exams* (the so-called *aggregation*), or between Greek philosophers and those of the Roman world, led him to publish *La citadelle intérieure. Introduction aux pensées de Marc Aurèle*, in 1992. The book enabled him to do justice to this author by setting him in the history of philosophy, and to found his conception of philosophical life as a spiritual exercise above all. As he had already written in his inaugural lecture, *The Thoughts of Marcus Aurelius* enables us to "understand the relations between theory and practice in the philosophy of the time". Following the philosopher emperor, but also Epicurus, Porphyry and Plotinus, and of course Socrates, Pierre Hadot appealed for abstract theory, the accumulation of reasoning and acquired knowledge, not to be considered as an end in itself, the ultimate aim of the philosophical exercise. Instead, he argued, it was the union of theory with nature and with life that warranted being called wisdom. This objective was attained through meditation and spiritual practice, exercises that led some as far as mysticism. Pierre Hadot often discussed this subject.

Pierre Hadot's work is also characterized by a keen interest in the texts, in the sources. Not only did he not indulge to empty conceptualizing, he also applied himself to commenting on classical sources; he always was a translator, commentator and editor of texts. Illustrations of this include the following: Marc Aurèle, *Écrits pour lui-même* (Les Belles Lettres, 1998); *Manuel d'Epictète* (Hachette, 2000), and in 1977 already, Ambroise de Milan, *Apologie de David* (Editions du Cerf), which underscores another original aspect of the definitions of philosophy by Pierre Hadot. Nor did he mark the distinction between neo-Platonian or stoic philosophy, and contemporary Christian thinking. All these thoughts, which fed one another, belonged to classical thinking. In the eyes of an historian, this is probably the feature that best characterizes Pierre Hadot's work: he restored its originality to classical philosophy. He freed it of the scholarly yoke of the programmes of degrees and competitions (*concours*), and insisted on what philosophy represented as a way of life as opposed to a pure accumulation of knowledge. Above all, he restored their true meaning to the philosophical genre, to classical philosophical texts and even to Hellenistic thinking as a whole (*See What is ancient philosophy?*, Harvard University Press, 2004).

In his inaugural lecture Pierre Hadot had already insisted on the wrong done to classical authors by latter-day writers who often criticize them for composing badly, for contradicting themselves or for lacking coherence. But this stems from a lack of understanding of philosophy and more generally a lack of knowledge of classical culture. Pierre Hadot repeatedly stressed the originality of this culture which, rather than producing new writings, commented on or translated great texts from the past, for example from Greek into Latin. "Misunderstandings, shifts or losses of meaning, reinterpretations, even misinterpretations" inevitably resulted. The history of Hellenistic and Roman thinking has the mission of recognizing and analyzing the evolution of the new meanings that were thus produced. It has shown, in particular, how Philo of Alexandria used Platonic formulae to comment on the Bible, and how Ambrosius of Milan translated Philo's text to present Christian doctrines. He said: "We are less interested in the idea itself than in the prefabricated elements in which we think we recognize our own thoughts". It is through this *bricolage* that thinking evolves, drawing on existing elements to which it gives new meaning, not only in Antiquity but also in latter-day philosophy—as his comments on Husserl's Cartesian Meditations and his fine volume on Isis' Veil attest.

Pierre Hadot was a man of quotations. By taking the sentence from Michelet that he cited in the fine volume of interviews with Jeannie Carlier and Arnold Davidson (*Philosophy as a Way of Life,* Oxford, Blackwell, 1995), saying that he wanted to be "the bond of time" that ensures "this vital chain which from the apparently dead past pumps the sap of life towards the future," we can sum up his work in the fact that he restored its originality to classical philosophy.

Owing to his dual culture nurtured by his reading of French and German authors, Pierre Hadot had a very clear view of culture in the European conscience. The following fine sentence from his chapter in *L'Histoire de la philosophie*, edited by Jacqueline Russ, and which draws his own portrait, bears witness to that: "It is not so much concepts as ideals and moral experiences that the Hellenistic era bequeathed to our Western civilization: the model of the sage transcending the human condition, the ideas of humanity and fraternity between people and of cosmopolitism, the experience of moral freedom, that is, the pureness of intention, of independence with regard to outside goods, the peacefulness of the soul, of acceptance of fate, but also the experience of the freedom of judgment, of the challenging of dogmatic opinions, of critical activity".

Source: *La lettre du Collège de France*, no. 30, December 2010.

Jacqueline de Romilly was born in 1913 in Chartres. She died on 18 December 2010, at the age of 97. She was laureate of the Concours général in Latin and Greek in 1930, the first year in which it was open to girls. She obtained the agrégation in literature in 1936 and a PhD in literature in 1947. In 1973, she became the first woman Professor at the Collège de France, where she held the Chair of Greece and the development of moral and political thinking from 1973 to 1984.

Reflection on the Life and Work of Jacqueline de Romilly

Denis Knoepfler

Jacqueline de Romilly was a top-ranking Hellenist, yet everyone knows that she was actually much more than that: she was one of the great women in the cultural life of the latter half of the 20th century, whatever their specialization and even their nationality.

She maintained this very prominent position throughout the first decade of the 21st century, continuing until the end and despite the effects of age, to publish essay after essay—not to mention novels and short stories—at a pace that one might even consider excessive. Yet, behind this production intended above all, in recent years, for the cultivated general public, there was the teacher's very legitimate concern to constantly go over the most important lessons from the past, to ensure the transmission of a heritage. This concern was moreover mingled with a growing anxiety, as we will see in this homage.

A French citizen and proud of it, Jacqueline de Romilly was also, throughout her life, highly representative of what, in my opinion, is the best that France can offer those who wish to join its intellectual elite. Born Jacqueline David in 1913, the future Madame de Romilly studied at French public schools between the two World Wars, regularly winning first prizes and always coming first in her class, right up to and including the *agrégation*. In 1947, shortly after the end of Second World

Prof. Denis KNOEPFLER
Epigraphy and History of the Ancient Greek Cities

War, she brilliantly defended and published a PhD thesis that had fully matured. The subject seemed particularly austere for a Hellenist, then very much aware of the role that women would be called on to play: the rising power of the city of Athens in the Ancient Greek world as Thucydides—certainly the least feminist of the authors of antiquity!—shows and explains it, without the slightest anecdotal concession, be it on ephemeral political pacts or romantic intrigues. Strengthened by this fully merited success, Jacqueline de Romilly soon became a spokesperson, in a sense, for culture in France and in the world—in the wake of another great woman who was basically (let us not forget) a Hellenist as well, Marguerite Yourcenar. Was she not received in all the most prestigious institutions of this country? At the Institut de France, in two of its oldest academies, the Académie Française, from 1980, and the Académie des Inscriptions et Belles-lettres, from 1972; the Collège de France where she had the singular privilege of being the first woman Professor and where she taught for ten years (1973-1983) before a long, active period with an honorary status; and the Sorbonne, first, from 1957 to 1973. Needless to say, she was awarded the highest distinctions in the main national orders of honour, the *Légion d'Honneur*, the *Ordre du Mérite*, and the *Ordre des Arts et des Lettres*, and several others. Additionally, as the years went by, she also won a host of foreign distinctions—to the extent that it would almost be easier to draw up the list of academies which did not have the opportunity of hosting her, than those which were honoured to count her among their members.

It is well known that Jacqueline de Romilly fought fiercely for all the components of literary culture and, in fact, simply all culture. Her thoughts in the two essays *L'enseignement en péril* after 1968 and, a little later, *Lettre aux parents sur les choix scolaires* (republished together in 1991) bear witness to this, as do her chronicles, of a less dramatic nature, on the French language, and which she gave to a widely circulated women's magazine (these pieces have also been brought together in a single volume, under the attractive title *Dans le jardin des mots* ("In the garden of words").

> Jacqueline de Romilly was filled essentially with a passion that was never belied and never waned: the passion for Ancient Greece through its language, literature and, more generally, civilization.

In her case, talking of "passion" is by no means an exaggeration, since it was out of a *love for Greek*, as she put it, that she wrote and said so much. Recently (in 2000) she even used these words as a title for a collective volume that she edited with the late lamented Jean-Pierre Vernant, another great figure of French Hellenism who recently passed away. The fact that the Collège de France, in the early seventies (that is, when the eminent epigraphist and historian of Ancient Greece, Louis Robert, was about to retire after 35 years of uncontested domination), was able to recruit two Hellenists of this quality, truly does justice to the Assembly of the Professors of the time. They were able to see that there was no redundancy, and that with the teaching dispensed at the Collège by such personalities, fundamental aspects of investigation into the origins and nature of the "Greek miracle" could be presented to the public (in a remarkably complementary way). This was an immense privilege that all European and American academic institutions could envy us for.

Loyal to the choices that, until then, had served as a framework for her research within the Greek Institute at the Sorbonne, Jacqueline de Romilly gave the Chair created for her at the Collège de France a name which clearly defined her intentions: "of Greece and the development of moral and political thinking". She had started this reflection—actually much more than that—with her exceptional thesis "Thucydide et l'impérialisme athénien" (1947), and had continued it with a more synthetic essay "Histoire et raison chez Thucydide" (of which there have been three editions since 1956). In parallel, she had translated "L'Histoire de la guerre du Péloponnèse" (1953-1972) for the Universités de France Collection (Les Belles Lettres), and had written a long introduction in French for the editions of Herodotus and Thucydides (translated by other scholars) in a very practical volume published by Pléiade (1964). Thus, it was no coincidence that her first lectures were an opportunity to look at the particularly fascinating work constituted by Thucydides' account of a war very close to his own time, in order to try to identify more closely this great Athenian historian's conception, for example of power and justice—flouted as easily then as they are now— of democracy as it was practised in his time in Athens and, more generally, of various political regimes or even certain features of economic and social life. Broadening the perspective even more in one of her last lectures, she showed that this author, trained in the school of the sophists and the first theoreticians of medicine, was in a sense at the source of the humanities. Later (1990), she published, under the Collège's aegis, a captivating little essay on La recherche de la vérité chez Thucydide and, more recently (2005), her student Monique Trédé, professor at the ENS, took the fine initiative of bringing together in a large volume most of Jacqueline de Romilly's memoires devoted to this author.

But confining our colleague to the critique of a single work (no matter how innovative and abundant it may be) would paint a very narrow picture of her work and above all her curiosity. Actually, she never had the feeling of betraying the old travelling companion that Thucydides was for her, when she turned her mind to other great figures of Greek literature and studied their writings with equal sagacity. Did she not show at least equal empathy for the old Homer whose work inspired her several books (republished over and again in the "Que sais-je" collection), not to mention her recent finely nuanced moral portrait of Hector, that irreproachable adversary of the Greeks assembled outside Troy. He was probably the most endearing because he was the most human of the Homeric heros, a defender to the last of a cause that he knew was already lost. And what about the Athenian Tragedies, which Jacqueline de Romilly kept analyzing, until the end, to show the evolution of the thinking from Aeschylus to Euripides, through the words used and invented (or sometimes deliberately avoided) by them. For several years, her classes and seminars at the Collège—two types of teaching which were actually very much the same for her, although the latter enabled her to devote more time to direct reading of Greek texts—were devoted to the study of the development of moral concepts in tragedy, to the expression of *fear and anxiety (La crainte et l'angoisse)* or to *the evolution of pathos (L'évolution du pathétique)*—the titles of two of her works—always based on the Homeric epic,

an unavoidable reference (her bibliography in this respect is considerable as well, including her noteworthy synthesis, *Tragédies grecques au fil des ans* [1995]). She studied the content and use, by the tragic poets, of the words *eleutheros, eleutheria*, free, "freedom," encountering along the way the notion, so important among the Hellenes, of the soul "divided" between contradictory aspirations or, more often, duties. Themes of this nature led her naturally to pursue her inquiry among the philosophers (even though she claimed not to do philosophy), starting, of course, with Plato and his brilliant literary talents of which she was so keenly aware. She saw him as the very worthy heir—also in respect of poetry, in the strong sense of the term—of the great founders of Pericles' Athens. In fact, as her *Précis de littérature grecque* of 1980 (with a timely new edition in 2002) so clearly shows, it was her global vision, her reading of all the representatives of this literature, including the authors of the Hellenistic and Roman period (even though she less willingly followed in their footsteps, yet recognized their capacity to revive and transmit the values of Hellenism), that enabled Jacqueline de Romilly to study the history of various concepts: some singular, others seemingly trivial (and consequently neglected by her predecessors). An example is the requirement—not exclusively Christian—of "pardon," or "gentleness," which she showed in an exceptional book (*La douceur dans la pensée grecque*, 1979) was the touchstone of civilization, each era defining its norms in this respect and creating new words if necessary to express its ideal of humanity. This was the case of the fine word *philanthropia* (literally, "feeling of humanity" or "kindness" or "benevolence," etc.) which, surprisingly, did not appear until the early 4th century B.C. with the historian Xenophon and the rhetor Isocrates.

Given her wide renown in the most diverse circles, Jacqueline de Romily necessarily published academic texts, but she also wrote fiction towards the end of her life, especially novels that attest to a very fine sense of psychology (and not only feminine!), as well as a real talent as a writer. Her most lasting production will be the works devoted, for over a half-century, to her favourite authors: Homer and Euripides—the psychologist poet par excellence—first, of course, then Thucydides, and, as we have just seen, her work on the history of many fundamental concepts in Hellenic culture. That is perhaps where we see most clearly her rare ability to grasp all the tones of an ancient text, to compare it to several others owing to her exceptional familiarity with the entire literary corpus, while maintaining her constant concern to share with others her undying passion for the masterpieces of Ancient Greece.

> In spite of the faith that continued to drive her, in the last years of her life Jacqueline de Romilly was clearly worried about the transmission and permanence of the Hellenic heritage in today's world.

Nothing shows this better than her book published in the spring of 2010, *La grandeur de l'homme au siècle de Périclès*, which she presents herself, *in fine*, as a will, dictated rather than written directly by her own hand. In it she expressed not only her gratitude for everything that she personally derived from her daily contact with the Ancients, but also her suffering in "seeing the growing tendency today to lose interest in them," whereas, in view of the current crisis, no era "has had a greater need for our Greek literature, the talent of its authors […] to provide us with that example of success, and to move us in many ways with all the marvels that human existence represents, despite difficulties and disasters".

Who can deny that this concern was partially justified? Yet there is no reason to despair about the future of the Hellenic heritage which, for humanity, is a *ktema eis aiei*, "an asset forever," to use the immortal term coined by Thucydides. Even the teaching of Ancient Greek, which has known many other periods of declining interest but has always been revived, will return in force one day. The death of the "Old Lady of the Quai de Conti" will not mark the end of French Hellenism. We can say this with all the more conviction as the journalists—typically avid for simplification—will probably proclaim the contrary, thinking that they are paying homage to the deceased in this way. In this country (and elsewhere, of course) there are still many excellent Hellenists, including young scholars. It will now be up to them to fight in the front ranks (*en promachois*, as the authors of funeral epigrams say). We trust that they will do so with the talent, with the gift of persuasion, *peitho*, ranked so highly on the scale of Hellenic values, with the communicative passion, "that openness to the heart" (the title of one of Jacqueline de Romilly's novels: *Ouverture à cœur*) that our highly eminent and, for some of us, very dear colleague devoted to it until the last days of her life.

Source: *La lettre du Collège de France*, no. 31, June 2011.

FACTS AND DATA

The Collège de France's Scientific and Strategic Orientation Committee (COSS)

Role and functioning of the COSS

As the document adopted by the Assembly of the Professors in 2003 specifies, the role of the COSS is "to analyse the Collège de France's scientific and strategic orientations and the conditions for fulfilling its missions, so that it can make recommendations on how these might evolve or be enhanced. The COSS also examines the coherence of the institution's strategy, the significance and exploitation of the multidisciplinarity of its Chairs, its international policy, the adequacy of its research resources in relation to its objectives, and the optimization of its administrative structures. The COSS is not expected to individually examine the scientific activities of each Chair as these are evaluated by outside experts."

Since its inception in 2003, the COSS has held several meetings, notably in November 2003 and March 2004 when it drafted the May 2004 report addressed to the President of the Republic and several ministries and political officials, as well as to all the professors of the Collège de France. Other reports for internal circulation within the Collège were drawn up by the COSS during the period between 2004 and 2007.

In 2007, half the members of the COSS were re-elected and the March 2008 report was produced following discussions held within the new Committee and in Paris on 16 and 17 March 2007, and on 9 and 10 November 2007.

The 2011 COSS Report

All the members of the COSS were re-elected in 2009 and 2010. Following several work sessions with the Collège de France Executive Board and the professors in charge of specific issues, the members of the COSS met at the Collège de France on 11 and 12 March 2011.

The agenda proposed by the Collège was as follows:

1. What are the specific characteristics of the Collège de France? How can it preserve its identity in the current context of restructuring of French research and higher education? How can it maintain its autonomy and freedom in the face of current initiatives to group together institutions and projects (Fondation Paris Sciences et Lettres—PSL, a research and higher education 'Excellence Initiative' project within the Investment for the Future programme)? In short, what purpose does the Collège de France serve today?

2. How can the intellectual life of the Collège de France's scientific community be sustained by maintaining a balance between professors who are on site and those who are not? What model should it adopt compared with other international institutions?

3. How can interdisciplinary projects and interaction be fostered?

4. How can the Collège make changes in the selection of future professors while taking into account criteria used in the past?

5. What is your view of the Collège de France's contribution to international scientific life?

Following the two days of interaction with the Executive Board and the professors of the Collège de France, the COSS members drafted this new report.

On 23 September 2011 the report was presented by Mrs Suzanne Berger and Mr Dominique Lambert, respectively chairman and vice-chairman of the COSS, to the professors of the Collège de France in a seminar.

Members of the COSS

Riccardo Barbieri
Professor of Theoretical Physics
at the Scuola Normale Superiore di Pisa (Italy)

Suzanne Berger, chairman
Raphael Dorman-Helen Starbuck Professor of Political Science at the Massachusetts Institute of Technology (USA)

John Henry Coates
Senior Research Fellow in Neuroscience and Finance, University of Cambridge (United Kingdom)

François Diederich
Swiss Federal Institute of Technology Zurich, Laboratory of Organic Chemistry (Switzerland)

Anne Ephrussi
Developmental Biology Unit, European Molecular Biology Laboratory, Heidelberg (Germany)

Didier Fassin
School of Social Science, Institute for Advanced Study, Princeton (USA)

Anthony Grafton
Henry Putnam University Professor
at Princeton University (USA)

Jonathan Hay
Ailsa Mellon Bruce Professor, Institute of Fine Arts, New York University (USA)

Dominique Lambert, vice-chairman
Full Professor at the F.U.N.D.P.,
Namur (Belgium)

Jürgen Mlynek
Helmholtz Association of German Research Centres, Berlin (Germany)

Thomas Pavel
Distinguished Service Professor of Romance Languages and Literatures and Social Thought, University of Chicago (USA)

Suzanne Preston-Blier
Allen Whitehill Clowes Professor of Fine Arts and Professor of African and African American Studies, Harvard University (USA)

Collège de France Organization Chart

Administrator of the Collège de France: Pierre Corvol

The Administrator is a Collège de France professor elected by his/her colleagues to direct the institution for 3 years.

Professors of the Collège de France

I—Mathematical, Physical and Natural Sciences

Mathematics

- Analysis and Geometry, Alain CONNES
- Partial Differential Equations and Applications, Pierre-Louis LIONS
- Differential Equations and Dynamical Systems, Jean-Christophe YOCCOZ
- Number Theory, Don ZAGIER

Physics

- Mesoscopic Physics, Michel DEVORET
- Physics of Condensed Matter, Antoine GEORGES
- Quantum Physics, Serge HAROCHE
- Observational Astrophysics, Antoine LABEYRIE
- Physics of the Earth's Interior, Barbara ROMANOWICZ
- Elementary Particles, Gravitation and Cosmology, Gabriele VENEZIANO

Natural sciences

- Biology and Genetics of Development, Spyros ARTAVANIS-TSAKONAS
- Climate and Ocean Evolution, Édouard BARD
- Experimental Medicine, Pierre CORVOL
- Experimental Cognitive Psychology, Stanislas DEHAENE
- Chemistry of biological processes, Marc FONTECAVE
- Molecular Immunology, Philippe KOURILSKY
- Human Genetics, Jean-Louis MANDEL
- Genetics and Cellular Physiology, Christine PETIT
- Morphogenetic Processes, Alain PROCHIANTZ
- Chemistry of Hybrid Materials, Clément SANCHEZ
- Microbiology and infectious diseases, Philippe SANSONETTI

II—Human and Social Sciences

Historical, Philological, Archaeological Sciences

- History and Civilization of the Achaemenid World and of the Empire of Alexander, Pierre BRIANT
- Techniques and Economies of the Ancient Mediterranean, Jean-Pierre BRUN
- Intellectual History of China, Anne CHENG
- Modern and Contemporary French Literature: History, Criticism, Theory, Antoine COMPAGNON
- Pharaonic Civilization: Archaeology, Philology, History, Nicolas GRIMAL
- Indo-Iranian Languages and Religions, Jean KELLENS
- Epigraphy and History of the Ancient Greek Cities, Denis KNOEPFLER
- Modern Literatures of Neo-Latin Europe, Carlo OSSOLA
- History of European Medieval and Modern Art, Roland RECHT
- Philology of Japanese civilization, Jean-Noël ROBERT
- The Hebrew Bible and/in its contexts, Thomas RÖMER
- Religion, Institutions and Society in Ancient Rome, John SCHEID
- Turkish and Ottoman History, Gilles VEINSTEIN
- History of Modern China, Pierre-Etienne WILL
- Literatures of Medieval France, Michel ZINK

Philosophy, sociology

- Writings and Cultures in Modern Europe, Roger CHARTIER
- Anthropology of Nature, Philippe DESCOLA
- Economic Theory and Social Organization, Roger GUESNERIE
- Contemporary Arab History, Henry LAURENS
- Modern and Contemporary History of Politics, Pierre ROSANVALLON
- Metaphysical Knowledge, Claudine TIERCELIN

III—Annual Chairs 2011–2012

- Information Technology and Digital Sciences, Serge ABITEBOUL
- Knowledge against Poverty, Manuela CARNEIRO DA CUNHA
- Artistic Creation, Gilles CLÉMENT
- Sustainable Development—Environment, Energy and Society, Paul COLONNA
- Technological Innovation Liliane Bettencourt, Jean-Paul LAUMOND

Emeritus Professors of the Collège de France

- Maurice AGULHON, Contemporary French History
- Étienne-Émile BAULIEU, Bases and Principles of Human Reproduction
- Alain BERTHOZ, Physiology of Perception and Action
- Georges BLIN, Modern French Literature
- Yves BONNEFOY, Comparative Studies of the Poetic Function
- Pierre BOULEZ, Invention, Technique and Language in Music
- Jacques BOUVERESSE, Philosophy of Language and Knowledge
- Michel BRUNET, Human Paleontology
- Pierre CHAMBON, Molecular Genetics
- Jean-Pierre CHANGEUX, Cellular Communication
- Claude COHEN-TANNOUDJI, Atomic and Molecular Physics
- Yves COPPENS, Palaeontology and Prehistory
- François-Xavier COQUIN, Modern and Contemporary Russian History
- Gilbert DAGRON, Byzantine History and Civilization
- Mireille DELMAS-MARTY, Comparative Legal Studies and Internationalization of Law
- Jean DELUMEAU, History of Religious Mentalities
- Jean-Marie DURAND, Assyriology
- Michael EDWARDS, Literary Creation in English
- Jon ELSTER, Rationality and Social Science
- Anne FAGOT-LARGEAULT, Philosophy of Life Science
- Marcel FROISSART, Corpuscular Physics
- Marc FUMAROLI, Rhetoric and Society in 16th and 17th century Europe
- Gérard FUSSMAN, History of India and Greater India
- Jacques GERNET, Social and Intellectual History of China
- Jacques GLOWINSKI, Neuropharmacology
- Christian GOUDINEAU, National Antiquities
- Gilles Gaston GRANGER, Comparative Epistemology
- François GROS, Cellular Biochemistry
- Jean GUILAINE, European Civilizations in the Neolithic and the Bronze Age
- Ian HACKING, Philosophy and History of Scientific Concepts
- Claude HAGÈGE, Linguistic Theory
- Françoise HÉRITIER, Comparative Studies of African Societies
- François JACOB, Cellular Genetics
- Pierre JOLIOT, Cellular Bioenergetics
- Yves LAPORTE, Neurophysiology
- Nicole LE DOUARIN, Molecular and Cellular Embryology
- Jean-Marie LEHN, Chemistry of Molecular Interactions
- Xavier LE PICHON, Geodynamics
- Georges LE RIDER, Economic and Monetary History of the Hellenistic Orient
- Emmanuel LE ROY LADURIE, History of Modern Civilization
- Jacques LIVAGE, Chemistry of Condensed Matter
- Edmond MALINVAUD, Economic Analysis
- André MIQUEL, Classical Arabic Language and Literature
- Philippe NOZIÈRES, Statistical Physics
- Jean-Claude PECKER, Theoretical Astrophysics
- Armand de RICQLÈS, Historical Biology and Evolutionism
- Daniel ROCHE, French History in the Age of the Enlightenment
- Jean-Pierre SERRE, Algebra and Geometry
- Michel TARDIEU, History of Syncretisms in Late Antiquity
- Javier TEIXIDOR, Semitic Antiquities
- Jacques TITS, Group Theory
- Pierre TOUBERT, Occidental History
- Paul-Marie VEYNE, History of Rome
- Nathan WACHTEL, History and Anthropology of Meso- and South American Societies
- Harald WEINRICH, Romance Languages and Literatures

Lectures given by the Professors Abroad

Belgium
Free University of Brussels
- Philippe DESCOLA (Chair of Anthropology of Nature)
  The shapes of the visible (4 lectures).
- Édouard BARD (Chair of Climate and Ocean Evolution)
  1. Causes and mechanisms of changes in sea level
  2. Influence of natural forcings (sun and volcanoes) on climate (2 lectures and 2 seminars).

Brazil
Federal University of Rio de Janeiro
- Serge HAROCHE (Chair of Quantum Physics)
  State estimation and reconstruction in quantum information.

Canada
Quebec Universities
- Jon ELSTER (Chair of Rationality and Social Science)
  Rationality in Social Sciences (4 lectures).
- Jean KELLENS (Chair of Indo-Iranian Languages and Religions)
  What do we know of the Avesta today? (6 lectures)

Peter Wall Institute of Advanced Studies—Vancouver
- Stanislas DEHAENE (Chair of Experimental Cognitive Psychology
  Brain architectures for human cognition and consciousness (3 lectures and 3 seminars).

China
Normal University East China (Huadong shifan daxue), Shanghai
- Anne CHENG (Chair of Intellectual Hisoty of China)
  Cosmological representations of space in ancient China.

Czech Republic
Charles University in Prague
- Roger CHARTIER (Chair of Writings and Cultures in Modern Europe)
  Written culture and literature. A necessary meeting.

Greece
University of Athens
- Spyros ARTAVANIS-TSAKONAS (Chair of Biology and Genetics of Development)
  Cell fate acquisition in development.

Israel
University of Tel-Aviv
- Thomas RÖMER (Chair of the Hebrew Bible and/in its Contexts)
  The formation of the traditions of the Torah.

Italy
University of Verona
- Pierre ROSANVALLON (Chair of Modern and Contemporary History of Politics)
  The democratic equality.

Institute of Contemporary History of Mantua
- Pierre ROSANVALLON (Chair of Modern and Contemporary History of Politics)
  Democracy and counter-democracy.

Sweden
Uppsala University
- Marc FONTECAVE (Chair of Chemistry of Biological Processes)
  Biological chemistry : metalloenzymes and bioinspired catalysts.

Switzerland
University of Geneva
- Antoine GEORGES (Chair of Physics of Condensed Matter)
  Issues in Physics of strongly correlated quantum systems (3 lectures).

University of Zurich
- Michel ZINK (Chair of Literatures of Medieval France)
  Humiliation in medieval literature.

United States
University of Chicago
- Anne CHENG (Chair of Intellectual History of China)
  The trouble with the Great Learning.

Harvard University
- Édouard BARD (Chair of Climate and Ocean Evolution)
  Deglacial sea level changes and their climatic implications.

Princeton University
- Édouard BARD (Chair of Climate and Ocean Evolution)
  Solar activity and climate forcing.

Swarthmore College, Pennsylvania
- Pierre-Étienne WILL (Chair of History of Modern China)
  1. Law and society in late imperial China: a view through judicial cases;
  2. Disseminating the knowledge of professionals: a study of published judicial casebooks and anthologies from the Ming and Qing (2 lectures).

Partnership between the Collège de France and the Institut Français

Within its mission to impart knowledge, the Collège de France actively fosters international exchange. Collège de France professors are regularly invited to teach courses in higher education and research institutions abroad. By special provision they are entitled to carry out up to a third of their teaching assignments outside of France. Chairs have been created in foreign institutions to host Collège de France professors, within the framework of close to twenty partnership agreements.

Collège de France professors are moreover regularly invited to give lectures organised by the cultural and cooperation network of the French Ministry of Foreign and European Affairs. This network, one of the largest in the world, consists of some 150 cultural centres and nearly thirty research centres abroad. Agreements have been signed with some of these institutions to set up series of Collège de France lectures. The first was inaugurated in 2007 with the Institut Français de Coopération in Tunisia. Lecture series are currently running in six other countries as well: South Korea (cultural and cooperation service of the French Embassy), Spain (Institut Français), Hungary (Institut Français de Budapest), Morocco (Centre Jacques Berque in Rabat), Romania (Institut Français), and the UK (Maison Française in Oxford). A lecture series is also being organised on the initiative of the Délégation Générale des Alliances Françaises in the USA. In all instances, local higher education and research institutions are partners in these events.

The creation of the Institut Français on 1 January 2011 was accompanied by a restructuring of the network of French cooperation and cultural outreach abroad. In view of this reorganization, the Collège de France and the Institut Français decided to enter an agreement to strengthen existing collaboration in promoting debate and disseminating scientific knowledge. This agreement was signed by Professor Pierre Corvol, Administrator of the Collège de France, and Mr Xavier Darcos, President of the Institut Français, on 12 December 2011, on the occasion of the conference on cultural diplomacy organised at the Collège de France by the Institut Français. This conference, at which several Collège de France professors were speakers, was webcast live with simultaneous interpretation in English and Spanish. It was thus available to a very large audience throughout the world.

Lectures and Lectures Series by Foreign Professors
invited by the Assembly of the Professors

State chairs reserved for foreign scholars

- Timothy J. BROOK, Professor
University of British Columbia (Canada), Oct. 2010
Valeurs et prix dans la Chine des Mings (1368-1644)
1. Un monde où tout a un prix
2. Le coût de la vie
3. Une économie de luxe
4. Chongzhen (1628-1644) : l'empereur renversé par la révolution des prix.

- Hitoshi ISHII, Professor
Waseda University (Japan), Jan. 2011
Long time asymptotic solutions of Hamilton-Jacobi equations.

- Dariusz KOLODZIEJCZYK, Professor
Historical Institute in Warsaw (Poland), Jan.–Feb. 2011
Le Khanat Tatar de Crimée, l'Empire Ottoman et l'Europe centrale (XV^{e}-XVIII^{e} siècle) :
1. Les ottomans de l'Europe de l'Est : le rôle d'*Antemurale Christianitatis* relève-t-il du mythe historique ?
2. Les frontières de l'empire ottoman, de la Hongrie au Yémen
3. La chancellerie du Khanat tatar de Crimée entre les traditions mongole, orthodoxe, ottomane et latine
4. Le khan tatar de crimée face au sultan ottoman : vassal ou souverain à part entière ?

- Christian MICHEL, Professor
University of Lausanne (Switzerland), Jan.–Feb. 2011
Le titre du tableau.

- Luiz DAVIDOVICH, Professor
Federal University of Rio de Janeiro (Brazil), Feb.–March 2011
Intrication, décohérence et métrologie quantique.

- Michel MEYER, Professor,
Free University of Brussels (Belgium), March 2011
La rhétorique et l'argumentation dans les sciences humaines.

- Miroslav VERNER, Professor,
Charles University in Prague (Czech Republic), May 2011
1. Abusir: The Rise and Decline of a Royal Necropolis
2. The Royal Family of the Fifth Dynasty
3. The Abusir Papyri: an Archaeological Perspective
4. Czech Archaeological Exploration of the Western Desert.

- Robert HARRISON, Professor,
Stanford University (USA), May 2011
Le phénomène de l'âge.

- Brett FINLAY, Professor,
Peter Wall Institute for Advanced studies (Canada), May 2011
1. Battling the Bugs: Confronting the Microbial Menace
2. The Interdisciplinarity of Enteric Infectious Diseases
3. The role of the microbiota in infectious enteric diseases
4. Salmonella: From Diarrhea to Typhoid Fever.

- Carla SCHATZ, Professor,
Stanford University (USA), May 2011
Dynamic Interplay between Nature and Nurture in Brain Wiring:
1. Brain Waves and Synapse Remodeling in the Developing Visual System
2. A Transient Scaffold for Circuit Construction: Subplate Neurons and the Cerebral Cortex
3. Releasing the Brake on Synaptic Plasticity: Immune System Genes Moonlighting in the Brain
4. Neural Plasticity, Critical Periods and MHC Class I Molecules.

- David FREEDBERG, Professor,
Columbia University, New-York (USA), May–June 2011
Art History and Neuroscience: the Challenge for the Humanities:
1. The Painter without Hands Mirrors, phantoms, and the History of Art
2. Zombie Connoisseurs: Automaticity and culture
3. A Dance to the Music of Time: Pictures and Dance
4. Wrestling with Berenson: Art History and Sport.

Others Invitations

- Aniruddh PATEL, Professor, Neurosciences Institute in San Diego (USA), Oct. 2010
  Music and Biological Evolution.
- Hans HELANDER, Emeritus Professor, University of Uppsala (Sweden), Oct. 2010
  The Roles of Latin in Early Modern Europe.
- Anne-Laure DALIBARD, Researcher at the CNRS, Nov.–Dec. 2010
  Quelques problèmes de couches limites en mécanique des fluides.
- Lars LIND, Professor, University of Uppsala (Sweden), Nov. 2011
  1. The Metabolic Syndrome and Cardiovascular Disease
  2. Non-Invasive Imaging of Atherosclerosis.
- Agostino PARAVICINI-BAGLIANI, Emeritus Professor, University of Uppsala (Sweden), Nov. 2010
  Les Papes de Dante.
- Simon PRICE, Professor, University of Oxford (United Kingdom), Nov. 2010
  La mobilité religieuse dans l'empire romain.
- Victor STOICHITA, Professor, University of Fribourg (Switzerland), Nov. 2010
  Les Anges du Caravage.
- Michel GOEDERT, Professor, Medical Research Council of Cambridge (United Kingdom), Dec. 2010
  The Central Role of Tau Protein in Neurodegenerative Diseases.
- Jacob L. WRIGHT, Professor, Candler School of Theology, Atlanta (USA), Dec 2010
  Making a Name for Oneself: Procreation, Heroic Death and Masculinity in Ancient Israel.
- Sylvain ARLOT, Researcher at the CNRS, Janv. 2011
  Sélection de modèles et sélection d'estimateurs pour l'apprentissage statistique.
- Andrew GLASS, Professor, University of Seattle (USA), Jan. 2011
  New Tools for the Study of Gandhari: the Gandhari Computerized Project.
- Benjamin ISAAC, Professor , University of Tel-Aviv (Israel), Jan. 2011
  1. Rome et les nomades
  2. Rome et les intellectuels provinciaux.
- Michel ATIYAH, Emeritus Professor, University of Edinburgh (Scotland), Fev. 2011
  Un géomètre explore l'univers.
- Nils BERGVALL, Professor, University of Uppsala (Sweden), Fev. 2011
  Starburst Galaxies.
- Brian BOYD, Professor, University of Auckland (New Zealand), Fev. 2011
  1. The Evolution of Stories
  2. Nabokov as Psychologist.
- Michael LOEWE, Emeritus Professor, University of Cambridge (United Kingdom), Fev. 2011
  Confucian Values and Practices in Han China.
- Michael METZELTIN, Professor, University of Vienna (Austria), Fev. 2011
  De la sémantique structurale à la sémantique textuelle.
- Martin KERN, Professor, Princeton University (USA), Fev.–March 2011
  1. Autorship and the Shijing
  2. Fate and heroism in Early Chinese Poetry.
- Vincent ELTSCHINGER, Professor, University of Vienna (Austria), March 2011
  Réflexion pure et volonté apologétique chez les derniers philosophes bouddhiques indiens.
- Shigeo YAMADA, Professor, University of Tsukuba (Japan), March 2011
  The Reign and Inscriptions of Tiglath-Pileser III, Neo-Assyrian Empire Builder (744-727 BC).
- Utah FRITH, Professor, University College London, Institute of Cognitive Neuroscience (United Kingdom), May 2011
  1. New development in Theory of Mind
  2. What is the link between talent and autism?
- Chris FRITH, Professor, University College London, Institute of Cognitive Neuroscience (United Kingdom), May–June 2011
  1. What is Social about Social Cognition?
  2. The cognitive basis of hallucinations and delusions.
- Alberto CANTERA, Professor, University of Salamanca (Spain), June 2011
  La cérémonie du Visperad.
- Andrew CLELAND, Professor, University of California, Santa-Barbara (USA), June 2011
  1. Images of Quantum Light
  2. How to be in two places at the same time?

Events at the Collège de France 2010-2011

September

Symposia
- What is the long-term future of the AIDS epidemic? (Chair of Knowledge against Poverty 2009-2010)
- The biological sciences in France and in Russia (Pierre and Marie Curie University)
- Putting the brain first: a national issue (Société des neurosciences)
- Life sicences in society 2011 (Génopole)

Study days
- Simplexity (Chair of Physiology of Perception and Action)
- Practices and cultures of reconciliation in countries of the Arab-Muslim era (Laboratory of Social Anthropology)

Awards
- ANDESE thesis prize

October

Symposia
- For a commented publication of the Behistun inscription: Elamite, Ancient Persian, Babylonian, Aramean (Chair of History and Civilization of the Achaemenid World and of the Empire of Alexander)
- *Aux abords de la clairière* (At the edge of the clearing), in honour of Charles Malamoud
- The globalization of research: competition, cooperation, restructuring (Collège de France autumn symposium)
- One hundredth anniversary of the APMEP (Association des Professors de Mathématiques de l'Enseignement Public)
- Cellular biology, development and evolution thematic multi-organization institute (ITMO) inaugural symposium (French National Alliance for Life Sciences and Health)

Study days
- How to meet the international challenge for higher education? (Conference of the *Grandes Écoles*)

Lectures
- Inside a Nazi labour camp (Foundation for the Memory of the Holocaust)

November

Symposia
- Medicine, innovation and society—issues and perspective (Inserm-Transfert)
- Pontius Pilate (Chair of Modern Literatures of Neo-Latin Europe)
- Reading by Silvio Orlando (Chair of Modern Literatures of Neo-Latin Europe)
- The French Development Agency (AFD) symposium

Awards
- Grand Prix Inserm (Inserm Prize award)

December

Symposia
- The writings uncovered at the Ugarit site (Syria) (Académie des Inscriptions et Belles Lettres and the Chair of Assyriology)
- 25th birthday of the INSU (Institut National des Sciences de l'Univers - National Institute of the Sciences of the Universe)
- Biodiversity (Institut Écologie Environnement, Institute of Ecology and Environment, CNRS)

Seminar
- The new functions of renin and its receptor during development and in pathology (Chair of Experimental Medicine)

January

Opening
- The Year of chemistry, opening by Prof. Jean-Marie Lehn (Rectorat de Paris)

Symposia
- Paris in America (Chair of Comparative Legal Studies and Internationalization of Law)

Seminars
- Protein crossing of biological membranes: going in and out (Chair of Morphogenetic Processes)
- The intestine: a cell signaling paradigm (Chair of Biology and Genetics of Development)

April

Seminar
- Mechanisms of Brain Development: a cell signaling paradigm (Chair of Biology and Genetics of Development)

Symposia
- How does one become a prophet? (Chair of Assyriology and Chair of the Hebrew Bible and/ in its contexts)

- Rationalist Union (Chair of History of India and Greater India)
- Franco-Syrian day (Chair of Assyriology)
- Hominization, humanization: the role of law (Chair of Comparative Legal Studies and Internationalization of Law)

Awards
- Award of ENS prizes

Concert
- Quatuor Prazak (annual concert of the Collège de France

May

Symposia
- Biomedical innovation in the 20th century: challenges, trends, testimonials (Liliane Bettencourt Chair of Technological Innovation, 2010-2011)
- Towards the eradication of hunger (Chair of Knowledge against Poverty, 2010-2011)
- The commensal Microbiota: from homeostasis to disease (Chair of Microbiology and Infectious Diseases)
- The justiciability of social rights: vectors and resistance (École des hautes études en santé publique, School of Advanced Studies in Public Health)
- Tradition, "world administration" and reform: Qin Jun's Daxue Yanyi Bu (1487) and its impact in Ming and Qing China (Chair of the Intellectual History of China)
- Congress of the Science-Academy (Paris-Montagne Association)

Seminars
- Methods in the history of art: assessment of the current state of affairs (Chair of History of European Medieval and Modern Art)
- The ocean and climate change (Chair of Climate and Ocean Evolution)

Meeting
- Meeting of the University Vice-Chancellors

Inauguration
- CIRB (Centre Interdisciplinaire de recherche en biologie, Centre for Interdisciplinary Research in Biology)

June

Symposia
- Expectational coordination in financial markets (Chair of Economic Theory and Social Organization)
- Energy: socio-economical stakes and technological challenges (Chair of Sustainable Development—Environment, Energy and Society 2010-2011)
- *Mystique : continuation d'un projet* (The mystical as a continuation of a project). Texts and collections (Chair of modern Literatures of Neo-Latin Europe
- *Yama/Yima : variations indo-iraniennes sur la geste mythique* (Yama/Yima: Indo-Iranian variations on mythical epic (Chair of Indo-Iranian Languages and Religions)
- Cultivating the Future (forum Le Monde-La Recherche)
- *Et vous, le futur, vous le voulez comment ?* (So what are your hopes for the Future? Futur en Seine, the festival of numerical life and creation)
- The animalist turn (Chair of Anthropology of Nature)
- Readings and usages of the *Great Learning*—China, Korea, Japan (Chair of Intellectual History of China)
- The epistemology of disagreement (Chair of Metaphysical Knowledge)
- *Le Ciel dans tous ses états* (Chair of Assyriology and Chair of the Hebrew Bible and/in its contexts)

July

Award
- INRIA prize award

Research Teams Hosted

The policy of hosting research teams was implemented on the basis of an Assembly vote dated 18 March 2001 to contribute towards the training of young research teams and to enhance the Collège's scientific potential. In some cases it was a temporary solution for teams directed by a professor about to retire.

Space permitting, these teams, which have to obtain the approval of their parent institution and to receive on-going funds from it, can be officially hosted by the Collège de France for a four-year contract, renewable once.

They receive a €10,000 annual grant and may obtain ATER and lecturing posts, on the same basis as the laboratories of the Chairs.

The final decision to host these teams is taken by the Assembly of the Professors, after evaluation by a commission of professors.

Teams currently hosted

- **Catherine Llorens-Cortes**
  Central neuropeptides and the regulation of body fluid homeostatis and cardiovascular functions (U 691)
- **Laurent Venance**
  Dynamics and pathophysiology of neural networks
- **Christian Giaume**
  Junctional communication and interactions between neuronal and glial networks (U840)
- **Claude Rangin and Pierre Henry**
  EGERIE Research (Geodynamics, Research-Industry-Learning Exchange)
- **Tran Van Nhieu Guy**
  Intercellular communication and bacterial infections (U971)
- **Stefano Manacorda**
  Law Team is part of the ARPE (Association de recherches pénales européennes) (UMR 8103 of comparative law - University Paris I)
- **Sidney Wiener**
  Laboratory Physiology of perception and action (LPPA - U7152)
- **Alexander Fleischmann**
  Genetic analysis of olfactory processing and function
- **Fekrije Selimi**
  Molecular regulation of synaptogenesis in the mouse
- **Marie-Hélène Verlhac**
  Asymmetric oocyte division
- **Jonathan Touboul**
  Advanced mathematical approaches in neuroscience
- **Amaury Lambert**
  Mathematical models of biological processes

Temporary position at the Collège de France 2011-2012 (*Maîtres de Conférences* and *Ater*)

Temporary positions permit to receive yearly 5 *Maîtres de conférences* (Assistant Professors) and 161 *ATER* (Research lecturer and researcher) in the Chairs and research laboratories at the Collège de France.

Nationality of Temporary Positions

- French: 103
- Foreign: 31
- Nationals of the U.E.: 32

UMR: *Unité mixte de recherche* (Combined Research Unit)
U: *Unité* (Unit)

Publications 2010-2011

Books

The Collège de France has a partnership with the Éditions Fayard and the Éditions Odile Jacob for publishing the inaugural lectures of the professors, some lectures of invited professors and the proceedings of some of the Collège's colloquiums.

Éditions Fayard - Collection "Leçons inaugurales" (Inaugural lectures)

Jacques Nichet
Le théâtre n'existe pas (2010), no. 213.

Ismaïl Serageldin
Mobiliser le savoir pour éradiquer la faim (2010), no. 214.

Anselm Kiefer
L'art survivra à ses ruines (2010), no. 215.

Jean-Marie Tarascon
L'énergie : stockage électrochimique et développement durable (2010), no. 216.

Elias Zerhouni
Les grandes tendances de l'innovation biomédicale au xxie siècle (2011), no. 217.

Clément Sanchez
Chimie des matériaux hybrides (à paraître).

Martin Abadi
La sécurité informatique (2011), no. 219.

Claudine Tiercelin
La connaissance métaphysique (2011), no. 220.

Éditions Odile Jacob - symposia and conferences

Pierre Corvol et Jean-Luc Elghosi
Sortir de l'eau. De la vie aquatique à la vie terrestre, 2011.

Peter Piot
Le Sida dans le monde. Entre science et politique, 2011.

Yearbook

Cours et travaux du Collège de France. Résumés 2009–2010. Annuaire 110e année.

Open Edition/E-books

Since June 2010, 4 collections of the Collège de France have been published on Internet (open access): the *Inaugural Lectures*, the *Yearbook*, the *Letter of the Collège de France* and the *Conferences*.

The texts are published in partnership with the CLEO (Center for Open Digital Publishing). They are available on the College de France website (www.college-de-france.fr, section: publications) and on Revues.org (www.revues.org), a platform for journals in the humanities and social sciences run by the CLEO (see p. 71).

New e-books

Conferences

Gérard Fussman
La mondialisation de la recherche. Compétition, coopérations, restructurations (Actes du colloque de rentrée 2010 du Collège de France), 2011
[http://conferences-cdf.revues.org/285]

Oliver Jens Schmit
Korcula sous la domination de Venise au xve siècle. Pouvoir, économie et vie quotidienne dans une île dalmate au Moyen Âge tardif, 2011
[http://conferences-cdf.revues.org/270]

Inaugural Lectures

Jacques Nichet
Le théâtre n'existe pas, 2010
[http://lecons-cdf.revues.org/389]

Ismaïl Serageldin
Mobiliser le savoir pour éradiquer la faim, 2010
[http://lecons-cdf.revues.org/421]

Anselm Kiefer
L'art survivra à ses ruines, 2010
[http://lecons-cdf.revues.org/386]

Jean-Marie Tarascon
L'énergie : stockage électrochimique et développement durable, 2010 [http://lecons-cdf.revues.org/399]

Elias Zerhouni
Les grandes tendances de l'innovation biomédicale au xxie siècle, 2011 [http://lecons-cdf.revues.org/403]

Martin Abadi
La sécurité informatique, 2011
[http://lecons-cdf.revues.org/421]

Claudine Tiercelin
La connaissance métaphysique, 2011
[http://lecons-cdf.revues.org/444]

The Life of Forms
13 and 14 October 2011

This symposium will be devoted to the notion of Form in a multidisciplinary context, stretching across its definition in philosophy by Plato and Aristotle, its mathematical applications, its origins with the structure of the atom and the origin of life, its application to molecular and supermolecular chemistry and to the morphogenesis of living organisms, and its consequences in psychology and linguistics, anthropology and the arts. These debates will be an opportunity to re-examine the question of Intelligent Design, Turing's laws, Lévi-Strauss' structuralism, and the writings of both Henri Focillon—from which the title "The Life of Forms" is borrowed—and our late lamented colleague André Chastel in *Fables, Formes, Figures*.

Programme

13 October

- Opening by **Pierre Corvol**
  Administrator of the Collège de France
- Introduction by **Jean-Pierre Changeux**
  Collège de France
- Form in Plato and Aristotle's Work
  Anne Fagot-Largeault, Collège de France
- Duality between Forms and Spectrums
  Alain Connes, Collège de France
- The Forms of the Geometry and Universality of Mathematical Institutions
  Stanislas Dehaene, Collège de France
- Matter in all its Forms
  Pierre Fayet, École Normale Supérieure
- Forms in the Universe and Form of the Universe
  Jean-Claude Pecker, Collège de France
- The First Forms of Life
  Jacques Reisse, Free University of Brussels
- A Paleontological History of Life Forms: the First Vertebrates as we Imagine Them
  Philippe Janvier, Muséum national d'histoire naturelle
- The Genetics and Architectures of Life Forms
  Denis Duboule, University of Geneva
- Life Forms and the Mathematization of the World
  Alain Prochiantz, Collège de France
- Anatomical Forms and Physiological Functions from Claude Bernard to the Present Day
  Claude Debru, École Normale Supérieure.

14 October

- The form of the brain
  Jean-François Mangin, CEA, DSV-I2BM, NeuroSpin Centre, Saclay
- Brain Mechanisms that Integrate Features for the Perception of Visual Shape
  Pieter Roelfsema, University of Amsterdam
- Forms of the Latin Alphabet, between Writing and Reading
  Marc Smith, École Nationale des Chartes
- Neanderthal and the First Symbolic Behaviours
  Jean-Jacques Hublin, Max Planck Institut, Leipzig
- Natural Forms and Symbolic Classifications
  Philippe Descola, Collège De France
- Form of Built Space, Form of Thought: From the Bororo Village to the Network-Town
  Marcel Hénaff, University of California in San Diego
- Metamorphosis in Greek and Roman Antiquity. Around Ovid's Metamorphoses
  John Scheid, Collège de France
- Forms, Norms and Dogmas
  Mireille Delmas-Marty, Collège de France
- Literary Form
  Antoine Compagnon, Collège de France
- The Life of Musical Forms
  François-Bernard Mâche, Académie des Beaux-arts
- Fables, Forms, Figures—Homage to André Chastel
  Michel Hochmann, École Pratique des Hautes Études

History

As the Renaissance spread throughout Europe, great minds started to explore subjects that had previously aroused no curiosity, and the invention of printing meant that the wealth of philosophy contained in the chefs-d'œuvre of Antiquity was becoming more widely available. Teachers capable of interpreting and commenting on these matters were in demand. Thus, the Collège Royal was set up, which later became known as the Collège de France.

1530

King Francis I, on the advice of Guillaume Budé, his "master of the library", appointed six "royal readers": three for Hebrew (François Vatable, Agathias Guidacerius, Paul Paradis), two for Greek (Pierre Danès, Jacques Toussaint) and one for mathematics (Oronce Finé). Their lectures were free and open to anyone.

1551

After requisitioning the Collèges de Tréguier and de Cambrai where he installed "royal readers" in 1551, Henri II included philosophy in the range of subjects taught by the Collège. He created a Chair for Ramus (Pierre de la Ramée), a notorious and controversial anti-Aristotelian philosopher, who then went on to teach mathematics from 1559 onwards.

1567

The Collège was mentioned for the first time in a document. The degree awarded to Nicolas Goulu, certifying that he was qualified to teach Greek.

1610

On 28 August, Louis XIII laid the first stone of a new building bearing the following inscription: "In the first year of the Reign of Louis XIII King of France and of Navarre, aged nine, and of the Regency of Queen Marie de Médicis his mother MDCX" (*En l'an premier du Regne de Louis XIII Roy de France et de Navarre, agé de neuf ans, et de la Regence de la Royne Marie de Médicis sa mère MDCX*).

1699

On 18 January, the Collège Royal was granted its coat of arms: against a sky-blue background, a silver book lying open, in which are written the words *Docet omnia*. The book is surrounded by three golden fleurs-de- lis, two at the top and one at the bottom.

1707

There were now twenty Chairs: eleven for the arts, nine for scientific subjects.

1772

King Louis XV entrusted the architect Jean-François Chalgrin with the construction of the Collège Royal. Chalgrin was a winner of the Grand prix de Rome and a member of the *Académie d'architecture*. On 16 May, the Collège was incorporated into the University of Paris. It regained its independence in 1794. On 22 March, 1774, the Duc de La Vrillière laid the first stone of the new buildings, which were completed in 1778.

1870

The Collège Royal then the Collège Impérial became the Collège de France. There were now forty professors.

1963

The creation of two new Chairs brought the number of professors to fifty-two.

1976

The professors were allowed to provide some of their teaching outside Paris.

1988

The professors were allowed to provide some of their teaching abroad.

1989

Creation of European Chair.

1992

Creation of International Chair.

1998

Inauguration of new Collège de France premises. The renovation was carried out by the architects Bernard Huet and Jean-Michel Wilmotte.

2005

Creation of the Chair of Artistic Creation.

2006

Creation of the Chair of Technological Innovation Liliane Bettencourt.

2009

Creation of the Chair of Information Technology and Digital Sciences

www.college-de-france.fr

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The Letter of the Collège de France
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DE FRANCE
1530

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