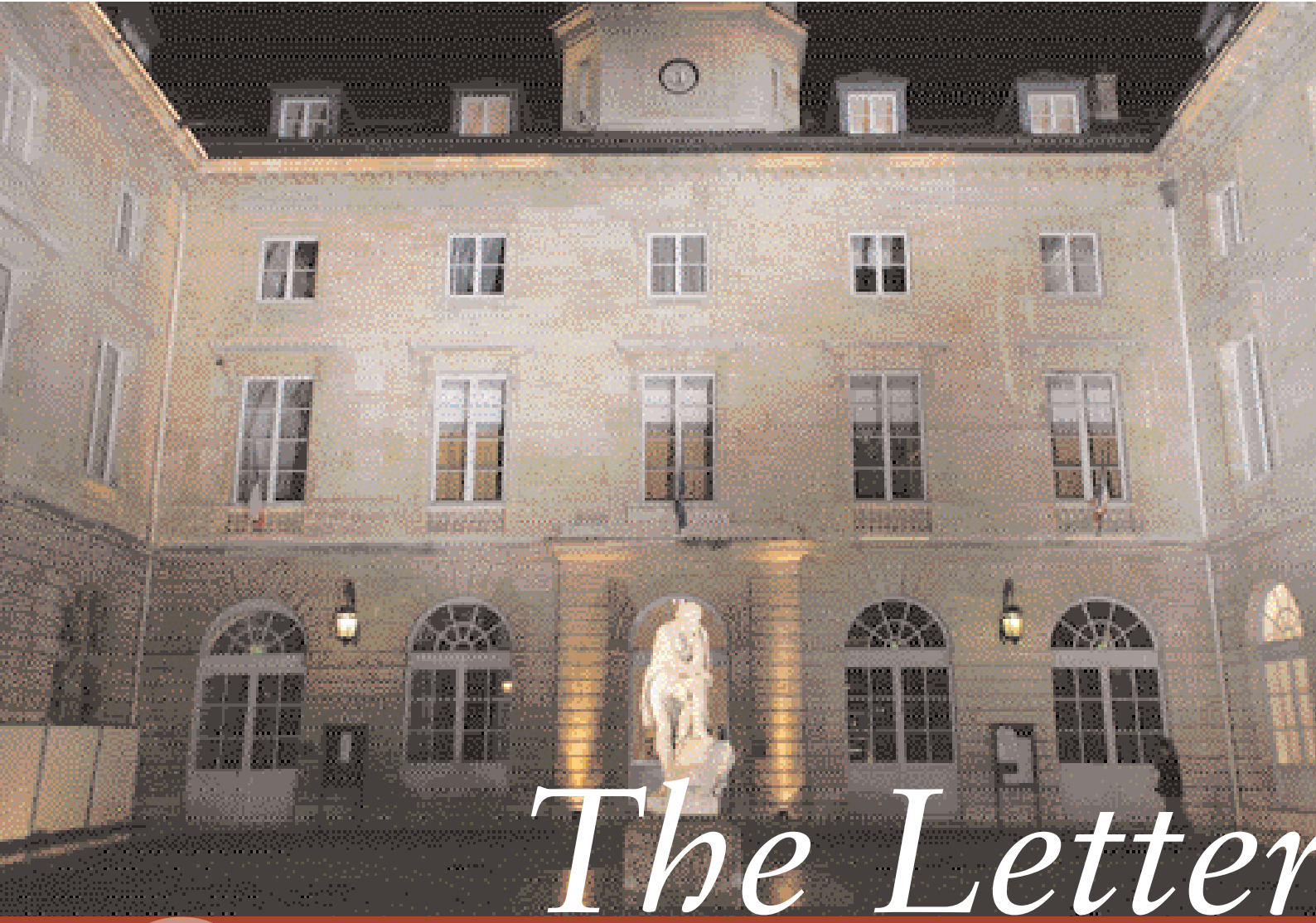
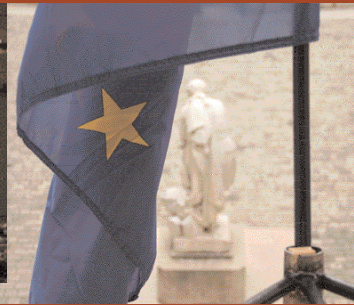


# The Letter

## of the Collège de France

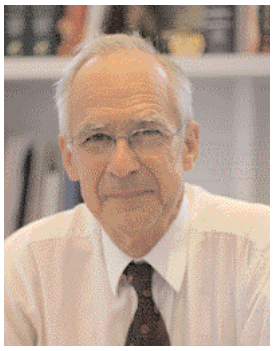
2

N°2 Academic year 2006-2007



# Editorial

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



by Pierre Corvol
Administrator
of the Collège de France
Professor,
holder of the Chair of
Experimental Medicine

'Today's world is seeking references, reasons to marvel, ambitious motivating projects. With the sole objective of furthering knowledge, basic research – that essentially disinterested research which demands real collaboration at international level – is one of the paths on that quest. Science is and will always remain a factor of emancipation for humans and it is important today to emphasize that obvious fact. In this context, the Collège de France has a unique position in France and in Europe but also in the world.' These are the introductory lines of the Annual Report of the International Scientific and Strategic Orientation Committee (COSS) submitted to the President of the Republic, the Prime Minister and the Collège de France's supervisory ministries in May 2004.

The creation of the COSS in 2003, on the Collège's initiative, stemmed from the wish to benefit from eminent colleagues' attentive and critical view of the Collège's main scientific and strategic orientations and the conditions in which they are implemented. It is not the COSS's role to evaluate the Chairs' scientific activities; this is the responsibility of research organizations and of the Ministry of National Education, Higher Education and Research.

The COSS report in May 2004 was a highlight in the Collège de France's life. This report, the fruit of several meetings, analysed the Collège's particular characteristics, its assets and its weaknesses. It also put forward suggestions and opinions. For instance, it proposed that the Collège enhance its communication policy and define a future-oriented policy for its libraries. It expressed the wish for the human resources policy to be optimized and the Collège de France's financial situation to be improved.

Four years later, as provided for in the statutes, half the member of the COSS have been renewed. The Committee currently comprises twelve scientific personalities from abroad. It is chaired by Professor Detlev Ganten and co-chaired by Professor Peter Mc Cormick. The secretary is Professor Jacques Reisse. The view from outside that the COSS has, with its opinions, critiques and proposals, still appears to be essential for the Collège's life. While the Institution is aware of the strengths that have made it famous – its universality, multi-disciplinarity and independence – it is nevertheless convinced that it has to develop and adapt to a fast-changing world.

Over the past few years the Collège has taken a series of initiatives which largely correspond to the wishes expressed by the COSS in 2004: efforts to increase the dissemination of knowledge, opening up towards society and economic life, moving closer to the university world through the PhD schools, increasing relations with foreign universities, and developing research at the Collège itself. Today a progress report is indispensable. The Collège will be attentive to the COSS's opinions on these points, as these will enable it to focus its strategy on the objectives that the Committee has reviewed and revised.

The COSS meeting in March 2007 enabled it to make contact with the members of the extended executive of the Collège and certain professors at the Cardinal Lemoine and Ulm sites. A preliminary study found that the advice and recommendations put forward by the COSS in 2004 had been followed. Additional details and figures, in a document "The Collège in Figures", will shortly be submitted to the COSS so that it has all the necessary information to draw up a draft report during its next meeting in November 2007 at the Collège. The final report will be presented to the President of the Republic, the supervisory authorities, and finally the Assembly of the Professors in March 2008.

The COSS's role is extremely valuable to enlighten the Collège de France in its scientific choices and its long-term strategic vision. To fulfil its mission today, the Collège defines orientations and takes new initiatives, some of which are entirely novel in the history of the Institution. If they are to be carried out fully, these will require more human and financial resources. It is therefore essential that medium- and long-term objectives and the means required to meet them be subjected to the COSS's critically illuminating scrutiny.

*Professor Pierre Corvol*
Administrator of the Collège de France

**Members of the COSS in March 2007 :**
Anthony Atkinson (UK), economist
Robert Darnton (US), historian
Denis Duboule (Switzerland), biologist
Detlev Ganten, chairman (Germany), biologist
Peter Mac Cormick, vice-chairman (Canada), philosopher
Paolo Matthiae (Italy), orientalist, archaeologist
Jürgen Mlynek (Germany), physicist
Jacob Palis (Brazil), mathematician
David Parkin (UK), anthropologist
Jacques Reisse, secretary (Belgium), chemist
Barbara Romanowicz (US), geophysicist
Karlheinz Stierle (Germany), romanist

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## Selected papers

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The papers published in this issue of the Letter of the Collège de France in English were originally published in the Letters n° 18, 19 and 20 (academic year 2006-2007).



## Institutional Data

# Selected Papers

# CHAIR OF MODERN AND CONTEMPORARY FRENCH LITERATURE: HISTORY, CRITICISM AND THEORY

**Antoine Compagnon**

Professor, University of Paris IV-Sorbonne

Member of the Academia Europaea

Member of the Haut Conseil de l'Éducation (2006)

gave his inaugural lecture on 30 November 2006. His course entitled 'Proust, memory of the literature' began on 5 December 2006.

*Extract from the inaugural lecture:*

"Speaking in this place, I am overcome by a feeling of turmoil, for it seems like yesterday that I entered the gates of this institution – to meet giants. I had just started at a neighbouring school; it was around 1970, I was twenty, and Paris was a celebration of the intellect. A friend's mother advised me to visit the Collège de France. I came here and consulted the programme, as astounded as the narrator of *La Recherche du temps perdu* looking at the Morris column announcing Berma in *Phèdre*. And then one morning, not without apprehension, I entered a lecture room, up there, I can't remember where exactly because everything's been changed since then. I kept to the back and there I listened to a small man who looked like a bird. He was explaining a Du Bellay sonnet, admirably and in great detail, as I had never heard anyone do nor imagined it possible to do. I learned the name of this man who had been invited by Claude Lévi-Strauss: it was Roman Jakobson, a great linguist who had traversed the 20th century, from Moscow to Prague, then New York to Harvard.

Unlike the narrator in *Phèdre*, that first time did not leave me disappointed. Have I ever got over that first visit? Does one not become a professor when one has been unable to leave school? I had found the road to the Collège, and it led me all the way here. Although I was studying engineering, I attended other lectures within these walls: that of Michel Foucault, the year he gave *Surveiller et punir*; that of Roland Barthes, whose seminar I had attended in the meantime at the Hautes Études. A colleague has reminded me that together, at Claude Lévi-Strauss' seminar, we listened to Julia Kristeva who subsequently supervised my PhD. The Collège de France thus precipitated my late conversion to the literary sciences.

Guez de Balzac warned against the opposite conversion: 'Leaving eloquence for mathematics', he commented in 1628, 'means being tired of an 18-year-old mistress and falling in love with an old woman'. Old, mathematics? Balzac was wrong, but for me literature has remained 'an 18-year-old mistress'. Moreover, one of my professors was also wrong when he warned me against taking that step: 'Would it not be better to remain a humanist engineer?'

Forgive me for mentioning these old memories; they explain the doubt that I am experiencing here before you. You cannot imagine everything that is lacking in my literary training, everything that I have not read and everything that I do not know since, in the discipline in which you elected me, I am virtually an autodidact. I have nonetheless been teaching literature for over thirty years and have made it my profession. Yet, as I will carry on doing here, I have always taught what I did not know, and taken my lectures as a pretext to read what I had not yet read and thus to learn what I did not know.

Unsure as to whether you would agree to my project for a Chair, and my candidature, I would ask myself: 'Will they not see their mistake?' Then I would stop myself by thinking that in fact a real impostor would be a professor who was sure of himself, who knew before seeking. Yet the names of those who have brought fame to modern French literature at the Collège de France for over half a century came to mind, from Paul Valéry to Roland Barthes, from Jean Pommier to Georges Blin, and then those of the eminent professors, present here today, who accepted me in their midst, Marc Fumaroli and Yves Bonnefoy, as well as the members of the Institute of Literary Studies who introduced me to you, Carlo Ossola and Michel Zink, to whom I am grateful…" ■

*This inaugural lecture is available shortly from Editions Fayard and on DVD (coproduction Collège de France/ CNED/Doriane Films).*

# International chair 2006-2007

## Daniele Vitali

Professor of archaeology, University of Bologna (Italy)

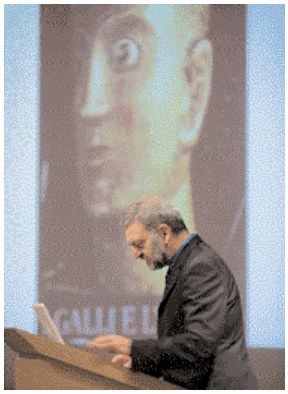
gave his inaugural lecture on 14 December 2006. His course entitled 'The Celts of Italy' began on 12 January 2007.

*Extract from the inaugural lecture:*

"The discovery of the Celts of Italy: from intuition to scientific findings.

It is above all ancient literary sources that attest to the presence and action of Celtic populations in Northern Italy, from the Alps to the foothills of the Apennines and the shores of the Adriatic. Whereas all ancient authors agree to situate the arrival of the Celts in Italy at the beginning of the 4th century BC, Tite-Live, in an account that has generated numerous controversies, suggests a more extensive antiquity and situates the first Celtic migrations some two hundred years earlier.

This excursus – that one commentator considered, with what logic we do not know, as 'una specie di Kamasutra della storia dei Celti' ('a sort of Kamasutra of the history of the Celts') – had the advantage of provoking a great deal of debate, for and against, but always with arguments, among historians and archaeologists from the birth of Celtic archaeology in the 19th century: M. d'Arbois de Jubainville, Karl Müllenhoff, Otto Hirschfeld and Salomon Reinach, to mention but a few from the end of the century.



*This inaugural lecture is available from Editions Fayard. The video can be downloaded from the Collège de France website.*

At the very beginning of the 4th century BC, Rome, which was already clearly advertising its hegemonic ambitions, was most unexpectedly defeated by these strangers from the north. It was conquered, occupied for seven months, and had to pay a heavy tribute to the barbarians. This was an episode which left a lasting imprint on Roman minds.

Cornelius Nepos situates the great invasion at the time of the fall of Melpum and of Veii (396 BC), whereas Diodorus of Sicily establishes a synchronism between the descent of the Celts into Italy and the siege of Rhegion by Denis 1st of Syracuse (386 BC). Appien proposes an intermediate date, so that this descent into Italy coincided with the 97th Olympiad (392-388 BC). He indicates, moreover, that these Celts came from the regions of the Rhine. No synchronization for the siege of Clusium and the taking of Rome is proposed by Tite-Live. On the contrary, he situates the oldest Celtic migrations in Northern Italy during the reign of Tarquin the Old (616-578 BC) and the establishment of Marseilles (600 BC), and indicates that these peoples came from Gaul.

These movements, in the form of more or less contemporaneous migratory waves, also had a significant impact on the population characteristics and the territorial and political balances of the peoples of Italy, whether they were directly affected by the passage, arrival and settlement of these foreign tribes, families and individuals or not.

The history of the Celtic peoples of Italy was of interest to ancient authors only in so far as it concerned the history of Rome itself. This history therefore amounts to a series of wars, military operations, diplomatic actions, periods of peace, resumption of conflicts and resistance, betrayals, defeats and losses of territories. In these accounts, internecine struggles also have their place. In all cases, and despite their recent arrival, literary sources treated these intruders as populations that were part of the mosaic of Italic peoples who were there to stay.

Historians, who had only these literary sources to go by until the mid-19th century, were unable to draw a picture of the organization and culture of the various Celtic peoples. Consequently, for a long time questions concerning the Celts of Italy were considered exclusively through the deforming prism of the history of Rome. But the archaeological testimonies that were lacking at the time soon appeared and became the sources of a less Roman and more global history." ■

# Chair of technological innovation - Liliane Bettencourt 2006-2007

## Jean-Paul Clozel

Researcher, CEO, Member of the Board and Founder of Actelion Ltd.

gave his inaugural lesson on 18 January 2007.
His course entitled 'Biotechnology: from science to medicine' began on 25 January 2007.

*Extract from the inaugural lesson:*

"Biotechnology, which I would define as the application of all living sciences towards improving health, is in the process of revolutionizing our daily life.

Some figures should give us cause for reflection. Every four years life expectation in the occident increases by one year. In France, by the year 2050, there will be three times more people over the age of eighty-five than today. A little girl born in 2006 will have a one in two chance of becoming a centenarian. The ageing of the population explains why the rapid rise in the prevalence of diseases such as cancer, Alzheimer and cardiovascular diseases can be seen. New infectious diseases have recently surfaced and others threaten us every day (…)

The problem is immense and it is easy to understand why occidental countries dedicate between nine and fifteen per cent of brut national production to the area of health.

To address these problems, a new industry was created about thirty years ago. Scientists, mainly in the US, decided to leave their university laboratories to create industrial enterprises dedicated entirely to applying their scientific discoveries (…)

Biotechnology represents a considerable section of the economy with market capitalization of 360 billion Euros and an average growth rate of 20% per year, double the growth of the classical pharmaceutical industry. This growth is evidently directly related to population increase and ageing. It is also linked to the improved technologies that allow medication obtainment.

Scientific innovation is obviously the essential motor that will define biotechnology's success. More often than not, this innovatory element starts with a discovery made at a university or in an academic institution. After that, either the scientist who made the discovery decides to found his own company or he decides to collaborate with a company that will try to develop his discovery (…)

In fact, as far as I know, no great biotechnology discovery has been made within a company itself. They are all the consequences of so-called academic discoveries made by university groups. But in all cases, these university groups had very specific characteristics. They were integrated in the heart of universities of a standard superior to most European universities. The number of people working in these laboratories was well above the average size of the European groups. Moreover, their projects were very long term and their financing allowed a significant level of risk-taking. This is the reason why I believe it to be much more important to have very large universities with a small number of multifunctional teams and with financing that allows the realization of projects that can run as long as ten years rather than a multitude of small teams without the critical size needed or sufficient financing capabilities (…)

Some figures give an idea of process and pricing difficulty. The research phase for a biotechnology project calculates a minimum of three to four years, the development phase six years and the registration phase one year. This makes a total of at least ten years. To select a product, an average of two to ten million products must be synthesized. One molecule in two will not pass the toxicology tests. Only one molecule in ten entered into man will finish all clinical trials. The average cost of such a project is between two and three hundred million Euros for a drug intended for hospital use. This cost could reach six or eight hundred million Euros for a drug aimed at the general public. It is at this price that we can foresee saving lives and treating otherwise incurable diseases." ■

*This inaugural lecture is available from Editions Fayard. The video can be downloaded from the Collège de France website.*

Translation: Billy Gilbert

# 2007
# Creation of the Chair of technological innovation - Liliane Bettencourt

Mrs Bettencourt, Prof. Corvol, Prof. Clozel, first holder of the Chair of Technological Innovation and Mr Bettencourt.

The creation of this new Chair in partnership with the Bettencourt-Schueller Foundation concretizes a common will to focus on technological innovation, and to highlight the importance of work in this field and of the effort that needs to be put into it.

Technological innovation concerns many sectors that contribute towards growth and progress, thus transforming human life.

The holder of the Liliane Bettencourt Chair of Technological Innovation will be renewed every year in order to promote teaching at the cutting edge of research in highly innovative sectors such as the nanotechnologies, computing, communication networks, data transfer and encryption, and the life sciences.

The biotechnologies are inaugurating the Chair's annual cycle of courses and seminars. The development of molecular biology and, more precisely, the birth of genetic engineering thirty years ago gave the biotechnologies that extraordinary thrust which changed the therapeutic approach so radically that it can be called a revolution in the life sciences. This new technology has combined expertise in the field of chemical molecules with new processes, to produce human proteins for medical purposes.

The Collège de France Assembly of Professors has appointed Mr Jean-Paul Clozel to present the latest developments in biotechnological research. In both public research and the private sector, he has contributed to the discovery of new molecules and to the development of new treatments. His work characterizing the actions of many cardiovascular drugs such as rennin inhibitors or calcium antagonists is recognized world-wide.

Mr Clozel is currently the CEO of Europe's leading biotechnology firm, which he founded in 1997 with three other researchers.

The Assembly of Professors unreservedly supported this partnership project with a private foundation as it enables the Collège de France to increase its research and teaching potential without disregarding one of the main rules governing the institution since 1530: the idea of free research.

Through this partnership the Bettencourt-Schueller Foundation will be pursuing one of its key objectives: supporting and promoting the development of scientific research at its highest level. It aims to encourage basic research, its teaching and its practical applications, the building blocks of tomorrow's new technologies.

This partnership between the Collège de France and the Bettencourt-Schueller Foundation is a first of its kind and is designed to last.

The Collège intends to continue this openness to the economic world, convinced that it is possible to achieve synergy and at the same time preserve each party's identities, interests and ways of functioning. The institution hopes to cement new, similar partnerships in the near future. ■

Prof. Jacques Livage, Prof. Pierre Corvol and Mrs Bettencourt.

# Chair of Artistic Creation 2006-2007

## Pascal Dusapin

Composer
Cino del Duca Prize 2006,
Dan David Prize 2007.

Commander of
*Arts et Lettres*

gave his inaugural lecture on 1 February 2007.
His course entitled 'Composition, Music, Paradoxes and Flows' began on 9 February 2007.

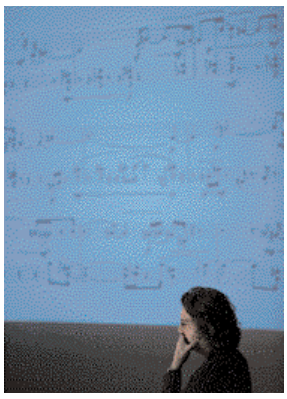
*Extract from the inaugural lesson:*

"Music is what never recurs" said Roland Barthes. We could perhaps add to this, saying that it is ever before. Basically, it is always already over. Listening to music could be seen as a menace, the threat of it already being over, yet again. So we persist. We listen once more. And again it is not there any more. Or even less than before. And it starts all over again. Before music, there is silence. And all that is left immediately afterwards is a recollection, a recollection of the silence before. All the ambiguity of listening is contained in these scraps of moments, moments which no longer exist. Anyone listening may claim to apprehend time. And yet, time is not. But we are still aware that it does mean something. So we succumb to temptation once more. We listen again. And it starts all over again. How can we express such time which constantly defies expression?

We can note that the essence of time spent listening is chiefly devoted to "topographical" detection. Listening deploys itself of its own accord, unbeknownst to us, as it were. Something leads our brain to move swiftly, to analyze links and signposts articulated in the flow. Listening means detecting the boundaries of a shape. It is in fact a mechanism for recognizing edges rather than any real limits, for we are not yet capable of grasping the time/form of the music. Once it is over, we believe we have had access to a whole, to a demonstration of that time. I like to believe that we are mistaken. In my opinion, every work of music beckons us along a path, to wander along the path, perhaps even to run away from meaning, at least from such meaning as has flooded our world. Music is a different meaning, a different rationale, which is why it is so relentlessly paradoxical. My statements as a composer will often (I fear) be similarly paradoxical.

Such wandering listening is the experience of a time scale we believe to be real, but is nothing more than mere intention.

Corresponding with the time of a work, grasping its existence, is a path to nowhere. It is easy to see that music is elusive, beyond any tangible realm. Yes, music leaves no trace, appearance merging with disappearance. Music fades so quickly, its boundaries are indefinable. By its nature, it is designed to be performed; it has escaped the realm of concrete definitions and returned to a state of pure intention. Listening takes us to the gateway of a world of infinite subtlety – the world of the emotions. There is no need to be wary of this term, emotion being an inherently human state of mind; what we get from music is emotion. Emotions obviously combine and amalgamate, forming muddled collections, but they transform us. Emotion is a movement, and it is through emotions that the mind and body recompose themselves. Listening means being aware of an experience occurring somewhere between a mental event and a physical event. Where does the experience originate? Or first, where does music originate? A work of music may not have a clearly defined source, coming from somewhere buried in the past and lost in a multitude of performances. Listening means retrieving this loss of meaning. Listening to music means inventing the demands of this desertion. But composing is not listening. A person composing hears, but does not listen. As a teenager, I believed that everything emerged from the same force and impetus, and for years I confused composing with listening. I was afraid to compose because I knew absolutely nothing about it. (According to Nietzsche, the ear is the organ of fear.) I didn't have the faintest idea about composing. Listening was the only way I had of making this unthinkable transgression. Listening was like a shadow. The shadow of composing.." ■



*This inaugural lecture is available from Editions Fayard and on DVD (coproduction Collège de France/ CNED/Doriane Films).*

# European chair 2006-2007

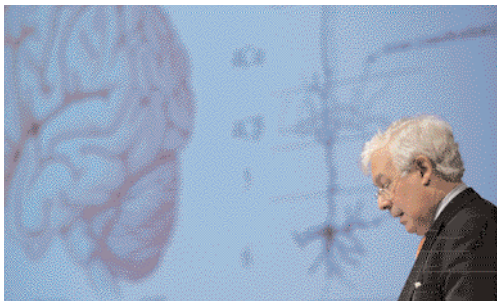
## Guy Orban

Doctor,
Professor of
Neurophysiology
at the Catholic
University of
Leuven and
Visiting Professor
at the *École*
*Normale Supérieure*

gave his inaugural lecture on 22 March 2007.
His course entitled 'Visual treatment and perception of form and movement' began on 30 March 2007.

*Extract from his inaugural lecture:*

"The brain is a very particular organ of the human body. According to one of my first intellectual guides, Pierre Teilhard de Chardin, it is also the most complex system in the biosphere. There is therefore no reason to consider the study of the brain as any less important than that of the other infinites, elementary particles and the cosmos – on the contrary, considering its medical and human implications. The brain's particularity stems from the fact that its components, neural cells or neurones, have extensions, dendrites and axons, through which they are linked to one another and exchange information in the synapses – as Ramón y Cajal postulated over a hundred years ago. A brain is an anatomically organized collection of cells. The human brain consists of tens of billions of neurons, each of which has several thousand connections. Such is the complexity of our brain in its raw state.



This complexity explains the gap between the brain and the neuron. Perfect knowledge of the neuron is indeed important, but it is totally insufficient for understanding the brain, whose function depends on anatomy. As Semir Zeki said, 'anatomy first'!

Connections in the brain give us a clue as to how to go about apprehending its complexity. They determine the levels of integration of the brain beyond the neurons, since the lower levels have more similarities with those of the other types of cell. These levels of integration express a fundamental law: the neurons that have to exchange the most information form the shortest connections; this enables them to gain valuable space since the skull cannot change shape. Neurons establish dense connections with their closest neighbours; this generates a first level of integration beyond the neurones, that of local networks, of which the cortical column, dear to Vernon Mountcastle, is the prototype.

These columns interact via horizontal connections linking columns of the same nature. This creates the following level, that of the cortical area, of which the primary visual cortex is the prototype.

Almost all the pyramidal neurons have axons which leave the grey matter and produce their terminal arborisation in another region of the cortex. These longer connections form the framework of the next level, that of cerebral systems, such as the visual system which comprises several dozen cortical areas. Finally, all these systems – motor, visual, auditory, limbic – are linked together and form the brain. The product of the brain is not a hormone or a metabolite but the behaviour and control of the internal milieu.

The brain underlies mental life but cannot be reduced to it. At the other extremity, it cannot be detached from its embodiment in the human body. The levels of integration show that its study cannot be reduced to genetics – which explores the simplest level, that of the coding of molecules – or to cerebral imagery which simply scans the most integrated levels. Study of the brain requires a multi-disciplinary effort, that of the neurosciences, which include not only genetics and imagery but also and above all neurophysiology, neuroanatomy and neuropharmacology, as well as the contributions of the behavioural and cognitive sciences and of mathematical modelling. To meet this challenge in the 21st century, the neurosciences have to cover all the levels of integration, including that of neurons, which are still the cornerstone of the brain. The aim of my lecture, today, is to demonstrate the important role that vision has played in the past and still plays today in the development of the integrative neurosciences in general and the cognitive neurosciences in particular. ■

*This inaugural lecture is available from Editions Fayard. The video can be downloaded from the Collège de France website.*

# Chair of Mesoscopic Physics

## Michel DEVORET

Professor of Physics at Yale University (USA)

gave his inaugural lecture on 31 May 2007. His course, entitled 'Introduction to mesoscopic physics: electrons and photons' began on 7 June 2007.

*Summary of his inaugural lecture:*

"Can complex machines function quantum-mechanically?

Since the discovery of the atom, we have divided nature into two worlds. One tends towards the infinitely big: that is the macroscopic world of objects with a very large number of atoms. The other tends towards the infinitely small: that is the microscopic world of particles, such as electrons and nuclei. The movement of macroscopic objects, directly accessible to our measuring and control instruments, is dictated by the laws of classical mechanics which, at any moment, allow for the analysis and correction of this movement to the finest degree. By contrast, microscopic particles obey the laws of quantum mechanics, which associate any input of information on their trajectory with a minimum uncontrollable perturbation of that trajectory. Hence, the problem of the observation and control of microscopic systems.

What makes quantum mechanics fascinating is the fact that the chaotic and disorderly character that seems to emerge from the uncertainty principle is more than compensated by the order created by another quantum principle: interference. According to this principle, a confined system can adopt only discrete states of energy (in the sense that they are not connected continuously) and this introduces a natural digitization into mechanics.

Consequently, when it is plunged into a noisy environment, the quantum-mechanical system, unlike the classical system, can remain ordered, if the average energy of the noise is substantially lower than the gap between its first two discrete levels. This regularity manifests itself for example in the indiscernability of atoms, an essential property on which chemistry and materials science are based. Better still, if we take adequate precautions, the quantum-mechanical system can reveal which of its states it is occupying, without making any transition to another one, the associated disturbance being then rejected in a variable without any influence on the occupation of the levels of energy. Is it possible to achieve the best of both worlds? Can one take advantage of the accessibility and manipulability of complex objects of the macroscopic world, while benefiting from the subtle quantum-mechanical order that reigns in the microscopic world? Owing to progress in the techniques of miniaturization, cooling and treatment of rapid signals, it has now become possible to create systems which participate in both the macroscopic and the microscopic. These systems, known as 'mesoscopic', function quantum-mechanically but since they consist of a large number of atoms, they have the necessary complexity to interact directly with our measuring instruments and be assembled easily from a set of standard parts, forming a sort of construction kit, comparable to the game of Lego. They thus prefigure what full-blown quantum machines could be, such as quantum computers. Such machines could for example push back the limits of data processing to the level required by fundamental laws, using a minimum of time and energy, and pursue the miniaturization of transistors up to the molecular stage. Perhaps they could even make use of certain phenomena specific to quantum mechanics, such as entanglement, in order to perform operations inaccessible to regular machines. Or maybe, beyond a certain threshold of complexity, they will show anomalies in quantum laws, which up to now have never been proved wrong." ■

*This inaugural lecture will shortly be available from Editions Fayard. The video can be downloaded from the Collège de France website.*

## CLIMATE AND OCEAN EVOLUTION


Prof. Édouard Bard

### Panama and the deep Atlantic circulation

Study published in the 22 February 2007 issue of *Nature*.

The likelihood of ocean currents slowing down in the Atlantic due to the present-day sea surface temperature increases is no longer disputed, even if uncertainties remain as to the extent and speed of future changes (see box page 14). By contrast, the inter-tropical zone's response to such rapid variations of the ocean-atmosphere couple and the impact of that response on ocean currents are still largely unknown.

The paleoclimatic approach is the only one that makes it possible to document this type of environmental variation, especially since it is now recognized that such abrupt events were frequent during the last glaciation. In particular, cold climate phases, called Heinrich events, which occurred during that period were characterized by the collapse of deep Atlantic currents due to an influx of fresh water following the destabilization of ice sheets.

Climate archives such as marine or lacustrine sedimentation, polar ice and stalagmites clearly show that these changes of the deep ocean currents are concomitant with large-scale climatic variations. While the most extensive temperature variations are observed in the North Atlantic region, recent research has shown that these rapid climatic changes have an influence on a planetary scale, in particular by affecting the water cycle. It seems that they are accompanied by a shift in the latitude (towards the south during cold events and towards the north during hot events) of the climatic equator separating the trade wind systems of the two hemispheres (inter-tropical zone of convergence).

A key region of this system is Central America, a narrow continental strip separating the Atlantic and Pacific Oceans. On the Atlantic side the surface waters are characterized by intense evaporation, which increases their salinity. The water vapour is then carried by trade winds to the Pacific where it falls as rain, thus reducing the salinity of surface water there. This exchange of water vapour between the two basins is equivalent to several hundred thousand cubic metres per second. This huge transfer of fresh water maintains a constant contrast of salinity between the two oceans. The surface waters of the tropical Atlantic are then transported, via the Gulf Stream, towards high latitudes where they warm the atmosphere, before sinking to the abyss in convection zones situated in the Greenland, Iceland, Norwegian, and Labrador Seas. The deep waters thus formed then flow into the world's oceans, purging the North Atlantic of some of its excess of salt.

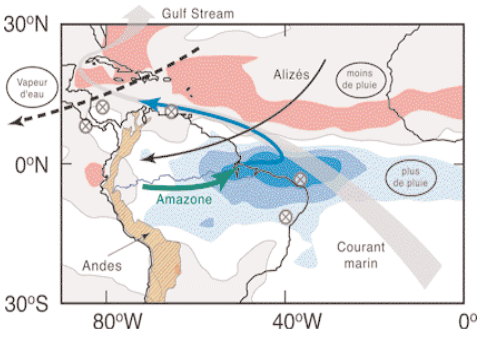
Based on many geochemical indicators measured in marine sediments extracted in 2002 West of the Isthmus of Panama by the French oceanographic vessel the Marion Dufresne, a team from the Aix-en-Provence CEREGE[1] reconstructed the salinity variations of surface waters, in the zone where water vapour evaporated in the Atlantic is deposited. This original study shows that the Heinrich cold periods correspond to salinity increases in the East Pacific zone, fingerprint of a reduction in the water vapour transport.

By comparing their results with other studies in the Atlantic sector and in South America, researchers have proposed a new positive feedback on climate dynamics, that is, a mechanism

1. Centre européen de recherche et d'enseignement des géosciences de l'environnement (CNRS, Universités Aix-Marseille 3 et 1, IRD et Collège de France).

which amplifies climate change. During climate crises, the humid trade winds migrate southwards. Blocked by the Andean cordillera, some of the rain which normally reduces the salinity of the Eastern Pacific falls into the Amazon drainage basin (see figure). This feedback involving the ocean, air currents, the topography and the network of rivers has the effect of re-injecting rainwater into the Atlantic, of thus reducing its salinity, and finally of slowing down its deep circulation.

This new study therefore shows that a close relationship exists between tropical hydrology and the North Atlantic currents, which impacts on the climate above and around the North Atlantic basin (especially in Europe). This new climate feedback can be studied by means of numerical models combining the atmosphere and oceans. Available simulations suggest that this phenomenon does indeed exist. Further calculations would be required to quantify this feedback by means of models with a high enough spatial resolution to adequately represent the topography of the mountain ranges of the tropical zone. ■




Legend: Annual mean rainfall anomaly simulated by models after a collapse of deep ocean circulation (increase in blue, decrease in red; from Stouffer et al., 2006).
The arrow with the broken line represents the current flow of water vapour. The arrows with bold lines indicate water transport (trade winds -> rivers -> ocean currents) during the climatic event. The crosses show the sites of paleoclimatic studies.

**Further readings:**
Leduc, G., Vidal, L., Tachikawa, K., Rostek, F., Sonzogni, C., Beaufort, L, Bard, E., 'Moisture transport across Central America as a positive feedback on abrupt climatic changes', *Nature* vol. 445, 908-911.

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http://www.cerege.fr/tracorga/

### What future for deep Atlantic currents?

Simulations to establish predictions for the next century, based on various scenarios of increasing greenhouse gas emissions, generally show a progressive reduction in the intensity of deep ocean currents in the North Atlantic. In some cases these currents could even end up collapsing - i.e. exceeding a threshold beyond which a return to the former state would become very difficult - and reaching a new stable state in which they were even weaker. In parallel, oceanographic data from the past fifty years suggest that hydrographic changes (temperature and salinity), as well as a reduction of water flows transported by certain marine currents, both at the surface and at great depths, have already occurred in the North Atlantic. In addition, satellite data show a recent acceleration in the melting of Greenland ice. Even if there are still many uncertainties, it seems that the risk of a slowdown and/or a collapse of the deep ocean circulation by the end of the century or the beginning of the next century has to be taken seriously and actively studied.

Prof. Pierre Briant

## Launch of MAVI, the Virtual Achaemenid Museum

From 1999 onwards a main focus of the newly created chair has been to contribute to the development of an encompassing Internet platform. The project aims to be, on the one hand, a crossroads of communications and exchanges between specialists based at a whole range of different countries, and, on the other hand, a repertory of existing documentation, which can be accessed and handled by newly-developed tools. It is against this background that, in the summer of 2000, www.achemenet.com was created. The site, re-developed in 2005, will soon celebrate its sixth anniversary. Throughout the global academic community it is nowadays considered to be the central locus for Achaemenid Studies. Another branch of the aforementioned project had hitherto not yet been developed, however, as a result of technical difficulties: the gathering and rendering accessible of tens of thousands of Achaemenid objects, originating from the vast expanses between the Indus and the Mediterranean, created during the period of the Great Kings' supremacy over these regions (550-330 BC), and since then dispersed over a dozens of different museum and institutions all over the world.

The first contacts and reflections on the project between Pierre Briant and José Paumard (Maître de conférences de Génie informatique at Paris-XIII), at the end of 2001, quickly led to the conclusion that a custom-made site would be a necessity, that this site would require functions that were not yet fully developed at that point, and that these functions would be embedded in software that had to be specifically written for the site, which would take the shape of an immense on-line data-base. Once the scientific part of the project had been precisely delineated and approved, José Paumard invested all his research time to developing specific software and building the electronic architecture of the nascent "musée achéménide virtuel et interactif" (MAVI). In order to help us conduct the project in the right direction, we asked Philippe Bertin, a computer consultant, site developer and graphic designer, to join the team. In addition, Pierre Briant was backed by an international steering committee charged with the task of negotiating with the world's largest museums and institutions, which are also the richest in terms of Achaemenid objects. Among these are the British Museum, the Musée du Louvre, the Bibliothèque Nationale de France, but also American, Dutch, German, Swiss and Iranian museums. All these have welcomed our project with great enthusiasm. By consequence, we have been able, in the course of the subsequent years, to collect almost 8,000 objects of which we now possess about ten thousand images in a very high resolution, stored on a server donated to the project. At the same time, thanks to the data provided to us by the cooperating institutions, but also thanks to the work of Marie-Françoise Clergeau, Salima Larabi and part-time aides, every object is accompanied by a file containing a highly detailed description that meets academic standards. Thanks to fine-tuned technical innovations, the Internet user can visit a given collection, but can also create his own personal archive (which he may save and reuse during a subsequent session), submit queries (thanks to the powerful Sinequa® search engine), and has access to an on-line help function (which gives him instructions by means of animations). Simultaneously, the project also aims at a wider public and for this purpose internal navigation has been expedited. In addition, an animated introduction (using Warmseason® software)

Chariot from the Oxus treasure
© British Museum

Seal impression © Badisches Landesmuseum Karlsruhe

Vase handle, © Louvre

on the Achaemenid empire, written by P. Briant and created by Ph. Bertin, as well as several modes to visualise the contents of the site have been put in place.

Fundamentally, the MAVI program enables its staff to accomplish a task of prime importance for both the present and the future. In fact, the cataloguing, archiving and consulting of data on cultural patrimony have become decisive concerns in current thinking about cultural and scientific affairs. The start of the 21st century marks a moment particularly well-conditioned for creating technical solutions for problems that cannot be solved by the existence of 'real' museums alone: preserving cultural patrimony and rendering it accessible. The joint progress achieved in digitalisation, in data-basing, and in Internet data-transferring, render possible what seemed impossible only yesterday. Today it is therefore the solemn responsibility of researchers and academic institutions to set themselves to the task of gathering data, archive it, and provide an access to those immensely rich artistic, archaeological and cultural archives – now still dispersed over hundreds of locations and publications, museums and their reserves, catalogues, excavation reports, articles and studies – by engendering a vast international cooperation, not only of specialists of the discipline in narrow sense (historians, archaeologists, museum keepers), but also of those from the humanities at large, from social sciences, and from computer sciences. This, in short, is the philosophy of a project that has by now been partially realised, that has been, and will continue to be, a generator of technological innovation, and that embraces the ideal of being applicable to other academic forums as well. Though we are well aware that there remains much to be done, the response in the daily and weekly press, in France and in Europe (September-October 2006), has shown that the choices we have made are considered to be the right solutions. Simultaneously, a considerable number of the world's museums have now declared their willingness to join our adventure. Briefly, launched in September 2006 after five years of intense preparation, MAVI remains a project for the future, a project in continuous development. ■

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http://www.museum-achemenet.college-de-france.fr

A brochure in .pdf format can be downloaded at
http://www.museum-achemenet.college-de-france.fr/doc/plaquette-MAVI-EN.pdfnt. n

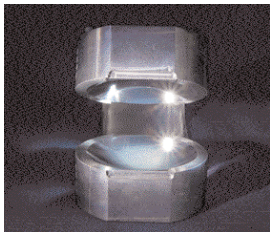
Prof. Serge Haroche

## Life and death of a photon: a new way to look

The photon is the ubiquitous particle of light which carries nearly all information we get from the outside world. It usually disappears while being detected. The retina, for instance, absorbs light, changing it into an electrical current which triggers the optical nerve. A similar phenomenon occurs on the photo-sensitive surface of usual light detectors, so that information carried by the photons is generally destroyed in the very process which records it. We certainly can see a macroscopic object as many times as we wish, but the photons which bring its image to our eye are at each time new ones.

To die while delivering its message is however not the ineluctable photon's fate. Quantum theory, which describes the behaviour of Nature at the microscopic scale, tells us that it is indeed possible to count light quanta without absorbing them, by realizing what is known as a quantum non-demolition measurement (QND for short). Non-destructive QND procedures have been successively applied to light beams containing large photon numbers, but it had not been possible so far to reach a sensitivity high enough to record repeatedly and non-destructively single light particles.

This is precisely what we have achieved recently, by implementing a QND method that we had proposed back in 1990. We have been able to observe hundreds of times the same photon trapped in a box. After a perceptible delay which can reach half a second, the light particle finally disappears, in a sudden process occurring at a random time. We have witnessed in this way the story of single photons and recorded the times of their birth and death. This experiment, whose results have recently been published in *Nature*, has required two conditions that were not fulfilled at the time of our early proposal. We had to trap light in a box for a tenth of a second on average, in order to have the time to perform repeated observations. We had also to develop a new kind of atomic detector able to record the imprint of a single photon without absorbing its energy. It has taken us several years of strenuous efforts to meet these challenges.



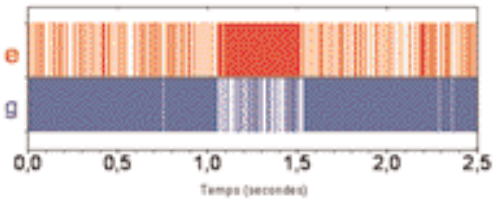


The photon box

Our microwave photon box is made of two metallic mirrors facing each other at a distance of 2.7 centimetre (see photo). The photons (which have a wavelength of about 6 millimetre) bounce more than a billion times between these mirrors before escaping through scattering on mirror's imperfections or absorption in the bulk of the metal. Such a high reflectivity, thousands of times larger than that of the best optical mirrors, is obtained by coating the mirrors with a layer of superconducting metal, cooled down to an absolute temperature below one degree. The mirrors substrate is polished with a roughness of a few nanometers only. A photon travels in this cavity over an average distance equal to the Earth circumference before vanishing. The appearance of a photon in the box is due to the radiation of its walls. Even at the very low temperature of the mirrors, their atoms have a residual thermal excitation which produces from time to time the emission of a light quantum. The laws of this so-called blackbody radiation have been first described by Planck and Einstein at the beginning of the last century. Their seminal papers have been the starting point of the quantum revolution.

The long lifetime of our photons is by itself not exceptional. In free space, a photon lives forever. The light that we receive from the outskirts of the Universe, which has travelled through empty space during billions of years is a direct evidence of the longevity of light quanta. To store for a long time a trapped photon is however very difficult. We must then have it interact with a material medium such as the reflecting walls of a cavity, or the transparent medium of an optical fibre. Under such conditions, the photon gets easily absorbed and becomes very fragile. The light quanta stored in our superconducting box set a world record for the longevity of light trapped in a small volume.

In order to observe our photons, we send one by one across the cavity rubidium atoms prepared in a very excited state known as a Rydberg state. One of the atomic electrons is promoted by laser excitation in an orbit of large size, whose radius is more than a thousand times larger than that of the electronic orbital in the atom's ground state. This very excited atom acts as a giant antenna, very sensitive to microwave radiation. An obvious way to use




Birth and death of a photon observed by the sudden changes of the atomic signal over time: the vertical bars represent an atom detected in *e* (red) or in *g* (blue). In this figure, whose size is reduced with respect to the original, bars are separated by a distance smaller than their width, giving the feeling of a continuous signal, blue for vacuum and red for one photon. Red bars on top of blue background and blue on top of red background are due to measurement errors.
(Reproduction with the permission of Macmillan Publishers Ltd : *Nature*, S.Gleyzes et al, 2007.)

these atoms for detecting a photon is to have them absorb a light quantum while undergoing a resonant transition from an initial Rydberg state (called *g*) to a more excited level *e*. By measuring the final atomic energy, we see the photon, but by the same process, it is absorbed and thus destroyed. A new measurement will then tell us, with certainty, that the cavity is empty.

For the measurement to be QND, the photon must leave on the atom a subtler imprint. To achieve this, we render different the frequency of the photon and that of the atomic transition between states *e* and *g*. By adjusting the mirrors' separation, we slightly detune the photon from the atom. Energy conservation then prevents the atom from absorbing the light. The photon slightly changes however the frequency of the atomic transition. This light shift effect is well known in atomic physics when it is produced by intense fields. In the unusual situation which we are dealing with here, the field of a single photon shifts by a detectable amount the rotation frequency of the Rydberg electron around the atomic nucleus.

This shift is detected by a very sensitive method of atomic spectroscopy, involving auxiliary microwave fields. We subject the atom to two microwave pulses, the first before it enters the cavity, the second immediately after it leaves it. These pulses have their frequency and amplitude tuned so that their combined effect is to bring the atom from *g* to *e* provided its frequency has been shifted by a single photon in the cavity. If there is no photon, the pulses cannot induce the transition and the atom remains instead in state *g*. The energy absorbed by the atom in the former case is borrowed from the auxiliary pulses and not from the cavity field. The photon is still there after having been observed and it is ready to be seen again by another atom.

This time resolved spectroscopy procedure, invented by the physicist Norman Ramsey, is currently used in all atomic clocks. In these devices, the transition between two states of a caesium or rubidium atom is induced by a double microwave pulse, generating a signal used to lock the microwave to the atomic frequency. In this way, a very precise time standard is realized. In our experiment, each Rydberg atom is like a microscopic clock whose ticking is slightly delayed by the field of a photon. The perturbation of the clock's rate is measured by the atomic signal (atom detected in *e* when the clock has been delayed by a photon, in *g* otherwise).

The figure shows a two and a half second-long sequence during which 2500 atoms are detected either in *e* (red bars) or in *g* (blue bars). During the first second, the atoms, mostly detected in *g*, indicate that the cavity is empty (a few atoms found in *e* are due to imperfections of the set-up). The signal then suddenly changes, with a majority of atoms detected in *e*. A photon from the thermal radiation background has appeared between the mirrors. In this particular sequence, the photon survives for about half a second, i.e. more than three times the average lifetime of the photons in the cavity. It then disappears as suddenly as it appeared, leaving the cavity empty. The sudden appearances and vanishings of light occur as fast quantum jumps, at random times. Only their probability can be predicted. By recording thousands of such jumps over many hours, we have directly checked all the statistical properties of thermal radiation.

This novel non-destructive way to look illustrates a fundamental quantum process never observed so far on light, and opens fascinating perspectives. For the first time, information carried by a photon can be shared by a large number of atoms interacting one at a time with the field. It is possible to realize a situation where the cavity is in a superposition of two states, one in which it is empty, the other in which it contains a photon. To achieve this, we can send across it a first resonant atom, adjusting its interaction time with the field so that it has a 50% probability for emitting a photon. Subsequent atoms will then be detuned in order to realize a QND detection. They will finally end up in a superposition of two states, one in which they are all in *e*, the other in which they are all in *g*. This strange superposition exhibits a quantum ambiguity analogous to that of the famous Schrödinger cat which, after interacting with a single atom, ends up being at the same time alive and dead. The study of these states will help us understand better the nature of the fuzzy boundary between the quantum and the classical worlds. ■

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## Kathinka EVERS

Professor, Centre for Bioethics at Karolinska Institutet & Uppsala University
invited by the Assembly of the Professors on the proposition of
Profs Anne Fagot-Largeault and Jean-Pierre Changeux


She has given 7, 14, 22 et 28 november 2006 four lectures entitled:
1. When Matter Awakens. The open mind and its enemies
2. The Responsible Brain. Free will and personal responsibility in the wake of neuroscience
3. The Neural Basis of Morality. The naturalistic fallacy revisited
4. Helping the Brain Forget. Perspectives on therapeutic forgetting

### When Matter Awakens
*The open mind and its enemies*

The 21st century has seen neuroscience develop rapidly and a new academic discipline emerge: neuroethics, the attempt to explain moral judgment in partly neurobiological terms. Neuroethics inspires hope as well as apprehension, and historic awareness is essential in order to determine the nature and raison d'être of this young research area. The aim in this lecture is to present neuroethics together with a dynamic model of the human brain and mind upon which neuroethics can fruitfully be constructed. Scientific theories about human nature and mind in the 19th and 20th centuries were occasionally caught in two major traps: ideological hijacking and psychophobia, notably in the form of naïve eliminativism, and naïve cognitivism. To avoid them, neuroethics needs to build on the sound scientific and philosophical foundations of informed materialism, that (1) adopts an evolutionary view of consciousness as an irreducible part of biological reality, an evolved function of the brain and a suitable object of scientific study; (2) acknowledges that adequate understanding of conscious, subjective experience must take both subjective information obtained by self-reflection and objective information obtained from anatomical and physiological observations and measurements into account; and (3) depicts the brain as a consciously and unconsciously autonomously active, plastic, projective and narrative organ evolved in socio-cultural-biological symbiosis; and (4) posits emotion as the hallmark of consciousness. Emotions made matter awaken and enabled it to produce a dynamic, flexible and open mind. As depicted by informed materialism, the neuronal person is truly awake, in the deepest sense of the word.

### The Responsible Brain
*Free will and personal responsibility in the wake of neuroscience*

The ideas of free will and personal responsibility function as social fundaments. All human societies presume that adult, healthy individuals are morally, socially and legally responsible for their actions, provided that they have acted freely and not under constraints. Free will is also a fundamental structure of human experience, a transcendental neuronal structure, like space, time and causality. The experience of free will has been considered "illusory", e.g., by virtue of being (1) a brain construct, (2) causally determined, or (3) non-consciously initiated. In line with the informed materialism presented in the previous lecture, and as an extension thereof, a neurophilosophical model of free will shall here be suggested in which an act of will can be "free" in the sense of being "voluntary" even though it is a brain construct that is causally determined and influenced by non-conscious neuronal processes. Contingent causation is compatible with free choice, a model for which the neuroscientific variability theorem offers empirical support. Behaviour that is contingently caused by non-conscious neuronal processes can qualify as "voluntary" on the assumption of mutual influence between conscious and non-conscious volitional neuronal processes. Both conscious and non-conscious volition can be voluntarily influenced; accordingly, both can entail responsibility: we may carry personal responsibility for the influence we exert both over conscious and over non-conscious neural states and processes and are, in that sense, responsible for some of the things that our non-conscious makes us do. In this account, non-conscious volition is not in principle exempt from moral responsibility. Given a certain level of maturity and health, the volitional human brain embedded in its cultural, social and historical context is a responsible organ.

### The Neural Basis of Morality
*The naturalistic fallacy revisited*

The explanatory relevance of neuroscience to moral thought presupposes an informed materialist

model of the mind and the brain that takes variability, emotions and creative thinking into account. According to informed materialism the brain is a variable, selectional system in which values are incorporated as necessary constraints. Biologically speaking, no creature with a brain is born value-free; it is neurobiologically predisposed to develop these complex and varied systems of values that enable it to function in its physical and social environments. In this model, the human propensity for passing moral judgment and capacity to perform free and responsible moral choices do not only make logical and practical sense but are biologically unavoidable for adult, healthy individuals. Four innate closely related preferential tendencies have evolved in the human species: self-interest, desire for control and security, dissociation from what is considered disagreeable or threatening (e.g., our own body, or nature), and selective sympathy versus antipathy towards others, both of which presuppose empathy (understanding) of others. Empathy is directed to far larger groups than sympathy: by nature, humans are empathetic xenophobes typically dissociating themselves from most other creatures. The neurobiology of sympathy and antipathy, and our numerous 'we-they' distinctions, as expressed, e.g., in racial or ethnic attitudes, are increasingly being studied. It is an important task for neuroscience to diagnose the human predicament in neurobiological terms, knowledge that can be useful, e.g., in the development of educational structures, or in the assessment of methods to remedy social problems. The theoretical and methodological relevance of neuroscience to ethics is strong and fast developing. According to the theory of neuronal epigenesis, socio-cultural and neuronal structures develop symbiotically with mutual causal relevance. The architecture of our brains determines our social behaviour including our moral dispositions, which influences the types of society that we create, and, vice versa, our socio-cultural structures influence the development of our brains. This is compatible with the position that norms cannot logically be derived from facts on pain of committing the naturalistic fallacy, which is an irrelevant objection to informed materialism.

## Helping the Brain Forget

*Perspectives on therapeutic forgetting*

Human beings strive to use their advancing knowledge about brain architecture to achieve increasing control over their brain's design and functions. One of the most desired goals of human brain design is to gain mastery of our own memories: enhancing our capacity to remember as well as our ability to forget. The human brain needs to maintain equilibrium between memory and oblivion and naturally rejects irrelevant or disruptive memories. However, extensive amounts of stress hormones released at the time of a traumatic event can give rise to such powerful memory formation that traumatic memories cannot be rejected and do not vanish or diminish with time: post-traumatic stress disorder may then develop. Recent pilot studies in the field suggest that it is possible to help the brain forget disturbing memories and induce so-called "therapeutic forgetting". Beta-blockers stopping the action of these stress hormones are suggested to reduce the emotional impact of disturbing memories or prevent their consolidation. Such intervention could in principle help people who suffer from post-traumatic stress disorder, but the idea of doing so is both scientifically and ethically controversial. The aim to gain control over memory functions in order to help people suffering from disorders is laudable, and from an ethical point of view there is no intrinsic problem with the development of methods to induce therapeutic forgetting. If controlled use of propranolol can cure people from, or help prevent PTSD that is laudatory. In contrast, it may encounter extrinsic problems if the techniques are misused or inadequately justified scientifically. Whether the benefits are sufficient to counterbalance the possible risks of (civilian or military) misuse is an essentially socio-political question that natural and social scientists, philosophers and policy-makers must answer by joint efforts. ■

## Paolo MANCOSU

Professor of Philosophy at the University of California, Berkeley (USA)
invited by the Assembly of the Professors on the proposition of
Prof. Jacques Bouveresse.

He has given 29 march 2007, one lecture entitled:
Mathematical explanation: Why it matters

The topic of mathematical explanation has recently been the subject of much interest. Although attention to mathematical explanation goes back to the Greeks, the recent revival in the analytic literature is a welcome addition to the philosophy of mathematics. In this talk I have set myself two goals. The first is that of giving a survey of the literature on mathematical explanation and of how the different contributions in this area are connected. Secondly, I would like to show that mathematical explanation is a topic that has far-reaching ramifications for many areas of philosophy including, in addition to philosophy of mathematics, epistemology, metaphysics, and philosophy of science.

I begin by clarifying two possible meanings of mathematical explanation. In the first sense 'mathematical explanation' refers to explanations in the natural or social sciences where various mathematical facts play an essential role in the explanation provided. The second sense is that of explanation within mathematics itself. The interest of mathematical explanations of scientific facts consists, from the point of view of theories of explanation, in the challenge they pose to the causal theory of explanation. However, until recently very little attention has been devoted to them. Accounting for such explanations is not an easy task as it requires an account of how mathematics hooks on to reality, e.g. an account of the applicability of mathematics to reality. And this opens the Pandora box of models, idealization, etc. In addition, mathematical explanations of scientific facts have also played an important role in recent discussions on the indispensability argument. In particular, a recent article by Baker (*Mind*, 2005) proposes a new version of the indispensability argument that, unlike the traditional one, does not depend on holism. The idea is that we ought to be committed not to any part of mathematics that gets applied in science but only to those parts of mathematics that play an essential role in the explanation of scientific facts. This is an interesting line of thought but we still badly need case studies of mathematical explanations of scientific facts that will allow us to obtain a better conceptual understanding of this type of explanatory activity.

After pointing out that similar indispensability arguments can also be developed within pure mathematics and that it is unlikely that an account of mathematical explanation of scientific facts will be independent of an account of explanation within pure mathematics, I proceed to discuss explanations in pure mathematics. The history of the philosophy of mathematics shows that a major conceptual role has been played by the opposition between proofs that convince but do not explain and proofs that in addition to provide the required conviction *that* the result is true also show *why* it is true. Philosophically, as I have shown in previous work, this tradition begins with Aristotle's distinction between *to oti* and *to dioti* proofs and has a rich history passing through, among others, the Logic of Port Royal written by Arnauld and Nicole, Bolzano, and Cournot. The opposition between explanatory and non-explanatory proofs is not only a product of philosophical reflection but it confronts us as a data from mathematical practice. A mathematician (or a community of mathematicians) might find a proof of a certain result absolutely convincing but nonetheless he (they) might be unsatisfied with it for it does not provide an explanation of the fact in question. After providing evidence from several mathematicians, including Mordell and Brumfiel, I discuss the two major accounts of mathematical explanation available in the literature, those of Steiner and Kitcher, and point out their shortcomings using some of my recent work and other literature in the area. The last section of the talk relates the problem of mathematical explanation to that of abstraction and generality in mathematics.

I conclude by summarizing why the problem of mathematical explanation matters to epistemology, ontology, and philosophy of science. ■

## Adelheid OTTO

Professor at the University Ludwig-Maximilian of Munich (Germany)
invited by the Assembly of the Professors on the proposition of Prof. Jean-Marie Durand

She has given 16 and 19 march 2007, two lectures entitled:
1. Tall Bazi, fortress in the Euphrates valley from the IIIrd millennium BC until Roman times
2. Tuttul/Tell Bica, a Syrian metropolis in the Bronze Age.

Tall Bazi is situated in Northern Syria at the upper Syrian Euphrates within the Tishrin dam salvage area. Rescue excavations were conducted by the German Archaeological Institute Damascus (1993-1998), since 1999 by the Ludwig-Maximilians-University Munich and financed by the DFG. They are directed by Berthold Einwag and Adelheid Otto.

The site consists of three parts: the Citadel, the Northern Lower Town and the Western Lower Town. While most of the lower town has been flooded, the Citadel, situated on a 60m high, natural mountain spur, now borders the Tishrin lake.

The „Weststadt" is an enlargement of the ancient settlement, that is a ‚new town' of the Late Bronze age (XIV-XII cent. BC). The houses still contained most of the inventories, because the settlement was violently destroyed and burned. This allows to reconstruct the function of the single rooms and the houses on a whole. The striking uniformity of the 50 excavated houses as well as the relatively similar size of the plots speak in favor of a little stratified society. Although 10,000 m² have been excavated, no buildings other than domestic structures came to light.

The contemporary texts from the neighbouring cities Emar, Ekalte and Azu show that the ‚Elders with the city god' guided the fate of the cities and the ‚Brothers' decided in private law affairs. This little stratified society is mirrored not only in the architecture of Tall Bazi, but also of other sites of Euphrates valley: no building ressembling a palace can be founded in any of the investigated settlements. Only houses and temples are attested for Tell Hadidi (Azu), Meskene (Emar), Munbaqa (Ekalte) and Tall Fray.

Our excavations at the fortified Citadel of Bazi revealed the same situation: on its plateau their is no residence, but a temple with two rooms. 38 m long and 16 m wide with 3m broad walls, it is one of the largest temples in Syria during the Bronze age. Two cuneiform tablets, found on the floor of the temple, are royal documents of the Mitannian kings Saushtatar and Artatama (end of XV and early XIV cent. BC).

The entrance of the temple, excavated in 2006, was flanked by two lion orthostats, of which only the paws are preserved. Nevertheless, they take an important place within the corpus of lion orthostats (a common decoration in the following Iron age): only the orthostats at Ebla (XVIII cent. BC) are definitely older.

The defense of the Citadel was effected by an elaborated system of walls, which ran around the steep flanks of the hill, and by an artificial ditch which separated the Citadel of the mountain ridge. In 2004 building 2 was discovered, a highly fortified entrance of the Early Bronze Age IV, close to the artificial ditch. It clearly demonstrates that all the Citadel dates to the IIIrd millennium – one of the most intriguing results. For the moment this is the most ancient fortress on a hill which exists in the Near East. Apparently it continued to be used during the following periods until Roman times, when the border between the province ‚Syria' and the Parthian Empire was situated here in the Euphrates valley.

The ancient name of the site may be deduced from an inscription of the Akkadian king Narâm-Sin (appr. 2250 BC). His description of the Citadel of ‚Armanum' fits quite well the archaeological remains at Tall Bazi. Armanum equals Armi/Armium of the Ebla-texts, the city which is after Mari et Emar most often mentioned in the texts. The Ebla texts concerning Armi/Armium confirm our identification, as well as the etymology of the name Armi, derived from ᶜRM, "steep height".

The Citadel represents the highest part of the Early Bronze age town. In total, the ancient town covered an area of 39 ha and thus constitutes one of the largest Syrian towns during Early Bronze age IV. The elaborated fortification of the citadel supposes that there stood important buildings ontop. Indeed, in all the trenches we uncovered BA IV levels on top of the rock. We hope to have the opportunity to investigate the nature of these structures in the future. ■

# Artificial man in the service of society
## Collège de France reopening symposium
## 12 and 13 October 2006

The title of this symposium may seem disturbing or provocative. 'Artificial man' conjures up the spectre of Golem, Frankenstein or the many other frightening creatures in myths and other fruits of the imagination. It was therefore interesting to go back over this mythology of the artificial man and robots that has haunted human imagination and culture at least since Hephaestus, Vulcan and Daedalus.

The idea that one can actually replace humans by machines is nothing new. The Greek gods were precursors in this respect. The Iliad suggests that Hephaestus was one of the first to produce artificial creatures, with his golden maidservants and animated tripods carrying the products of his forge to Olympia. King Minos' Crete was guarded by Talus, a brazen robot which, when incandescent, clasped the king's enemies in a fatally warm embrace.

A series of myths and legends relate attempts to create artificial beings. Some, like Pygmalion's statue, are appealing; most are frightening. The Renaissance mechanics and the automats and machines of the 17th and 18th centuries gave a touch of technical and optimistic reality to these early dreams from Greek antiquity. Finally, with the cognitive sciences and neurosciences, debates arose on the conception of the mind as a machine and even on the conception of virtual human beings. There is thus a long cultural tradition concerning machines, sometimes constructive, sometimes destructive and conveying a more or less veiled threat of destruction of humanity.

Medicine, by contrast, appears as a technique of reparation and care, aimed at combating death and disease, at overcoming deficits, at helping those suffering from disabilities. It invites us to reconsider the common tendency to discredit the artificial and to celebrate the natural. We need to be reminded that death is natural, that plants are often toxic, that venomous animals do exist, that disease is natural too and that we are overwhelmed by epidemics. This is enough to have some reservations on the hypothesis of an 'intelligent' plan that supposedly organized nature rationally, contrary to neo-Darwinian evolutionary theories.

Let us praise the artificial. Medicine is a human invention to fight against the suffering and all the evils plaguing humanity in the natural world. It is above all artificial. We actually live in an increasingly artificial world. Our food has been artificial for a long time. Plants used for food have been selected genetically since the Neolithic, through a slow transformation of natural varieties. It took tens, even hundreds of thousands of years to select varieties for human consumption. Technological developments and artificiality have thus been introduced not only into medicine but also into food. Very often the artificial frightens, when food is concerned; we disapprove of everything that seems to be 'chemical' or 'genetic' in food. But that means forgetting that an apple consists of nothing but chemical elements, like our bodies and brains.

Praising the artificial requires us to remember that in this world of techniques and artefacts in which we live, we expect machines to function more and more efficiently. When the telephone is down we feel helpless. If

Profs. Jean-Pierre Changeux and Pierre Corvol

the doctor cannot heal us, it is because science is too slow. Among our contemporaries a demand is developing for artificiality.

Without lapsing into technophile and scientistic optimism, we can consider that, on the whole, technological developments have contributed towards the welfare of most people in industrialized societies. Technophobic mistrust may be fashionable nowadays, but it is not all that unjustified to have confidence in science and to place reasonable hopes in it.

To be sure, this invasion of the technological for the good of humanity is not devoid of problems. In medicine, finance and all the domains that rely on increasingly powerful technologies, those same technologies expose us to failures and errors, and can be diverted from their initial purposes.

The universalism of technology warrants closer examination. Most important, probably, is to ensure that these techniques and artificial facilities made available to humanity are equally distributed on

a global scale. The symposium hardly addressed this question, as the scientific committee chose to focus on certain concrete aspects of scientific and technical progress and of living conditions, and to postpone the examination of social aspects to a later symposium. Yet an equal distribution of the benefits of science and technology on a global level should be a priority, in the name of justice and human rights. We are still very far from that goal. This is one of the problems, for example, with medical and pharmaceutical research which concentrates primarily on diseases prevalent in developed countries. Fortunately certain forces are striving to solve these problems: organizations such as INSERM, the Pasteur Institute and private foundations are endeavouring to ensure that the benefits of scientific progress are spread more evenly across the world. This is a political problem; policy-makers and decision-makers need to be made aware of these issues.

We also need to ensure that everyone is granted equal protection against risks. Scientific and technical development demands the most basic precautions and risk management. There has to be control by the law courts and equal protection against possible risks and misappropriation, along with compensation, for instance in the case of disabilities.

These concerns are our responsibility, as is stated in the universal declaration of human rights which invokes the concepts of fraternity and solidarity. These secular and common virtues are bound to no cultural tradition, but simply to a universal human nature.

Another subject of concern, in the context of this contemporary evolution of science and techniques, pertains to the future of humanity. Science universalizes. It offers humanity as a whole, without any distinction of cultural or ethnic groups, its results and the benefits that can be expected from it as regards living conditions and quality of life – a concept that is difficult to define. In parallel, we note that human groups are withdrawing into themselves and engaging in serious wars. A profound disharmony is therefore appearing between scientific evolution and the life of individuals in society. This has crucial implications for education. Education takes place during the period in which our brain is developing and the synapses are formed. This cultural epigenesis is a slow, gradual process which impregnates the brain, in a sense, for the rest of the person's life. It is difficult to teach a new language to someone who has already learned a native tongue; it seems that a child's mind is imbibed with cultural, philosophic and religious traditions in much the same way. Paul Ricoeur compared the establishment of symbolic systems with the acquisition of a language. For a neurobiologist, acquiring a language is the result of physical interaction between the signals of the outside world and the organization of the brain. We can refer in the same way to the creation of 'cultural circuits' in the brain.

Science and techniques are evolving at an extraordinary pace, in the course of one lifetime, especially with the lengthening of life expectancy. Most biological knowledge has been acquired over the past twenty to thirty years. This very rapid evolution of the scientific world can clash with the cultural imprints that we received during our childhood.

The solution depends on our mental flexibility and the possibility of changing our views. It is not enough to try to find things in common with others, to seek compromises with new ways of thinking and living. Instead, it is probably necessary for everyone to agree to alter their own identity a little, to the benefit of a truly collective and universal common good. We must guard against communautariste ideas that emphasize cultural differences and claim that they are immutable. In the spirit of human rights and by means of education, we should, on the contrary, develop our thinking and agree to change, even if it means giving up a part of our identity. Education is the crucial point here. Yet the accent is put on the potential developments of science and technology, and too little attention is paid to children's education and the cultural environment in which they live, so often saturated with violence through the media and games. Parents need to become aware of the power of the image and learn not to leave their children to watch television without any adult control. This is the responsibility of parents and educators, not of techniques. These issues are too often absent from reflection on science and technology.

The Collège de France has a role to play in this reflection. The large multi-disciplinary symposiums that it organizes are opportunities for encounters between scientific fields and between differing points of view. These encounters are conducive to the construction of critical approaches and changes of opinion. From a political and ethical point of view, it is important for the different scientific disciplines to engage in open and fruitful dialogue, both with one another and with the human sciences. During this symposium the issue of jurists' doubts was discussed. Such doubts are and should be present in scientists, above all. Major cultural conflicts such as those that we are currently experiencing could be avoided if we agreed to submit to a discipline of dialogue and critical examination like the one found in the sciences. This collective construction and universalism of knowledge is consistent with the spirit of the universal declaration of human rights. The aim of this symposium is therefore to make it clear that scientific and technical progress is not against humans' interests; it is in their service. The intention is to take stock of the scientific and technical progress which enables humans to live in increasingly artificial conditions. This artificiality must be managed to the benefit of society as a whole. We need to conceive of the ethics of the future in a more and more artificial world, and to find harmony and balance between what we are now and what we are likely to be in the future. ■

*Jean-Pierre Changeux*
(closing address, transcription MK)

This symposium to launch the new academic year, organized by a scientific committee of Collège de France professors under the presidency of Jean-Pierre Changeux, is part of a series of multi-disciplinary symposiums on major social issues.

The proceedings of these symposiums are published by Odile Jacob.

The symposiums organized at the beginning of the academic year are funded by the Hugot Foundation.

**TITLES OF THE PAPERS**

- " Around Hephaestus' golden maidservants ", the ancient myth of artificial humans *John Scheid and Jesper Svendro*
- Stem cells and therapeutic cloning, *Nicole Le Douarin*
- Genetic therapy?, *Alain Fischer*
- Chimaera, artifice and imagination, *Françoise Héritier*
- Automats and man-machines: from the Renaissance until today, *Bruno Jacomy*
- From symplectic biology to synthetic biology: are we able to construct a living organism?, *Antoine Danchin*
- The artificial hand, *Maria Chiara Carrozza*
- Blood: replace or copy nature?, *Luc Douay*
- The artificial kidney in France, *Pierre Corvol*
- The electronic doctor, *Patrice Degoulet*
- Mental tools and objects of thought: mathematics, *Jean-Pierre Kahane*
- Is the human brain a Turing machine?, *Stanislas Dehaene*
- From artificial sensors to auditory perception, *Christine Petit*
- Artificial vision: between myth and reality, *José-Alain Sahel*
- Numeric simulations and medicine, *Pierre-Louis Lions*
- Virtual man, *Alain Berthoz*
- Children and the electronic virtual, *Aldo Naouri*
- Is there a (non-electronic) trader in the hall?, *Jean-Michel Lasry*
- Living with a disability and prostheses, *Anne Fagot-Largeault*
- Justice between the robot and the reed, *Mireille Delmas-Marty*
- Of Machines and Men, *Erich Spitz*
- Future humans and human rights, *Jean-Pierre Changeux*

# Mathematics, Physics and Philosophy

## Symposium for the commemoration of the centenary of the death of Ludwig Boltzmann (1844-1906)

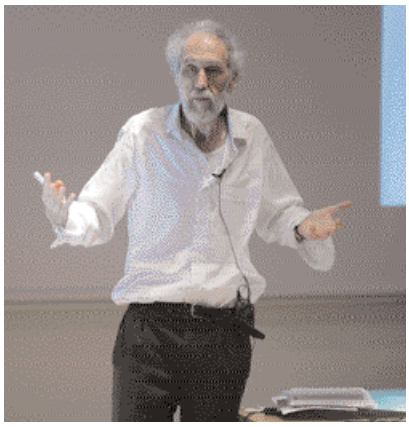
Organized by Prof. Jacques Bouveresse (Collège de France)
22 November 2006

Ludwig Boltzmann, who was born in 1844 in Vienna, committed suicide on 5 September 1906, the day before the start of the new academic year, during what was supposed to be a period of rest and relaxation with his family in Duino. Predictably, a great deal has been written, speculated and invented concerning the real reasons for his suicide. Many myths are still circulating, intended to present him as a sort of hero and martyr of the truth, the victim of misunderstanding and persecution by a hostile scientific community. Yet, although it is true that his ideas were not readily accepted, and even encountered strong resistance, at the time when he decided to take his own life few physicists in Europe enjoyed a reputation and authority comparable to his.

Thus, as well as being the centenary of the birth of Gödel, another one of the most eminent scientists and thinkers that Austria has produced, the year 2006 was the centenary of Boltzmann's tragic death. It was a centenary that was unfortunately likely to be overshadowed by that of the discovery of the theory of relativity, only one year earlier. In his book *Ludwig Boltzmann, Mensch, Physiker, Philosoph*, published in 1955, Engelbert Broda commented that 'at a time when the word "atom" is before the readers' eyes daily, the layman can hardly conceive of the difficulty that the pioneers of atomic physics had to overcome barely a half-century earlier, for the atomistic conception of the structure of matter to be recognized as valid by everyone'. Of course this is even truer a half-century later. Few people are still able today to imagine the battle that Boltzmann had to wage for his ideas to prevail, and the fact that he eventually could have had the feeling to be completely defeated. From an historical point of view this is a tragic irony since, in the years immediately following his death, the ideas for which he had fought and which he had not succeeded in imposing himself, gradually gained currency almost everywhere.

Boltzmann was one of the physicists who played a decisive part in the evolution and final triumph of the kinetic-molecular theory of heat and of matter. His name will forever be associated with two contributions that immortalized him: the definition of entropy as a well-defined mathematical measure of what can be called the 'disorder' of atoms – a definition expressed in the famous formula engraved on his tombstone at the Vienna Central Cemetery – and Boltzmann's equation which, from an historical point of view, was the first equation to describe the evolution of a probability in time. This equation is used today in a multitude of fields, seemingly very different and distant from that of the kinetic theory of gases. There is no longer any doubt that, as Felix Klein put it, 'it was Boltzmann, and not Maxwell or Gibbs, who defined exactly how the second law [of thermodynamics] relates to probability, thus creating the topic of statistical mechanics'.

Boltzmann has the noteworthy particularity of having been both one of the last great representatives of classical physics, and one of the pioneers of modern physics. 'The God by the grace of whom the kings reign, is the basic law of mechanics', he said in 1900. He thus continued to affirm the fundamental role of mechanics in theoretical physics at a time when novelty and the future were supposed to be represented by energetism, and when he had the feeling of being one of the last to dare to openly defend the point of view of the Ancients. But his work also had a considerable influence on modern physics in a multitude of

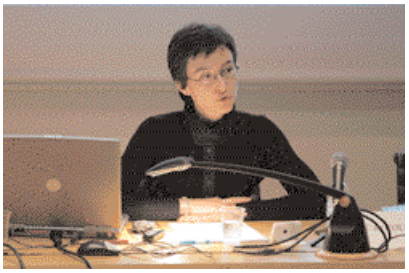


Prof. Alain Connes

ways, especially through Planck's work on light quanta and Einstein's on Brownian motion.

To be sure, the 'atomic hypothesis' for which Boltzmann relentlessly fought throughout his life has changed most significantly, especially since the advent of quantum physics to which his own ideas contributed substantially; and of course quantum particles are very different from classical particles, not to mention the entities which – as he himself was able to envisage and explicitly suggested – could eventually, in the evolution of physics, take the place of particles some day. But, as Roger Penrose points out, it is precisely 'noteworthy that Boltzmann's "classical" atomic image functions so extraordinarily well in normal conditions'. Despite the fact that he considered himself more as a representative and defender of ancient physics, and that his mode of thinking gives the impression of being essentially of the 19th century, Boltzmann was actually at the centre of a major scientific revolution. It is no exaggeration to say that, while the classical physics era closed around 1900, and a new era started at that point for physics, it was his work that effectively bridged the gap between 19th and 20th century physics.

Yet Boltzmann was able to be such a brilliant and revolutionary physicist only because he also had an interest and remarkable skills in mathematics (he lectured in pure mathematics at the University of Vienna from 1873 to 1876). This was a decisive advantage for him in the confrontation with the representatives of the energetist school, such as Mach, Ostwald and Helm. He had highly interesting ideas, from today's point of view, on what mathematics and physics could and should learn from each other. Boltzmann was for instance particularly concerned about knowing whether his famous H-curve – which during the last years



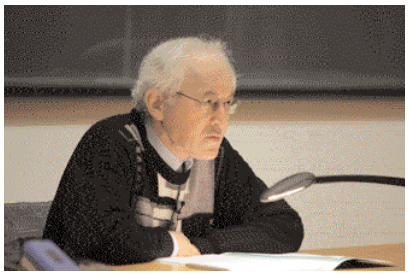
Nadine de Courtenay

of his life, in moments of depression, he thought was perhaps meaningless from a physical point of view – had any strictly mathematical value or not. In a letter dated 15 March 1898 to Felix Klein, he wrote: 'I am delighted that mathematicians are showing some interest in the H-curve. Something of this kind only gains substance when it is freed by mathematics from the special physical need'.

There has also been some awareness, for quite a few years now, that Boltzmann made a significant contribution to the philosophy of science, even if for a long time it was far less known and influential than that of Mach. (It is generally acknowledged that he anticipated certain basic ideas in Popper's epistemology, especially the evolutionary conception of the theory of knowledge and of epistemology, based on Darwin's theory, of which he was a fervent supporter, as well as certain aspects of Kuhn's theory of scientific revolutions.) We now know, mainly from manuscripts and letters published recently, that during the last years of his life he even tried to work seriously on philosophy itself and to write a philosophical book in due form. (There was at that time a very interesting correspondence between him and Brentano, whom he, in some sense, took as an adviser for the philosophical beginner he had the impression to be.) That gives us a more precise idea of the reasons why he can be considered as a representative not only of Austrian physics, but also of what we have become accustomed to calling the Austrian philosophical tradition, and of the way in which his ideas influenced a philosopher like Wittgenstein or the members of the Vienna Circle, and anticipated certain theses of 'analytical' or 'linguistic' philosophy. He may well have been a pioneer in this field too. If Frege can be seen as the father of analytical philosophy, it is not completely absurd to suggest that Boltzmann might have been somehow one of its grandfathers.

Boltzmann's contribution to theoretical physics was indeed exceptionally important, and the final acknowledgement of the place of theoretical physics and theory in general in science was largely owing to the battle that he waged for them

Prof. Pierre-Louis Lions



Prof. Jacques Bouveresse

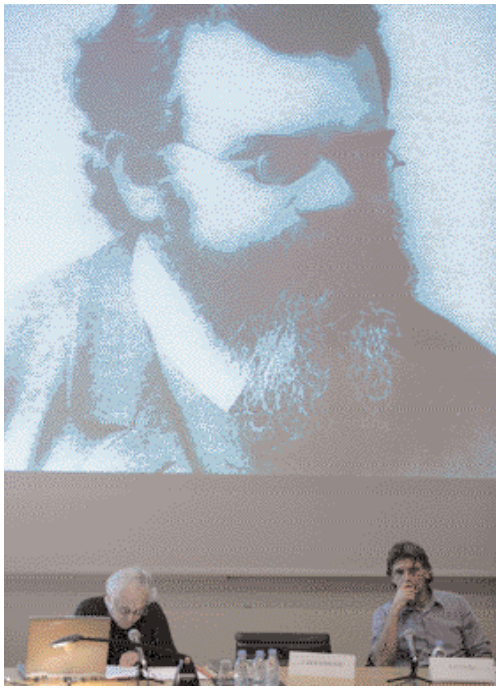
under difficult conditions (as David Lindley noted in a recent book, in a sense he 'left his intellectual imprint on the very idea of modern theoretical physics'). But he was also an exceptionally talented and inventive experimental physicist, and an advocate for new techniques and technology in general, with respect to which he thought that 'pure' science would be wrong to manifest a somewhat contemptuous feeling of superiority. There is nothing more practical than theory, he said, but there is also nothing to which the origin of science owes more than purely practical needs. Therefore, no one would have been happier than he to see, for instance, that his famous equation is still both an important object of research and discovery in pure mathematics, and a tool used to solve the most technical problems.

On this day of commemoration, which has brought together representatives of mathematics, physics, the history and philosophy of science, and philosophy itself, we have tried to do justice to some of the most important aspects of Boltzmann's work and to the considerable heritage that he left, in a multitude of fields where his presence is often barely suspected and even less recognized, going from science in its most technical fields and developments to some of the most significant aspects of the general knowledge and culture of our time. A complete overview of the successes of his ideas throughout the 20th century and still today is obviously impossible. More modestly, we have wanted to show through a few key examples just how wrong the physicist was when, at the end of his life, he feared seeing an era of 'energetic barbarianism' destroy the influence of his life's work for a long time. Today the future of that work seems more sure and brilliant than ever. ■

*Prof. Jacques Bouveresse*

On the occasion of this commemoration, the following talks were delivered:
- Pierre-Louis Lions (Collège de France), *Boltzmann et la modélisation mathématique*
- Bernard Derrida (ENS), *Le rôle des fluctuations en physique statistique*
- Olivier Darrigol (CNRS – REHSEIS), *Le va-et-vient entre les points de vue global et moléculaire dans les recherches thermo-statistiques de Boltzmann*
- Alain Connes (Collège de France), *Temps et thermodynamique quantique*
- Nadine de Courtenay (CNAM and REHSEIS), *La philosophie des sciences de Ludwig Boltzmann : une 'aventure technique'*
- Jacques Bouveresse (Collège de France), *Ludwig Boltzmann et le problème de l'explication dans les sciences.*

These talks can be downloaded from the Collège de France website (Prof. Bouveresse's page, section 'colloquiums').



Profs Jacques Bouveresse and Pierre-Louis Lions

# Collège de France colloquium in Berlin

## The new world of public health and prevention

The second Collège de France colloquium abroad was held in Berlin on 11 and 12 May 2007. It was organized in cooperation with the Berlin-Brandenburg Science Academy (*Berlin-Brandenburgische Akademie der Wissenschaften*) and the Charité Medical University of Berlin. The French Embassy's support allowed for simultaneous translation into French and German.

The colloquium was opened by S.E. Claude Martin, Ambassador of France, Professor Günter Stock, President of the *Berlin Brandenburgischen Akademie der Wissenschaften*, Prof. Detlev Ganten, President of Charité, and Prof. Pierre Corvol, Administrator of the Collège de France.

Prof. Pierre Corvol

Prof. Detlev Ganten

As Pierre Corvol, Administrator of the Collège de France, explained, this colloquium was intended to initiate multi-disciplinary dialogue with a view to furthering our understanding of the importance and complexity of the issues encompassed in the term 'public health', as well as the challenges, both present and future. This highly topical subject is a particularly sensitive issue in Germany. The term 'public health' has no equivalent in German (the English term is used), and similar German expressions still have strong connotations relating to Nazism. This colloquium was therefore an opportunity to reopen the debate on public health problems in Germany in new terms. It marked a turning point in the German approach to these concerns, as it coincided with the announcement of the creation in 2007 at the Charity Medical University of Berlin – a partner in the colloquium – of a new multi-disciplinary school of public health (the Berlin School of Public Health).

The first session of the colloquium was devoted to lessons from history. It was opened by Anne Fagot-Largeault (Collège de France) who presented the first steps in the development of modern hygiene (gradual appearance of social statistics from the 16th century, public health councils in 18th century cities, and the teaching of hygiene in the medical curriculum in the 19th century); then its peak in the mid-19th century (the administration, through laws and institutions, was aiming to act as the instrument of a scientific hygiene policy); and finally its decline from the early 20th century, due to hygienists' excesses, the exclusion of doctors to scientists' benefit, and insufficient attention paid to the conflicts of interest inherent in a veritable public hygiene policy. This periodization largely overlaps that proposed by Patrice Bourdelais (Paris, EHESS) and Paul Unschuld (Berlin, Charité). Bourdelais has emphasized the coincidence of public health preoccupations with the emergence of citizenship and the ideals of the Enlightenment after the French Revolution, as well as the importance of intellectual interaction between 19th century scholars, which largely explains the simultaneity and similitude of public health policies in Northern Europe at the time. Paul Unschuld has related the acme of public health policies to the expectation, from the late 18th century, of a strong and therefore healthy state (men in good health for the factories and the army). He shows that they subsequently declined in the period when these constraints were less prevalent and when health, which had become the affair of individuals, was taken care of primarily by individual medicine. Yet, as Anne Fagot-Largeault has argued in her conclusion, modern hygiene has not disappeared: many signs today attest to a revival of public health concerns and a rehabilitation of prevention, neglected for a long time when an essentially curative approach was favoured instead.

This necessity to grant more importance to prevention (to 'public medicine' on the one hand, alongside 'individual medicine', as Paul Unschuld put it), appeared clearly through the four case studies that comprised the second session: cardio-vascular diseases; infectious diseases (especially tuberculosis which, with 15,000 new cases per day, causes two million deaths annually), Aids, and obesity. The latter example was used by Arnaud Basdevant (University Paris VI) to emphasize the complexity of prevention which cannot rely only on individual responsibility (a healthy diet and physical activity in the case of obesity); it also needs to concern the social, economic and living environment (via the construction of public sports equipment and bicycle lanes, for instance, or the struggle against social discriminations highlighted by several surveys). This second, more indirect aspect of preventive measures does not seem to be taken into account sufficiently in the prevention policies implemented today, even though it has been shown that economic factors play a crucial role in the case of obesity. For instance, access to food with a healthy calorie level is impossible for people who live on less than €2.40 per day – a situation that concerns over two million of our fellow citizens. Michel Kazatchkine (Executive Director of the World Fund to combat Aids, tuberculosis and malaria) and Stefan Kaufmann (Max-Plank Institute, Berlin), amongst others, have emphasized the crucial importance of the economic aspect since, when it comes to public health and prevention, those populations concerned the most are also the poorest, at a national as well as at a global level. There is far too little interest among pharmaceutical laboratories in research on the three main epidemics world-wide – malaria, Aids and tuberculosis – and the production of vaccines, which should be a priority.

The third session of the colloquium examined comparative studies of public health policies and of the institutions responsible for them (between European countries or between Europe and other counties), and the way of addressing the new challenges that have appeared in recent years. Didier Tabuteau (Paris, IEP) spoke about the problem of sanitary security which reappeared in the 1990s during the contaminated blood affairs, and the role of the agencies (re)created at the time of that crisis. Françoise Forette (Assistance publique des hôpitaux de Paris) considered the question of longevity and the challenge of developing and restructuring geriatric services to ensure that the cost of caring for the dependent aged does not increase in proportion with their (constantly growing) numbers.

Health, a global public good? The last speakers endeavoured to answer this question from various points of view: political (Bernhard Badura, Bielefeld), economic (Roger Guesnerie, Collège de France), biological (Philippe Kourilsy, Collège de France) and methodological problems (Karl Wegscheider, Hamburg). Although it is difficult to define, health appears to be a good that is at least 'collective' in so far as it concerns the community and benefits everyone by benefiting each individual. This is true at a national level but also on a global scale, on which one has to reason today. There is still a long way to go to bridge the '90/10 gap', i.e. the fact that 90% of the world's financial resources for medical research benefit 10% of the population.

The speakers also stressed the need to renew approaches concerning prevention, especially in developing countries. Philippe Kourilsky, for instance, argued for an evaluation and reform of regulations concerning new drugs, and for the establishment of a real field science in which experience and knowledge acquired in the field could be applied. Pierre Rosanvallon (Collège de France), scientific organizer of the colloquium, clearly emphasized in his conclusion that issues of prevention and public health involve complex balances (between individual and collective responsibility, long-term efficiency and short-term profitability, respect for individual freedoms and restrictive aspects of the measures to adopt), which demand a multi-disciplinary approach – like that of the colloquium. Health is not simply a question of physiology; as Pierre Rosanvallon put it, it has 'a total social phenomenon dimension'. ■

*Céline Vautrin*

The talks given during this colloquium can be listened to on the Collège de France website (www.college-de-france.fr), both in French and in German.

S.E. Claude Martin, Ambassador of France, Prof. Detlev Ganten, President of Charité and Prof. Pierre Corvol, Administrator of the Collège de France, at the French Embassy in Berlin.

## Program

Friday 11 May 2007

The lessons of history

Prof. Anne Fagot-Largeault, Collège de France, Paris

**From public hygiene to public health**

Prof. Patrice Bourdelais, EHESS, Paris

**Public health, field of progress and citizenship issue (18th to 20th centuries)**

Prof. Paul U. Unschuld, MPH, Direktor, Horst-Görtz-Institut für die Theorie, Geschichte und Ethik Chinesischer Lebenswissenschaften, Charité, Berlin

**The political perception of public health – an historical perspective**

Dr Carsten Mantel, MPH, Leiter, International Health Programme, Institut für ropenmedizin, Charité, Berlin

**From public health to international and global health**

Revolutions and contemporary challenges: case studies

Prof. Rainer Dietz, Charité, Berlin; Mitglied der BBAW

**Cardio-vascular diseases**

Prof. Stefan Kaufmann, Max-Planck Institut für Infektionsbiologie, Berlin; Mitglied der BBAW

**Infectious diseases: tuberculosis**

Prof. Arnaud Basdevant, Université Paris VI, Paris

**Obesity, a new challenge for public policies**

Prof. Michel Kazatchkine, Executive Director of the Global Fund to Fight Aids, Tuberculosis and Malaria

**The Aids issue**

Saturday 12 May 2007

The institutions managing public health: a comparative approach

Prof. Didier Tabuteau, Institut d'Études Politiques de Paris

**Sanitary security, institutional reform or reappearance of public health policies?**

Prof. Reinhard Busse, MPH, Berlin

**Comparative European perspective on the health systems of social insurance**

Prof. Françoise Forette, Assistance Publique Hôpitaux de Paris

**The implications of longevity**

Prof. Adelheid Kuhlmey, Charité, Berlin

**Demographic trends, the new challenges and institutional demands**

Health, a global public good?

Prof. Bernhard Badura, Bielefeld

**Political dimension of public health**

Prof. Roger Guesnerie, Collège de France, Paris

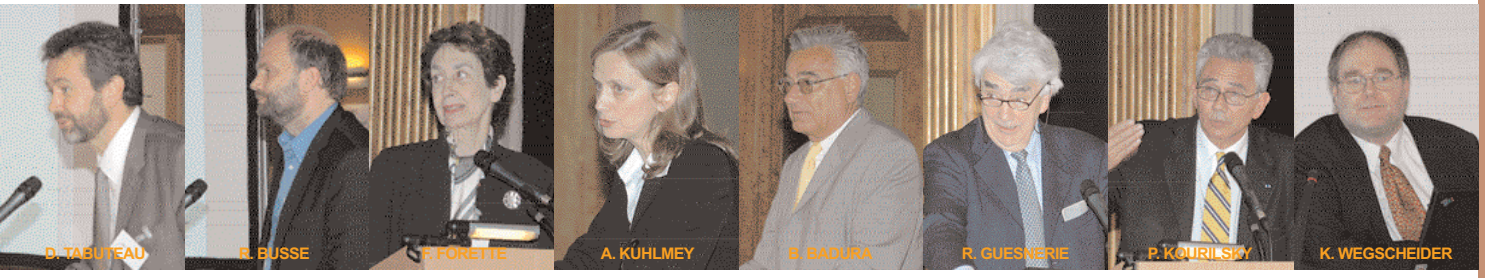
**Global public goods – an economistic point of view**

Prof. Philippe Kourilsky, Collège de France, Paris

**Science and actions in the field**

Prof. Karl Wegscheider, Hamburg

**Methodological challenges in public health**



This colloquium was organized jointly by Prof. Pierre Rosanvallon, holder of the Chair of Modern and Contemporary History of Politics, and Mr Detlev Ganten, President of the Charité Medical University of Berlin (Germany) and President of the Collège de France's Scientific and Strategic Orientation Committee (COSS).

At the dawn of the 21st century, public health issues are one of citizens' and governments' main concerns. New epidemics such as Aids and new threats such as SARS have appeared. Problems relative to lifestyle, such as obesity, have become major health challenges of a kind previously unknown.

In these areas more and more questions are arising on the conditions of an operational global management. Which institutions, procedures, financing and rights ought to be established to ensure effective management and reduce the worst inequalities? Like environmental and climate-change issues, those of public health are core challenges that the community of nations will have to meet in coming years. The gravity of the situation is an indication of the amplitude of the task.

We cannot move forward to meet these challenges without a methodological review of actions already undertaken in the field. The long history of hygienism and sanitary management of populations by states has many lessons and warnings, not always heeded. The very terms on which these issues are apprehended, as well as the redefinition of public health as a global collective good, should also be revised.

At the crossroads of science and action, economics and politics, national public interventions and international action, the management of public health problems first requires joint reflection by different categories of specialists who are too seldom invited to work together. The aim of this colloquium is to advance in this direction by bringing together the best professionals and the main French and German decision-makers on these issues. Biologists, doctors, historians, philosophers, economists and the heads of national and international public agencies are going to work together during these two days to explore 'the new world of public health and prevention'.

*Prof. Pierre Rosanvallon*

C. Mantel and Prof. P. Rosanvallon

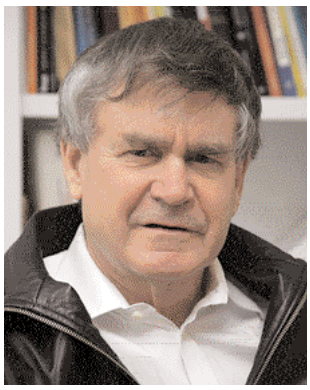
Crédits stills pp. 29-32 : Berlin-Brandenburgische Akademie der Wissenschaften / A. Schaefgen.

At the public conference on the evening of 11 May, French and German political personalities spoke on the subject of public health in the presence of Ms Katrin Lompscher, German Minister of Health, the Environment and Consumer Protection, who delivered a paper.

A discussion on health in large cities was then held between Prof. Didier Houssin, Director General of Health (Paris), Prof. Reinhard Kurth, President of the Robert Koch Institute (Berlin), Prof. Alfred Spira, Inserm U569, Kremlin Bicêtre Hospital (Paris), and Prof. Stefan Willich, Director of the Institut für Sozialmedizin, Epidemiologie und Gesundheitsökonomie, Charité – Universitätsmedizin (Berlin).

Public Lecture

# Philosophers of the sciences and the secrets of nature



Prof. Ian Hacking

Lecture given at the University of Cordoba (Argentina), 14 March 2007 where he was awarded a doctorate honoris causa.

I should like to take this occasion to say a few words about the sciences, philosophy, nature, and the search for truth. It was suggested that I say something about what philosophers of the sciences are doing today, but I shall be as much concerned with what we do not do.

About 40 years ago a bizarre engraving caught the attention of my colleague at the Collège de France, Pierre Hadot, the great scholar of neo-Platonism. It is a very strange image. A naked man with a lyre is lifting the veil off a many-breasted and very Egyptian looking goddess. She is Artemis, at whose feet is a volume of Goethe's tract, The Metamorphosis of Plants.

Alexander von Humboldt had it engraved in 1807, for his *Geography of Plants*. As we well know, the understanding of life was forever changed by the travels of two great European naturalists to and around South America: Charles Darwin, of course, but also Humboldt, whose work Darwin adored. Goethe was much pleased when he got the book from the scientist. He wrote in a letter that it was, 'a flattering illustration that implies that Poetry too might lift the veil from nature'.

Lifting the veil from nature? That is what Pierre Hadot contemplated for decades, finally publishing, in 2004, *The Veil of Isis: An Essay on the History of the Idea of Nature* (English 2006, surely, soon, it will appear in Spanish). It is an absorbing discussion of the idea that nature has secrets, that can be discovered (or not) by many means, including the sciences. We philosophers of science tend to become involved in special sciences, or to focus on questions about particular types of scientific inquiry, so I thought it worth while, this morning, to speak about our relationship with nature itself.

And what is nature? At the beginning of modern science, Robert Boyle, one of the first great experimentalists, asked exactly that question. His little pamphlet, *On the Vulgarly Received Notion of Nature*, 1686[1], found eight meanings for the word. Boyle pretty much suggested we scrap the lot. No one paid him any heed. And with good reason. Nature is too deeply entrenched in our awareness of the world.

Nature is awesome. Nature is gentle tranquillity itself. Nature is terrifying. Nature is female. Nature is how things ought to be, a positive value, so natural is best. Nature is crueller even than Man, so that from its very beginning, the human race has had to shield itself from the forces of nature. Nature, above all, is other than us – except that we are part of nature.

And nature has secrets. Most metaphors die in the course of a lifetime. Their play is forgotten, and they become literal or lost. How long can a metaphor live? Pierre Hadot's absorbing book is written around a single phrase: Nature likes to hide. That is a mistranslation of a fragment that Heraclitus inscribed some 2500 years ago. As Hadot likes to say, 'To write the history of thought is sometimes to write the history of series of misinterpretations'.

The saying, that nature likes to hide, is alive and well. Here is a physicist, Steve Chu, in 1994: 'I'm betting on nature to hide Bose condensation from us. The last 15 years she has been doing a great job.' Bose condensation is a weird phenomenon that takes place when atoms of the right kind get very cold, ultracold, almost to absolute zero. Einstein foresaw it in 1925, but no one could produce it until 1995. (Chu lost his bet.) Chu shared a Nobel Prize in 1997 for one of the tricks needed to make this strange condensate (using laser light to cool atoms). The people who did make the stuff got another Nobel, 2001. I myself am fascinated by Bose condensation, which was the topic of my address to AFHIC, the

1. R. Boyle, *A Free Inquiry into the Vulgarly Received Notion of Nature*, 1686.

Asociación de Filosofía e Historia de la Ciencia del Cono Sur, in Florianopolis last year.

And what is on the back of the gold medals for physics and chemistry that these physicists received? An engraving of Nature, whom the Swedish academy describes as a goddess resembling Isis. She is being unveiled by an unclothed youth, the genius of science. He is revealing her secrets, including her breasts. I have discovered that some, and possibly most, physics and chemistry laureates are astonished, or even appalled, when told to look at what is on the back of their medal. They seem never to have noticed the woman being undressed.

Hadot's book has 20 plates reproducing such images – often, less chaste than the Nobel one – throughout the history of modern science. They start with engravings in books by the likes of Leeuwenhoek, great pioneer of the microscope.

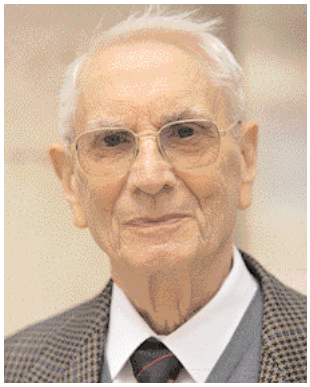

Pierre Hadot,
*Le Voile d'Isis: Essai sur l'histoire de l'idée de Nature*,
Paris: Gallimard, 2004.
*The Veil of Isis: An Essay on the History of the Idea of Nature*, transl. Michael Chase.
Cambridge, Mass.: The Belknap Press, 2006.

The ancients called Heraclitus as 'the obscure one'. No one knows what he meant by the sentence he wrote down. Hadot tries out a few candidates, and favours the unimpressive thought that what causes birth tends to cause death, or what is born wants to die. Only much later do we get 'Nature loves to hide'. The Greek word we translate as nature – phusis (which word became our 'physics') – evolved almost beyond comprehension.

In Heraclitus's day, Hadot teaches, it was nature of; the nature of a thing was on the one hand its process of genesis, appearance, or growth, hence Hadot's reading. On the other hand, it meant a thing's 'constitution, or proper nature' – one of our meanings today, and out of which ancient philosophy constructed essence. But when the word became not of, but absolute, the secrets of nature were much talked about. Nature became personified, and she had secrets, as in the Orphic hymn, 'O Nature, mother goddess of all things, mother of innumerable ruses'. Dame Nature came on stage, although always in the role of a divinity.

Who's who in the images of Nature? Isis is an Egyptian goddess. She becomes identified with Artemis of Ephesus. Nature is progenitor, hence the Egyptians endowed her with many breasts, that she might suckle her creatures. Or maybe not, could those be bull's testicles on Egyptian statues, as some would have it, male offerings to the goddess who creates? The Ephesian version definitely has breasts, six or more, and thus equipped she enters the modern world. But thanks to Heraclitus's maxim, she is veiled.

Nature is as politically alive now as she has ever been, precisely as



Prof. Pierre Hadot

we begin to worry that technology has irrevocably destroyed her, as we debate genetically modified organisms, the climate that we have modified at our peril, or simply how much land we want to consign to what we call nature preserves. Nature works her rhetoric as much as she ever did. Hadot tells us some of the reasons why.

There are two overarching attitudes to nature, Promethean and Orphic.

Zeus, you recall, was disturbed that people were becoming too uppity, and hid fire away from their knowledge. Prometheus by trickery stole it, thus exposing one of the secrets of nature for us all to use. There is a raft of metaphors at work here. Secrets must be extracted from nature. The initial model is not the laboratory but the law. Nature must be brought to court and tried. In a trial, informants were tested by torture. Nature's secrets must be wrung from her. The great prophet of the 17th century was Francis Bacon, who praised not only torture but also dominance. 'I am come in very truth leading to you to Nature with all her children, to bind her to your service and make her your slave.(2)'

2. Francis Bacon, *Temporus partis masculus* [c. 1610]. In B. Farrington, *Temporus partis masculus:* An untranslated writing of Francis Bacon, *Centaurus* 1 (1951): 193-205.

Our present civilization is founded upon the use of 'technical procedures to tear Nature's "secrets" from her in order to dominate and exploit her', writes Hadot, but he urges also that Bacon's programme was clearly foreseen in ancient times, even around the end of the 3rd century BCE. He quotes a long passage including two clear statements: That everything produced contrary to nature is produced by human technology or technique (*techne*); the aspect of technology needed to overcome difficulties is trickery.

The Greek words that he translates as trickery are none other than ancestors of our word, 'mechanics'. It is right to think that a lot of laboratory science is trickery, cunning, which is not to diminish its value. Over eighteen centuries after that 200 BCE talk of trickery, mechanics came into its own, not only with machines but also with what the physicists still call Galilean mechanics, Newtonian mechanics, classical mechanics.

Twentieth century phusis is quantum mechanics. Those Nobel prizes, mentioned above, are for new techniques for tricking nature – no other word will do – quantum tricks that cool atoms to almost zero in an almost vacuum. Prometheus stole fire to warm us and cook, and we end by stealing the ultracold.

Then there is the other attitude to nature, which Hadot calls Orphic: the poets, if you will, who are also in the laurel grove. The Orphic, Hadot writes, 'penetrates the secrets of nature, not through violence but through melody, rhythm and harmony … inspired by respect in the face of mystery and disinterestedness'. He mentions Leonardo as both Promethean and Orphic, but I would say the same of many of the living scientists whom I most respect, including those who are the most cunning tricksters. Hadot's own example is his contemporary and colleague, François Jacob. Hadot loves a remark of Jacob's that, whereas Jacques Monod wanted life as produced by natural selection to be logical, Cartesian, rational, problems efficiently solved, Jacob in his own charmingly sexist words 'saw nature as a rather nice girl who was generous but a bit sloppy, a bit muddleheaded, working at one thing at a time, and doing her best with what she found handy'. Nature as playful, nature as joy.

'Poetry too might lift the veil from Nature' said Goethe when he received von Humboldt's tribute, but we tend to forget that Goethe had very strong prose views about most of the sciences: plants, the origin of the earth, light. He was an obsessive collector of geological specimens – if you want to please the old man, it was said, take him a new rock for a present. He intensely hated Newton. Newton had done the unspeakable; he had tortured light by splitting it up into colours with his damn prism. (It seems to have been OK for Nature to do it with raindrops.)

In 1790 Goethe published a pamphlet with a long title, which is known simply as *The Metamorphosis of Plants*. It is the culmination of a line of observation and marvelling; it began on the Italian journey, where he speculated that there had to be one original plant, which he called the Ur-plant. Some readers have praised it, as prefiguring evolutionary thinking. Well, that seems confused: Goethe would have detested natural selection as much as he detested Newton's torturing the colours. Yet *The Metamorphosis of Plants* has an extraordinary 'feeling for organism'.

Goethe thought Nature has secrets, but not that she is veiled. The shutters are on our eyes for not seeing what she shows us outright. Everything inside is also outside: inner and outer are one for those who will see, or so he said in a short poem, 'Epirrhema'. Indeed about 1798 he wrote a marvellous love poem of two pages, *The Metamorphosis of Plants*. It joyously conveys the emotion behind his botanical tract with the same name. The poem begins, incidentally, making fun not only of the search for a secret inside, but also of Linnaean nomenclature. One message is, don't classify, look!

That antique phrase, 'Nature likes to hide', could be an emblem of life itself, constantly mutating, evolving, changing its meaning. Perfect, because mutations themselves, so we are taught, are often just misinterpretations, mistranscriptions, of code. Hadot takes us as far as an ultimate Orphic misreading, Heidegger and dread. The anxiety is caught by Sartre's titles, *Being and Nothingness* on the one hand, and *Nausea* on the other. (Both works figure at the end of Hadot's book.) How can there be being? Some schoolmen said God had to create everything, every instant, to keep things going. Existentialism turns such thoughts into fear and trembling, but also a kind of self-loathing.

Yet even here there is a strange play between the Promethean and the Orphic. There may be a physicist's response to the wonder (or dread) of existence, and I do not at all mean a much touted Big Bang when everything comes into being. The closest to nothingness that can be imagined is a vacuum

at zero degrees Kelvin. In classical mechanics, that is where nothing happens. Thereby lies one of the most marvellous paradoxes of quantum mechanics. An absolutely cold vacuum is a buzz of quantum activity. There is talk, at present, that when the almost empty, almost zero, is probed by amazing tricks, it may reveal core truths about the fundamental forces of nature. That in turn would tell us more about being and nothingness than has yet been dreamt of in our philosophies. What a wonderful place for nature to hide some of her deeper secrets, an absolutely cold total vacuum!

This contrast, between the Orphic and Promethean, is precisely where a lack of comprehension begins, between those who love scientific work and those who fear it. There was talk, a few years ago, of the 'culture wars' between humanistic and scientistic cultures – as if that were an event of the 1990s. In the 1960s, C. P. Snow's *Two Cultures*. Hadot makes us think more deeply. Children from their earliest years, and the human race, from its beginning, all love to interfere in and modify what we find in nature. Humans are Promethean, it is part of our nature. But we are also the wondering animal, filled with awe, aware of beauty, which we think of as another type of secret of nature. People who read Snow say we need "bridges" between the two, but that is not what we want. We want to acknowledge both parts of our nature, on the one hand the trickster who changes nature, on the other, the poet who experiences her. The poet must at least respect the experimenter's infinitely subtle ways of tricking nature, and the experiment must marvel at what is seen, as it is.

Reading Hadot, one is in the company of a wise Greek, a pagan, a philosopher who believes that a role of philosophy is to teach how to live.(3) Pagan? Monotheism has been so triumphant that we have forgotten about pagans. Hadot recalls a pagan prefect, whose words he would like to see inscribed in gold at the door of 'all churches, synagogues, mosques and temples'. The man was appalled when a Christian Emperor wanted to remove the Altar of Victory from the Roman Senate: 'We contemplate the same stars, the Heavens are common to us all, and we live in the same world. What matters the path of wisdom by which each person seeks the truth?' Well, it matters a lot. Those who make mathematical models of parts of nature, and use tricks to alter her, in order both to understand her and to exploit her, have one way to reveal the secrets of nature. The poets and sages have another. Both leads to types of wisdom, and the wise must both respect the other wisdom and help preserve it from error, dangerous error. ■

2 See, for example, the essays collected in *Philosophy as a way of life: Spiritual Exercises from Socrates to Foucault,* 1995. But also, *¿Que es la Filosofía Antigua*?, México, 1998.

# Danger! Museums adrift

Roland RECHT
Professor at the Collège de France
holder of the chair of *History of European Medieval and Modern Art*
since 2001.

On 13 December 2006, an article written by Françoise Cachin, emeritus director of French museums and of the Musée d'Orsay, Jean Clair, former director of the Musée Picasso, and myself appeared in the 'Débats' section of *Le Monde* newspaper. Entitled "Les musées ne sont pas à vendre" ("Museums are not for sale"), the article denounced the erratic course presently being steered by the French government which intends to lend out for a period of twenty years the Louvre ensign – much as a trademark is licensed by a franchise agreement – and also hundreds of works of art chosen from France's major national museums; in exchange the government will receive 1 billion euros. A petition was launched on the site of the online journal latribunedelart.fr, with our text being used as a manifesto. More than 4,600 signatures were collected, but this protest movement, emanating from professionals working in the art world, was to no avail. It met merely with a blunt refusal from the French authorities.

The decisions taken in recent years concerning the future of our national heritage cannot fail to shock. Certainly the question of how our heritage's perennity can be guaranteed does need to be asked. Nonetheless, the answer surely does not lie in the dismantling of our national museum collections by a long and drawn-out process of haemorrhaging our heritage away, and nor is it to be found in this idea of 'selling for a song' our monumental patrimony. Earlier generations did not hesitate to invest both their energy and their personal conviction when creating institutions – such as the major museums which date from the Revolution or the Commission des Monuments historiques (Commission for historical monuments) – to ensure that the Republic's cultural goods could be promised a safe and reliable transmission down the centuries. Later generations will have managed to undo this work within only a few years. And their only objective is that of cultivating a short-term view of the profitability of our patrimony and our museum holdings, one which insists that these works are to be considered entirely in terms of their exchange value.

It would seem that the works kept in our museums are currently undergoing a change in status. When a work of art enters a museum, its status as a part of the patrimony is recognized, and at one and the same time it loses one function whilst gaining another one. Its practical value is thus altered – for example an object used in religious rites becomes, on entering the museum, primarily a work of art – and, parallel to this, the same work no longer possesses any exchange value. Public collections are meant, by dint of their inalienability, to be protected definitively from any attempt to dismantle them occasioned by either capricious or financially motivated decisions on the part of the authorities. The various acquisitions which have been made by successive generations of curators bear witness to the history of changes in taste. These works of art can be seen as superimposed strata which, when viewed as a whole, reveal the distinctive history of the individual museum institutions.

It is this very inalienability which constitutes the particularity – and also the credentials – developed in the French system of museums which are not in private hands and can thus be said to be truly independent. These museums are based on an underlying principle, namely the Republican ideal of the transmission of the country's patrimony. It is a model which has, until now, been successfully exported and which has constituted a veritable point of reference for all countries which wished to resist any attempts to privatize art collections. The State protected its collections, and this in turn guaranteed that not only progress in education and study but also the display and promotion of museum collections should be accorded an important role in the public life of the country. By deciding to reintroduce an exchange value for works of art, the State has severely weakened the status of museum objects. We are starting down a slippery slope. Loans which are negotiated at prices until now neither seen nor even dreamed of could soon lead to a progressive abolition of the inalienability of French collections. There is much that can be done – and indeed nothing should be left undone – in order to stop this very dangerous drift, which could well have even more fatal consequences in the future. After all, what has become of the fine and ambitious promises enshrined in the law on museums, passed in 2002, with its clause concerning the "protagonists of cultural development and democratization"? ■

Translation: Dr. Cecilia Griener Hurley

# The origins of the Institut Marey of the Collège de France and its role in the upsurge of French neurophysiology

by John Simon McKenzie
Senior Fellow *of the University of Melbourne*

Étienne-Jules Marey

The Institut Marey was named after its founder, the renowned physiologist Marey (1830-1904), a Professor at the Collège de France in the Chair of Natural History of Organised Bodies. Marey devoted his life of research to the accurate mechanical recording of various physiological phenomena, which culminated in his invention of chronophotography (1882-1892) for the analysis of human and animal movement which led to cinematography.

Backed by the 4th International Congress of Physiology at Cambridge in 1898 which elected an international Control Commission to foster the standardisation of methods and apparatus used in physiology, he organised the funding of an institute to work on this program. The 5th International Congress in Turin, 1901, designated the Control Commission as the "Institut Marey", to be established in a new building, on land at the Parc des Princes, already leased by the City of Paris to the Collège de France to accommodate the Physiological Station attached to Marey's Chair. The building was located at the rear of the terrain, on the large circular track equipped for the analysis of walking and running, opposite the Station Physiologique at the street entrance.

The first official meeting of the international commission, as the Association of the Institut Marey, took place at the Station Physiologique in 1902. Its members came from various countries: Belgium, England, France, Germany, Italy, Russia, Switzerland, and the United States of America. They drew up the statutes of the Institut, which were approved by a decree of the Council of State in 1903, the Institut Marey being recognised as an Establishment of Public Utility.

## Great hopes unrealised

Marey's death in 1904 put the Institut in a difficult situation. It had been his brain child and he would have been its driving force. His position as Director had by this very fact made the Institut a dependency of the Collège de France. But with Marey gone, the members of the Institut made it clear that this tutelage, which had been only *de facto*, could not be taken as binding, and claimed the exclusive use of the track and the central lawn for the Institut. After four years of dispute, in 1908 the City of Paris decided on a division of the terrain with separate leases for each of the parties.

The statutes of the Institut had inadequacies that were seriously harmful to it, in particular the lack of provisions for financing that could measure up to its objectives. Its President, elected by the Association for five years, had the duty of directing the Institute, though without salary. It was therefore predictable that he would give priority to his own professional obligations. In fact the permanent personnel of the Institut consisted of only two researchers, two technicians and a porter. In the mind of its founders, the establishment would accept recognised researchers who would visit the Institut for limited periods to work on themes concerning standardisation. In reality very few came, and finally the function for which the Institut had been created was forgotten.

For 35 years, the effective direction of the Institut Marey was assured by Lucien Bull (Dublin 1876-Paris 1972), who had begun as Marey's assistant in 1896. Bull was an enlightened amateur in the field of photography who had obtained a first degree from the University of Paris in natural sciences (Botany, Geology and Zoology) in 1908, but he was not a physiologist. He was essentially interested in high-speed cinematography. The other full-time researcher was Pierre Noguès (1878-1961?) who had been an assistant to Marey. A very skilful mechanic, he constructed a cinematographic camera capable of taking 300 frames per second. The titular Director from 1911 was Charles Richet (1850-1935), Professor of Physiology at the Paris Medical Faculty, Nobel Prize winner in 1913 for the discovery of anaphylaxis, made together with Paul Portier. He was also the author, in 1923, of a *Traité de Métapsychique* defending his spiritualist claims. He was content to leave the running of the Institut Marey to Bull, promoted assistant-director (*sous-directeur*). It seems that their main preoccupation was the financing and the construction of a monument in honour of Marey, where his ashes were deposited, and which was unveiled on the eve of the Great War.

During the Great War, Lucien Bull and the Institut Marey collaborated with a British Lieutenant, Lawrence Bragg (Nobel Prize for Physics in 1915), to develop a method of locating enemy artillery batteries, based on the arrival time of the sound of a gun discharge at a series of microphones aligned close to the front. It was widely adopted by the allied armies,

the Institut producing many of the necessary equipment installations. Bull received honours for his work: Chevalier de la Légion d'Honneur and Commander of the Order of the British Empire.

This brief period of fame did not prevent a progressive decline of the Institut after the war, its international character disappearing so much the faster when it was decided to exclude the physiologists of Germany and its allies. The reputation of the Institut probably suffered further erosion in the mid-1920s, when Richet sponsored the much-criticised work of Athanasiu, obtained at the Institut Marey with their string galvanometer.

By 1921, Richet, crowned with the Nobel Prize, had become a sort of patriarch reigning unchallenged over French medical physiology. He disregarded his statutory obligations. The Institut suffered from a chronic lack of funds, its equipment had become obsolete, and its direction unable to remedy the situation. The most serious failure was the incapacity of the Institut, despite considerable initial expenditure, to set up a laboratory of work physiology within the deadlines agreed with the authorities. The expected funding was withdrawn and allocated to others, Richet being associated with this humiliating transaction, as is shown by the Association minutes (5 Sept. 1913).

After Richet's death in 1935, the electrophysiologist Louis Lapicque was elected President of the Association in 1936. In 1938 he gave his approval to Alfred Fessard, then Maître de Recherches of the Caisse nationale de la recherche scientifique (ancestor of the CNRS), to install his laboratory in the premises of the Institut Marey, which by then no longer had any activity related to its original purpose, and had become practically derelict.

## Alfred Fessard

Alfred Fessard was born on 28 April 1900. His father, a printer in Montmartre, hoped to make him his successor. Fortunately, he was noticed by the psychologist Jean-Maurice Lahy, a client

Alfred Fessard

of the printery, who speedily had him give up commercial studies so as to prepare for competitive entry into the Ecole normale for teacher formation at Auteuil (1921-1922). He was then able to study for a first degree (*licence*) in Physics at the Sorbonne. Still advised by Lahy, he studied the physiology of the nervous system with Louis Lapicque, and physiological psychology with Henri Piéron. He was interested in associating with psychologists and psychiatrists who placed their hopes in the experimental analysis of cerebral functions.

He started as a demonstrator (*préparateur*) of the École pratique des hautes études (EPHE) in the Laboratory of Physiology Applied to Mental Hygiene created for the psychiatrist Edouard Toulouse. Its section of applied psychology was directed by J-M Lahy, and that of physiology by a pupil of Lapicque's, Henri Laugier, who made the most of the young physicist's knowledge for carrying out electromyographic recordings and psychophysiological tests. In 1927 Fessard joined the EPHE laboratory of physiological psychology of the Sorbonne, directed by Piéron, where he soon became assistant-director.

While associated with certain of Piéron's psychophysiological experiments, Fessard was also the laboratory's expert in statistics applied to aptitude tests, to biotypology investigations, and to experimental results. From 1928 he concentrated mainly on electrophysiology, the development of which was favoured by the advances in electronics. In 1923, Piéron was named Professor at the Collège de France (Chair of Physiology of Sensations), ant it was in an adjunct to his laboratory known as the "steel house" that Fessard did the work for his doctoral thesis: "Rhythmic properties of living matter. Rhythmic responses of isolated nerves", which he defended in 1936. At the time he was author of numerous publications, particularly on the genesis of electromotive force in the electric organ of Torpedo, about thirty of them in collaboration with his friend Daniel Auger. They were the first in France to present recordings of unitary action potentials. In the years 1934-1936, Fessard played a primary role in the introduction of electroencephalography into France.

In 1937, thanks to a scholarship of the Rockefeller Foundation, he was able to spend six months in the Cambridge physiological laboratory directed by Edgar Adrian (Nobel Prize for 1932, shared with Charles Sherrington), who had demonstrated the numerical coding (number and frequency of action potentials) in sensory and motor axons. Working with Adrian's collaborator Bryan Matthews, Fessard succeeded in recording a slow potential generated in a filament of spinal cord dorsal root in the frog, in response to a single action potential in a single afferent fibre. They named this response a "synaptic potential".

On his return to the Institut Marey, Fessard continued his research on the electric organ of Torpedo. In 1938/39 he showed with Wilhelm Feldberg and David Nachmansohn that acetylcholine acted as a mediator for transmission of excitation from the nerve to the electroplaques generating the discharge of the electric organ. This organ thus served as a model for the transmission of excitation at neuro-muscular junctions and neural synapses. The further investigations they planned were interrupted by the war in 1939.

As a Captain in the reserve, Fessard was mobilised into the Air Force. With Piéron, appointed director of the psycho-physiological section in Medico-

psychological Inspection of the Air Force, together with certain of their collaborators, they left Paris for the military airbase of Mérignac, near Bordeaux.

Demobilised after the armistice of 1940, Fessard regained his EPHE laboratory at the Institut Marey, where, despite the difficulties of the Occupation, he resumed research as best he could. With the neurologist Auguste Tournay, a pupil of Babinski, he performed electromyographic recordings on adolescents afflicted with poliomyelitis. He also undertook the initiation of clinicians to the practice of electroencephalogaphy. In 1942 he married his second wife, Denise Albe, an engineer-physicist from the school of Physics and Chemistry of the City of Paris, who had been associated with the work of the laboratory since 1940.

In 1946, he was sent on an Official Mission to visit neurophysiological installations in the U.S.A. His report emphasized the serious lag of France in the neurosciences. As a result, the CNRS established the Centre d'études de physiologie nerveuse et d'électrophysiologie at the Institut Marey in 1947, directed by Fessard. In 1949 he was elected to a new Chair of General Neurophysiology at the Collège de France, and the Institut Marey was reattached to the Collège as "Station Institut Marey of the Collège de France", again with Fessard as Director.

He began recruiting promising researchers in 1947, and soon had with him the nuclei of diverse groups: brain neurophysiology (Pierre Buser and Denise Albe-Fessard), electrophysiology of human movement and muscle synergies (Jacques Paillard), intracellular study of synaptic transmission between the large identifiable neurons in ganglia of the marine mollusc Aplysia (Ladislav Tauc). He introduced Thomas Szabo to research on electric fishes.

Pierre Buser, a graduate of the École normale supérieure, with an *agrégation* in natural sciences, had tenure in the Faculty of Sciences, but lacking premises had come to the Institut Marey since the foundation of the Centre d'études. Following his first investigations on the visual system of various lower vertebrates, he spent several months in 1952 in Horace Magoun's laboratory in Los Angeles with a leading group working on the monkey brain reticular formation and mechanisms controlling attention. On returning to Paris, he collaborated with Denise Albe-Fessard in 1952 to accomplish the first intracellular recordings in the brain, in the electric lobe of Torpedo and then in the cerebral cortex of the cat. In 1953 he defended his thesis, was appointed professor in the Faculty of Sciences, and resumed his research at the Institut Marey. He also worked with Arlette Rougeul on various subcortical structures and on responses in the association cortex, including the effects of conditioning using chronically implanted electrodes.

In the years 1945-1950, the Fessards had pursued their investigations on electric fish in the marine biological station at Arcachon, and with Carlos Chargas in Rio de Janeiro. Fessard and Tauc determined the membrane potential of the electroplaque in 1951. In 1950, D. Albe-Fessard defended her thesis on the electrogenesis of the discharge in the electric organ of Gymnote, Torpedo, and Ray.

Yves Galifret, recruited by Piéron in 1942 as a laboratory technician, became his assistant at the Collège de France in 1946, working with him on the psychophysics of vision. On Piéron's retirement in 1951, Galifret became Fessard's assistant and later his assistant-director. For some years he continued to work with Piéron, who had obtained from the CNRS the possibility of continuing his research for a while. In 1955 he could join the Institut Marey and occupy the space made available by the departure for Marseille of Michel Dussardier, a graduate of Alfort veterinary school who studied the control of the digestive tract in sheeps. Pierre Buser introduced him to electrophysiology in the course of a study of the electrical response to visual stimulation of the optic tectum in the Tench (a freshwater fish). He then undertook his own doctoral

Monument in memory of Étienne-Jules Marey after its restoration

research on the Pigeon visual system – anatomy, physiology and psychophysiological correlations (1966), which was continued with various collaborators in studying the centrifugal visual system.

Following the perspectives developed by Fessard in a succession of international congresses, researchers in the Institut Marey investigated in depth the activity of nervous pathways underlying "non-specific" sensory brain responses involved in attention, emotion and pain. Such responses could be implicated in associative mechanisms operating in learning and even in consciousness.

Jean Massion, a medical graduate from Louvain, arrived in 1961 in the Institut Marey. He first worked on intralaminar thalamic responses with D. Albe-Fessard, Michel Meulders and Lawrence Kruger, and then on the influence of sleep states on somatic responses. Soon he began a long and detailed investigation of the motor pathways relaying in the cerebellum, brainstem and thalamus, and their control by the cortex. In collaboration with Robert Naquet and Monique Denavit-Saubié, D. Albe-Fessard also studied the role of diencephalic zones on sleep.

These different research themes began to attract numerous postgraduate researchers from France and abroad. In the Institut Marey of the 1960s, ideas seemed to be bubbling over, and the research increasingly diversified in both topics and methods of approach. In 1961, encouraged by her faithful collaborator Pierre Aléonard, Denise Albe-Fessard began collaboration with the neurosurgeon Dr. Gérard Guiot at the

Hôpital Foch. By recording evoked field potentials and single-neuron activity in the thalamus of Parkinsonian patients, she could guide a needle electrode to nearby locations with the best chance for effective therapeutic lesions. At the same time new information was provided on somatic representation in the human thalamus. This led her to complementary research on brains of laboratory simians. In parallel, Jean Delacour's team studied the behavioural effects of thalamic and limbic lesions in the Rat. With electrophysiological responses, Henri Korn mapped the pathways of somesthesic and visceral representations in the cat brain. Albe-Fessard explored the possible involvement of the caudate nucleus in non-specific response mechanisms while working with Oswaldo-Cruz and Rocha-Miranda, Brazilian post-doctoral workers. Investigations of the caudate nucleus were developed further by George Krauthamer, Research Fellow of an American foundation. This expanded into investigations of basal ganglia pathways and their relation to Parkinsonism by Paul Feltz, Jean Féger and others, among them C. Ohye, a Japanese neurosurgeon. Tauc's meticulous intracellular research on Aplysia ganglia also attracted important visiting workers, including future Nobel Prize winner Eric Kandel from Harvard, who came to Marey "to learn Aplysia".

Since 1947, the Institut Marey had grown by the early 1960s to some 40 researchers, with 16 electrophysiology stations, and 25 other staff, distributed among technical assistants, administration and maintenance personnel, with an important service for histology, under the direction of Suzanne Laplante, extensive animal housing with facilities for animal training, and mechanical, electrical, electronic, photographic, and illustration workshops. The main building had changed little externally in sixty years, but the room arrangements had been altered as required, with laboratory services and electrical wiring brought to contemporary standards. The garden was flourishing, and additional quarters that had to be added in temporary buildings were partly screened by vegetation behind the Marey monument at the north-east side of the lawn, bordered by flower beds near the main building.

The impact of the Institut Marey began to spread with the return home of visitors and the departure of some staff to other centres. Buser, a full Professor at the Faculty of Sciences of Paris, in 1961 obtained his independent laboratory in the new Faculty of Sciences at Jussieu. Paillard went to Marseille, was appointed professor, and soon was Director of the new CNRS Institute of Neurophysiology and Psychophysiology, where he was joined by Massion in 1967. Henri Korn went to John Eccles' USA laboratory in 1967, and Galifret, appointed professor at Jussieu, soon had his own premises there. In the same period, Besson's team which included Gisèle Guilbaud began to grow in the Institut Marey, studying nociceptive pathways and their control by cortex and brainstem. In the Institut's research, emphasis was being given to tracing specific neural pathways for pain, and connexions in the basal ganglia, using new anatomical techniques for axonal transport in association with antidromic stimulation.

The events of 1968 accelerated the planned transfer of the Centre d'Etudes to the CNRS domain at Gif-sur-Yvette in the southern suburbs of Paris. Delacour and other researchers took posts with their teams in new universities, formed after 1968 by splitting up the old unwieldy University of Paris.

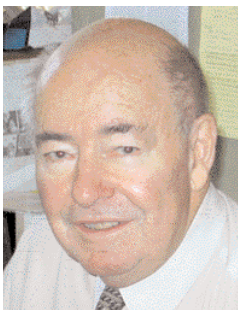
## The Last Years

Successive Administrators of the Collège de France had resisted pressure from the adjacent Roland Garros tennis stadium wanting to expand onto the adjacent site leased by the City of Paris to the Collège de France for the Station Physiologique and the Institut Marey, but the lease was due to expire in July 1972. On Alfred Fessard's retirement in 1971-72, the Collège obtained 5 years' grace for the concession while a new location for Prof. Albe-Fessard's laboratory was sought. In 1977, she moved at Paris VI, Jussieu, rejoining Buser and Galifret. It was she who had advised Jacques Glowinski to take up the biochemical study of the brain. She herself continued with her investigations well after retirement. Her last published article was a review of pathological pain in 2001. She died in 2003, aged 87 years.

The historic buildings of the Station Physiologique and the Institut Marey at the Parc des Princes were demolished at the end of 1978, and the monument containing Marey's ashes was restored thanks to the generosity of the French Tennis Federation, and displaced to its present site in the grounds of the Roland Garros stadium. The Institut Marey had lasted only three quarters of a century!

Alfred Fessard, who was elected in 1963 to the Academy of Sciences of the Institut de France, died on 20 February 1982 at the age of 82. In a death notice, Pierre Buser wrote that Fessard's profound reflections on integrative brain activities had deeply influenced the research at the Institut Marey: "His great simplicity, the warmth of his welcome, attracted the young; a number of physiologists owe their vocation to this attitude of mind, and their career to the certainty and scrupulous equity of his judgement and decisions". ■

*John McKenzie*



Dr John Simon McKenzie, now Senior Fellow in the Department of Physiology of the University of Melbourne, worked in the Institut Marey in two periods, the years 1968 and 1976. The electrophysiological investigations he pursued in the laboratory of Denise Albe-Fessard were concerned with the organisation of connexions between various deep cerebral structures of the basal ganglia in different mammals. His article on the Institut Marey is the summary of an exhaustive study on the history of this institute, which he has finished after several years of research.

Pierre-Gilles de Gennes
Chair of *Physics of Condensed Matter*
1971-2004

† 18 May 2007

Pierre-Gilles de Gennes was an outstanding scientist with an overflowing imagination and an insatiable curiosity. His deep and sure physical intuition always allowed him to penetrate to the heart of the phenomena that he was studying.

Throughout his scientific career, he never stopped to explore and to open up new scientific fields, going from superconductors to the mechanism of memory, passing through liquid crystals, polymers, colloids, gels, soap bubbles, vulcanization. In each of these domains, he brought decisive contributions, started research teams which pursued with success the new projects that he had initiated. No sooner had he laid the foundations of a new research field that he was starting to investigate another one, with always the same success and the same creativity.

Pierre-Gilles de Gennes can be considered as the founder of a new domain of physics and chemistry called now "soft matter", where one studies systems which are generally quite complex and whose scientific analysis seems at first sight too difficult, and even impossible. He has been able to build models for them and to identify their essential features allowing one to understand their properties and to predict their behavior in new environments. De Gennes's talent for imagining new applications of fundamental studies, like liquid crystal displays or systems avoiding aquaplaning, was unique.

He was also very much concerned by the reform of scientific studies. During several years, he was the Director of the "École de physique et chimie industrielle de la ville de Paris", where he renovated completely the programs of the courses given to the students, opening them with a great success to other fields like biology. He devoted also a lot of his time to college and high school students, introducing them to simple physical phenomena and trying to convince them that science was an attractive and fascinating adventure.

He was an exceptional lecturer. During more than 30 years, he gave lectures at the Collège de France which were followed by a large community of researchers and which have played a very important role for structuring this community and for orienting it towards new topics. The fact that his lectures were dealing with different subjects every year, as this is the rule at the Collège de France, explains certainly his desire to constantly explore new research fields.

His death is felt with a great sorrow all over the world, and in particular at the Collège de France. We will remember him as friendly colleague, highly cultured, paying great attention to the new developments occurring in other fields. His great simplicity and his sense of humor were greatly appreciated and were making easier the contacts with him which were always stimulating. His presentations at our faculty meetings were remarkably clear and appropriate. We will always think of him with emotion and admiration. ■

*Prof. Claude Cohen-Tannoudji*

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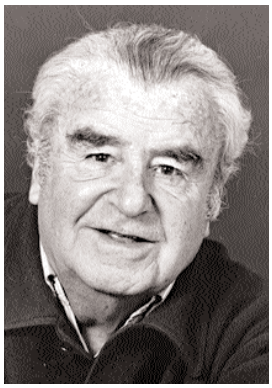


Jean-Pierre Vernant
Chair of *Roman History*
1975-1999

† 9 January

Others would be able to talk more knowledgeably about the scholar, who was a Hellenist but also a philosopher and psychologist. Jean-Pierre Vernant showed, for example, that in order to understand history, whether Greek or other, it is better to have general ideas, that is, philosophical ideas, on what human matters are, as they constitute history. For many, Vernant thus triggered a generation gap, a break with the humanist tradition and pure philology. Unde irae. The Marxism of his youth was at the origin of that break: all young communist historians learned that one could only write history illuminated by a theory. But it is about the man himself that I want to talk, he who, from the creation of the Armée Secrète (resistance army) in November 1942, was put in charge of it for the Toulouse area, and who freed Toulouse on 19 August 1944 at the head of his volunteers. Among those volunteers was Yves Laporte, future Administrator of the Collège de France, who welcomed Vernant when he was elected to the Collège, calling him 'mon Commandant'. Vernant was a born leader, one might be tempted to say. Yes, but he was far more than that: he was a rare and invaluable type of human being, embodying a virtue that Aristotle called greatness of spirit, Saint Thomas d'Aquin (reader of Aristotle), virtue of strength, and Descartes, generosity. I have never seen a chief be as egalitarian as he was and, to put it mildly, as 'kind'. He embraced communism on the basis of his ideal of solidarity and equality. He cared for others, he was open, welcoming, and talked to everyone on an equal footing for, as Descartes wrote, the most generous are usually the most humble. Courage is the other side to magnanimity; during the months preceding the Normandy landing, wrote Vernant in a volume of his memoirs, 'with every step we wondered whether it would be the last'. ■

*Prof. Paul Veyne*

# Institutional Data

# Collège de France Organization Chart

## Administrator of the Collège de France: **Pierre CORVOL**

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

## Professors of the Collège de France

I – MATHEMATICAL, PHYSICAL AND NATURAL SCIENCES

- Analysis and Geometry — Alain CONNES
- Differential Equations and Dynamical Systems — Jean-Christophe YOCCOZ
- Partial Differential Equations and Applications — Pierre-Louis LIONS
- Number Theory — Don ZAGIER
- Quantum Physics — Serge HAROCHE
- Mesoscopic Physics — Michel DEVORET
- Elementary Particles, Gravitation and Cosmology — Gabriele VENEZIANO
- Geodynamics — Xavier LE PICHON
- Climate and Ocean Evolution — Edouard BARD
- Observational Astrophysics — Antoine LABEYRIE
- Chemistry of Molecular Interactions — Jean-Marie LEHN
- Chemistry of Condensed Matter — Jacques LIVAGE
- Human Genetics — Jean-Louis MANDEL
- Genetics and Cellular Physiology — Christine PETIT
- Biology and Genetics of Development — Spyros ARTAVANIS-TSAKONAS
- Morphogenetic Processes — Alain PROCHIANTZ
- Molecular Immunology — Philippe KOURILSKY
- Microbiology and infectious diseases — (not appointed yet)
- Experimental Cognitive Psychology — Stanislas DEHAENE
- Physiology of Perception and Action — Alain BERTHOZ
- Experimental Medicine — Pierre CORVOL
- Historical Biology and Evolutionism — Armand de RICQLÈS
- Human Paleontology — (not appointed yet)

II PHILOSOPHICAL AND SOCIOLOGICAL SCIENCES

- Philosophy of Language and Knowledge — Jacques BOUVERESSE
- Philosophy of Life Science — Anne FAGOT-LARGEAULT
- History of Syncretisms in Late Antiquity — Michel TARDIEU
- Anthropology of Nature — Philippe DESCOLA
- Economic Theory and Social Organization — Roger GUESNERIE
- Modern and Contemporary History of Politics — Pierre ROSANVALLON
- Writings and cultures in modern Europe — Roger CHARTIER
- Contemporary Arab History — Henry LAURENS
- Rationality and Social Science — Jon ELSTER
- Comparative Legal Studies and Internationalization of Law — Mireille DELMAS-MARTY

III – HISTORICAL, PHILOLOGICAL AND ARCHAEOLOGICAL SCIENCE

- Pharaonic Civilization: Archaeology, Philology, History — Nicolas GRIMAL
- Assyriology — Jean-Marie DURAND
- Biblic communities — (not appointed yet)
- History and Civilization of the Achaemenid World and of the Empire of Alexander — Pierre BRIANT
- Epigraphy and History of the Ancient Greek Cities — Denis KNOEPFLER
- Religion, Institutions and Society in Ancient Rome — John SCHEID

- Indo-Iranian Languages and Religions — Jean KELLENS
- History of India and Greater India — Gérard FUSSMAN
- History of Modern China — Pierre-Étienne WILL
- National Antiquities — Christian GOUDINEAU
- Turkish and Ottoman History — Gilles VEINSTEIN
- French Mediaeval Literature — Michel ZINK
- Modern and Contemporary French Literature: History, Criticism, Theory — Antoine COMPAGNON
- Modern Literatures of Neo-Latin Europe — Carlo OSSOLA
- Literary Creation in English — Michael EDWARDS
- History of European Medieval and Modern Art — Roland RECHT

### Annual Chairs (2007-2008)

- Chair of Artistic Creation — Ariane MNOUCHKINE
- European Chair — Manfred KROPP
- International Chair — Pierre MAGISTRETTI
- Chair of Technological Innovation - Liliane Bettencourt — Gérard BERRY

## Emeritus Professors of the Collège de France

- Anatole ABRAGAM — Nuclear Magnetism
- Maurice AGULHON — Contemporary French History
- Étienne-Émile BAULIEU — Bases and Principles of Human Reproduction
- Georges BLIN — Modern French Literature
- Yves BONNEFOY — Comparative Studies of the Poetic Function
- Pierre BOULEZ — Invention, Technique and Language in Music
- 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
- Jean DAUSSET — Experimental Medicine
- Jean DELUMEAU — History of Religious Mentalities
- Marcel FROISSART — Corpuscular Physics
- Marc FUMAROLI — Rhetoric and Society in 16th and 17th century Europe
- Jacques GERNET — Social and Intellectual History of China
- Gilles Gaston GRANGER — Comparative Epistemology
- Jacques GLOWINSKI — Neuropharmacology
- François GROS — Cellular Biochemistry
- Jean GUILAINE — European Civilizations in the Neolithic and the Bronze Age
- Ian HACKING — Philosophy and History of Scientific Concepts
- Pierre HADOT — History of Hellenistic and Roman Thinking
- Claude HAGÈGE — Linguistic Theory
- Françoise HÉRITIER — Comparative Studies of African Societies
- François JACOB — Cellular Genetics
- Pierre JOLIOT — Cellular Bioenergetics
- Yves LAPORTE — Neurophysiology
- Jean LECLANT — Egyptology
- Nicole LE DOUARIN — Molecular and Cellular Embryology
- Georges LE RIDER — Economic and Monetary History of the Hellenistic Orient
- Emmanuel LE ROY LADURIE — History of Modern Civilization
- Claude LÉVI-STRAUSS — Social Anthropology
- Edmond MALINVAUD — Economic Analysis
- André MIQUEL — Classical Arabic Language and Literature
- Philippe NOZIÈRES — Statistical Physics
- Jean-Claude PECKER — Theoretical Astrophysics

- Jacques PRENTKI — Theoretical Physics of Elementary Particles
- Daniel ROCHE — French History in the Age of the Enlightenment
- Jacqueline DE ROMILLY — Greece and the Development of Moral and Political Thinking
- Jean-Pierre SERRE — Algebra and Geometry
- Javier TEIXIDOR — Semitic Antiquities
- Jacques THUILLIER — History of Artistic Creation in France
- 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
- Jean YOYOTTE — Egyptology

### Administration

- Director of Cultural Affairs and External Relations: Florence TERRASSE-RIOU
- Director of Administrative and Financial Affairs: Jean-François RIGONI

## Lectures Given by the Professors Abroad

CANADA

- Institute of International Studies, Montreal
  - Mireille Delmas-Marty (holder of the Chair of Comparative Legal Studies and Internationalization of Law)
    *International penal justice.*
- Laval University, Québec
  - Philippe Descola (holder of the Chair of Anthropology of Nature)
    *The production of images.*
  - Pierre-Étienne Will (holder of the Chair of Modern Chinese History)
    *1. Daily life in China seen through legal documents from the 18th and 19th centuries;*
    *2. The difficulties of the empire as perceived by the Emperors Daoguang (1821-1850) and Xianfeng (1851-1861).*
- University of Montreal
  - Philippe Descola (holder of the Chair of Anthropology of Nature)
    *Du social au collectif.*
- University of Quebec
  - Philippe Kourilsky (holder of the Chair of Molecular Immunology)
    *The birth of systemic immunology.*
  - Jacques Bouveresse (holder of the Chair of Philosophy of Language and Knowledge)
    *The question of philosophical pluralism: are the comparison and choice between systems possible?*
    and two seminars on: *Gödel and the Vienna circle.*

BULGARIA

- New Bulgarian University, Sofia
  - Gilles Veinstein (holder of the Chair of Turkish and Ottoman History)
    *The Ottoman Empire's treaties with European states. The question of 'capitulations' (15th to 18th centuries)* and one seminar on: *Ottoman documents relative to the 'capitulations'. Some examples.*
- St. Kliment Ohridski University, Sofia
  - Gilles Veinstein (holder of the Chair of Turkish and Ottoman History)
    *The body of Muslim clerics (Oulemas) and its organization in the Ottoman Empire.*
    *Ottoman documents on the Oulemas. Study of some examples.*

CHILI

- University of Santiago
  - Jacques Livage (holder of the Chair of Chemistry of Condensed Matter)
    *Frontiers in Materials research: soft chemistry.*

GERMANY

- Ruprecht-Karls University, Heidelberg
  - Roland Recht (holder of the Chair of European Medieval and Modern Art)
    *Questions pertaining to medieval art and all his seminars on: The comparative historiography of art.*
- 'La Charité' University, Berlin
  - Pierre Corvol (holder of the Chair of Experimental Medicine)
    *Angiogenesis and cancer.*

INDIA

- Tata Institute of Fundamental Research (Bangalore) - Research Institute of Hyderhabad
  - Spyros Artavanis-Tsakonas (holder of the Chair of Developmental Biology and Genetics)
    *Disease and Developmental Biology.*

ITALY

- University of Ferrare
  - Alain Berthoz (holder of the Chair of Physiology of Perception and Action)
    *The brain and space.*
- University of Florence
  - Jean Guilaine (holder of the Chair of European Civilizations in the Neolithic and the Bronze Age)
    *The Neolithization of the Mediterranean: open questions.*
  - Jean-Marie Lehn (holder of the Chair of Chemistry of Molecular Interactions)
    *From Supramolecular Chemistry to Constitutional Dynamic Chemistry.*
- University of Naples - Suor Orsola Benincasa
  - Carlo Ossola (holder of the Chair of Modern Literatures of Neo-Latin Europe)
    *Traditions of the ut pictura poësis.*
- University and École Normale Supérieure of Pisa
  - Gabriele Veneziano (holder of the Chair of Elementary Particles, Gravitation and Cosmology)
    *Theory of chords and black holes.*
- University of Sienna
  - Michel Zink (holder of the Chair of Medieval French Literature)
    *The Occitan chansonniers as prosimètres.*
- University of Venice
  - Pierre-Étienne Will (holder of the Chair of History of Modern China)
    *1. Militarism and the revolutionary connection in late-Qing and early Republican Shaanxi province;*
    *2. Engineers and state-building: Li Yizhi (1882-1938) and his circle.*

LEBANON

- Saint-Joseph University of Beirut and the Institut français du Proche-Orient
  - Henry Laurens (holder of the Chair of Contemporary Arab History)
    *Autobiography – Arab politician.*

SPAIN

- University and Institute of Chemistry Research, Seville
  - Jean-Marie Lehn (holder of the Chair of Chemistry of Molecular Interactions)
    *From Supramolecular Chemistry to Constitutional Dynamic Chemistry.*

SWEDEN

- University of Uppsala
  - Jean-Marie Lehn (holder of the Chair of Chemistry of Molecular Interactions)
    *From Supramolecular Chemistry to Constitutional Dynamic Chemistry.*

SWITZERLAND

- University of Geneva
  - Édouard Bard (holder of the Chair of Climate and Ocean Change)
    *Astronomic influences on the climate.*

SYRIA

- Universities of Damascus and Alep
  - Jean-Marie Durand (holder of the Chair of Assyriology)

  *Syrian culture of cuneiform expression.*

UNITED KINGDOM

- Newton Institute (Cambridge)
  - Alain Connes (holder of the Chair of Analysis and Geometry)

  *Non-commutative geometry and motives.*
- Oxford University
  - Michel Zink (holder of the Chair of Medieval French Literature)

  *Images of the narrative and the spirit of poems. Reflections on 'the love story without words' of the Chantilly manuscript, Musée Condé.*

UNITED STATES

- University of Chicago
  - Jean Kellens (holder of the Chair of Indo-Iranian Languages and Religions)
- Harvard University
  - Stanislas Dehaene (holder of the Chair of Experimental Cognitive Psychology)

  *Putting neurons in culture: the cerebral foundations of reading and mathematics:*
  *1. Recycling the visual brain for reading;*
  *2. Space, time and number: cerebral foundations of mathematical intuitions;*
  *3. Conscious processing and the human Turing machine.*
  - Michel Zink (holder of the Chair of Medieval French Literature)

  *The razos of the troubadours and the notion of poetry.*
- Yale University
  - Édouard Bard (holder of the Chair of Climate and Ocean Change)

  *Abrupt climate change: external forcing and internal rearrangements.*

URUGUAY

- Pasteur Institute of Montevideo
  - Christine Petit (holder of the Chair of Cellular Genetics and Physiology)

  *Molecular physiology and pathophysiology of the cochlea.*

UZBEKISTAN

- Universities of Tashkent, Samarkand and Termez
  - Gérard Fussman (holder of the Chair of History of the Indian World)

  *Indian inscriptions found in Uzbekistan: philological analysis and historical interest.*

# Lectures and Lecture Series by Foreign Professors

## by Invitation of the Assembly of the Professors

### State chairs reserved for foreign scholars

- John ROGISTER, Directeur of Research associated with the École Pratique des Hautes Études
  1. A Florentine member of the "Republic of Letters', Abbot Antonio Niccolini (1701-1769)
  2. Abbot Antonio Niccolini and the president of Brosses, author of the *Lettres familières sur l'Italie*
- Kathinka EVERS, Professor, Centre for Bioethics at Karolinska Institute and Uppsala University
  1. When matter awakens. The open mind and its enemies
  2. The responsible brain. Free will and personal responsibility in the wake of neuroscience
  3. The neural basis of morality. The naturalistic fallacy revisited
  4. Helping the brain forget. Perspectives on therapeutic forgetting
- Suzanne NALBANTIAN, Professeur, Long Island University (USA)
  1. The autobiographical memory: from literature to neurosciences
  2. Neuro-aesthetics: scientific theory and aesthetic practice
- François OST, Professor, Vice Rector, Saint-Louis University, Brussels (Belgium)
  1. The detours of Babel. Translation as a paradigm
  2. Law as translation
- Yuri MANIN, Professor, Max-Planck Institute for Mathematics (Bonn, Germany)
  Symmetries and deformations in non-commutative geometries based upon operads
- Erwan ROUSSEAU, Lecturer, Louis Pasteur University, Strasbourg
  Hyperbolicity of complex varieties
- Jérémie SZEFTEL, Instructor, Princeton University (USA)
  Mathematical problems around the conjecture of the L2 curve for Einstein's equations
- Thomas UEBEL, Professor, Manchester University (UK)
  Beyond Verificationism and Reductionism: The Contemporary Relevance of the Vienna Circle
- Paolo MANCOSU, Professor, University of California, Berkeley (USA)
  Mathematical explanation: why it matters
- Michael FRIEDMAN, Professor, Stanford University (USA)
  Carnap, Cassirer and Heidegger: the Davos Disputation and twentieth-century Philosophy
- Pierfrancesco CALLIERI, Professor, University of Bologna (Italy)
  The archaeology of Iran (and especially of Fars) in the Hellenistic period
- Ofer Bar YOSEF, Professor at Harvard University
  1. Sedentarization and the beginnings of agriculture in the Near East (Natoufien, "PPNA")
  2. The apogee of the pre-ceramic neolithic (the "koiné" PPNB)
- Josep FULLOLA PERICOT, Professor, University of Barcelona
  1. Rupestrian art of lower Mexican California
  2. Bronze Age mummies in Cova del pas (Minorque, Spain)
- Michael SHERINGHAM, Professor, Oxford University; Fellow, All Souls College (UK)
  Everyday poetics: the street, the day, archives
- Ali CHAMSEDDINE, Professor, American University of Beirut (Lebanon)
  Computational tools for spectral action
- Bruno HELLY, (CNRS), Lyon, Maison de l'Orient Méditerranéen
  The capital of Thessaly faced with the threat of the 3rd Macedonian War: the year 171 BC at Larissa. (Une relecture critique du décret de Larissa pour Bombos d'Alexandrie de Troade -BCH 59, 1935, 55-66 numéro 2)
- Adelheid OTTO, Professor, Ludwig-Maximillian University, Munich (Germany)
  1. Tell Bazi, Fortress on the banks of the Euphrates from the 3rd millennium until the Roman era
  2. Tuttul/Tell Bica, a Syrian metropolis in the Bronze Age
- Hartmut KÜHNE, Professor, Free University of Berlin (Germany)
  1. The river and the steppe: living conditions in the Assyrian era in Ha bur
  2. Dur-Katlimmu, western capital of the Medio-Assyrian kingdom

3. Dur-Katlimmu the magnificent: urban and functional division as a mirror of the social structure
4. After the collapse of the Assyrian Empire: legends and new data

- Anne PORTER, Professor, University of Southern California (USA)
  1. Real dimension of the nomadic fact
  2. Wool, writing and religion: the role of pastoralism in Urukian expansion
  3. Shepherds' practical policy
  4. Since when, the Amorites?
- Francisco RICO, Professor, Autonomous University of Barcelona (Spain)
  The Spanish novel and history of the novel
- Andrew J. MAJDA, Morse Professor of Arts and Sciences Courant Institute of Mathematical Sciences, New-York University (USA)
  Mathematical strategies for multi-scale and stochastic modelling in atmosphere/ocean science
- Jean-Jacques SLOTINE, Professor, Massachusetts Institute of Technology
  The dynamic brain
- Fabrizio DORRICCHI, Professor, 'La Sapienza' University, Rome (Italy)
  The 'geometrical' brain: neuropsychology, shortcomings and paradoxes in the cerebral representation of space
- Peter STANG, Professor, University of Utah (USA)
  1. Nanoscale molecular architecture: design and self-assembly of metallocyclic polygons and polyhedra via coordination
  2. Chemical publishing of the 21st century: perspectives of a JACS editor
- Cynthia KENYON, Professor, UCSF, California
  Genes, cells and hormones that control the lifespan of C. Elegans

# Events at the Collège de France – 2006-2007

**September**
- "History of Neuroscience", ENS, Department of Philosophy
- "Christians' controversies in Sassanide Iran", UMR 7528, Mondes Iranien et Indien and Collège de France (Prof. Michel Tardieu)
- Projection of the documentary "Au-delà des apparences" on the anthropologist Jacques Lizot (Prof. Philippe Descola)

**October**
- "The science of reading and its learning" (Prof. Stanislas Dehaene)
- "Filiation in former and present European and Mediterranean societies" (Profs Françoise Héritier, John Scheid and Philippe Descola)
- Presentation of the Inserm Grand Prix

**November**
- "Social models in crisis. How to get past the dead-end?", annual cycle of lectures of the Mécénat Altadis and of the République des Lettres
- "Society of precaution and scientific research", Mouvement Universel de la Responsabilité Scientifique
- Symposium to commemorate the centenary of the death of physicist Ludwig Boltzmann (Prof. Jacques Bouveresse)
- Day in honour of Professor Jean-Pierre Changeux
- Ceremony to inaugurate the 16th year of the Institut Universitaire de France
- "Envie d'Amphi", organized by the Mairie de Paris (Lectures by Prof. Dehaene and Prof. Laurens)
- Inauguration of the Institut Émilie du Châtelet, Mme Barret-Ducrocq

**December**
- 25 years of the ANRT
- "Notions of tradition in the work of Walter Benjamin" (Prof. Philippe Descola, Nathan Wachtel)
- Presentation of the awards of the Academy of Computer Science and Applied Mathematics, INRIA
- Meeting of the Haut Conseil de l'Education Artistique et Culturelle (the High Council of Artistic and Cultural Education)

**February**
- Symposium of the Union Rationaliste (Prof. Gérard Fussman)

**March**
- 7th Franco-Syrian Days (Prof. Jean-Marie Durand)
- "Landscape beyond land: New ethnographies of landscape and environment (Prof. Philippe Descola)

**April**
- Concert, Philharmonic Orchestra of Aubervilliers (Prof. Carlo Ossola)
- "The Hair-Bundle Cytoskeleton" (Prof. Christine Petit)

**May**
- "Around Europe" (Prof. Mireille Delmas-Marty)
- "Orality and the social link in the Middle Ages (the West, Byzantium, Islam): word given, faith sworn, oath", Institut d'Études Byzantines
- "Christians and the Arab World: heritage and future" (Profs Henry Laurens and Gilles Veinstein)
- Symposium of the Asian Society (Prof. Jean-Marie Durand)

**June**
- Final symposium of the ACI of Integrative Computational Neurosciences
(Prof. Alain Berthoz)
- "PhD Schools" symposium of Paris VI University
- General Assembly of the École des Ponts et Chaussées

**July**
- "Vision-Audition" (Prof. Christine Petit)

## Outside events

Collège de France Colloquium abroad:
"The New World of Public Health and Prevention"
Berlin (Germany) 10-12 May 2007
Collège de France, La Charité – Universitätsmedizin Berlin, Berlin-Brandenburgische Akademie der Wissenschaften

# Research Teams Received

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 team 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 Professors, after evaluation by a commission of professors.

**Teams currently hosted:**

- François TRONCHE
  Molecular genetics, physiology and behaviour (UMR 7148)
- Christian ROBIN
  Semitic studies (UMR 7119)
- Jean-Claude CHEYNET
  Centre for the Study of Byzantine History and Civilization
- Alain THOTE
  Centre for Research on Chinese and Japanese Civilization (UMR 7129)
- Lyne BANSAT-BOUDON
  Institute for Indian Studies
- Xavier JEUNEMAITRE
  Genes and blood pressure mineralocorticoid (U 772)
- Catherine LLORENS-CORTES
  Central neuropeptides and the regulation of body fluid homeostatis and cardiovascular functions (U 691)
- Jean-Michel DENIAU
  The dynamics and physiopathology of neuron networks (U 667)
- Misha TSODYKS
  Computational neuroscience
- Christian GIAUME
  Junctional communication and interaction between neuronal and glial networks

UMR: Unité mixte de recherche (Combined Research Unit)
U: Unité (Unit)

# Maîtres de Conférences and Attachés Temporaires d'Enseignement et de Recherche (ATER) at the Collège de France – 2006-2007

Temporary position permit to receive yearly 31 Maîtres de conférences and 15 ATER in the chairs and research laboratories at the College of France.

| Nationality | Number |
|---|---|
| German | 2 |
| Belgian | 1 |
| Brazilian | 2 |
| Chilean-Italian | 1 |
| French | 35 |
| Franco-Swiss | 1 |
| Dutch | 1 |
| Indian | 1 |
| Italian | 4 |
| Russian | 1 |
| Swiss | 2 |
| Taiwanese | 1 |

# The Collège de France Institutes

The Collège de France has four Institutes: Biology; the Contemporary World; Literary Studies; and the Far East. These are informal structures with no official status from an administrative point of view. They group together Chairs and hosted teams.

The Institutes are created or closed on the initiative of the professors concerned, after a formal decision by the Assembly.

They promote and facilitate research by defining common projects and by pooling technical staff, equipment (technical facilities, libraries, etc.) and premises.

The modalities of these Institutes' organization may vary.

## Institute of Biology

The Collège de France Institute of Biology, created in 1983 on a decision of the Assembly of Professors, includes the Collège's Professors of Biology (whether their laboratory is located at the Collège itself or elsewhere) and the teams hosted by the Collège. The incumbent President is Alain Berthoz.

*Chairs whose laboratories are located at the Institute of Biology:*
- Alain Berthoz – Physiology of Perception and Action (CNRS UMR 7152)
- Pierre Corvol – Experimental Medicine (Inserm U833)

*Chairs whose laboratories are not located at the Collège de France:*
- Spyros Artavanis-Tsakonas – Developmental Biology and Genetics
- Stanislas Dehaene – Experimental Cognitive Psychology (Inserm-CEA 562)
- Philippe Kourilsky – Molecular Immunology
- Jean-Louis Mandel – Human Genetics (Inserm U596)
- Christine Petit – Genetics and Cell Physiology (Inserm U587)
- Alain Prochiantz – Morphogenic Processes (arrival on the Marcelin Berthelot site in 2008)

*Hosted teams located within the Institute of Biology (they benefit from all the Institute's resources):*
- Jean-Michel Deniau – Inserm U667 – Dynamics and Pathophysiology of Neuronal Networks
- Xavier Jeunemaitre – Inserm U772 – Genes and Blood Pressure
- Catherine Llorens-Cortes – Inserm U691 – Central neuropeptides and the regulation of body fluids
- François Tronche – CNRS UMR 7148 – Molecular Genetics, Neurophysiology and Behaviour
- Christian Giaume – Inserm U840 – Junctional communication and interaction between neuronal and glial networks.

Mrs Anne Fagot-Largeault, holder of the chair of Philosophy of Biological and Medical Science, and Mr Armand de Ricqlès, holder of the chair of Historical Biology and Evolutionism, also participate in discussions concerning the Collège de France Institute of Biology.

The aim of the Institute is to promote the research being done within the Collège de France, via several actions defined by the professors of the Institute and applied by its Coordination Committee. This committee consists of staff from each of the units and research laboratories located on the Marcelin Berthelot site. It is chaired by the President of the Institute of Biology.

*Shared resources:*
- animal facilities: conventional and transgenic
- technical platforms: confocal imaging and electron microscopy, neural imaging
- equipment for studying behaviour in rodents
- document library

*Scientific activities:*
- Seminars by each professor or laboratory, and PhD examinations
- Seminars organized jointly by different professors and hosted teams
- Organization of the Institute of Biology's Science Day.

One of the Institute of Biology's most important missions is to enable young teams to occupy research space on a four-yearly basis, renewable once.

*Shared funding:*
Funding is provided by the Collège de France Voronoff Foundation and a grant from the Collège's Federative Institute of Biological Research (IFR 52, Inserm-CNRS).

## Institute of the Contemporary World

The Institute of the Contemporary World was created in 2005.

It groups together six Collège de France Chairs, five of which are located on the Ulm site and one on the Cardinal Lemoine site:

- Mireille Delmas-Marty – Comparative Legal Studies and Internationalization of Law
- Philippe Descola – Anthropology of Nature
- Jon Elster – Rationality and Social Sciences
- Roger Guesnerie – Economic Theory and Social Organization
- Henry Laurens – Contemporary Arab History
- Pierre Rosanvallon – Modern and Contemporary History of Politics

The Institute is coordinated by a professor on the basis of a two-year rotating system. Pierre Rosanvallon is coordinator for 2006 and 2007.

The members of the Institute are currently all participating in a multi-disciplinary study on globalization, focused on the following three dimensions: democracy, the rule of law, and the market.

Three key topics are addressed:
- Management of global collective (public) goods
- National sovereignty in question and the question of governance
- Towards a global political society: law and politics in the constitution of an international order.

Several colloquiums will address these issues in 2007 and 2008. Study days will also be devoted to the problems of terrorism and civil wars.

## Institute of Literary Studies

The Institute of Literary Studies combines the Collège de France Chairs devoted to literature studies and related subjects (history of art, history of books):

*Professors:*
- Roger Chartier: Writing and cultures in modern Europe
- Antoine Compagnon: Modern and contemporary literature: history, theory, critique
- Michael Edwards: Studies of literary creation in English
- Carlo Ossola: Modern literatures of neo-latin Europe
- Roland Recht: History of european medieval and modern art
- Michel Zink: Literatures of medieval France

*Emeritus Professors:*
- Yves Bonnefoy: History of the poetic function
- Marc Fumaroli: Rhetoric and society in Europe (16th–17th centuries)
- Harald Weinrich: Romance languages and literatures.

Michel Zink is currently the Director of the Institute of Literary Studies. Odile Bombarde, lecturer, is responsible for the secretariat and coordination.

For the past fifteen years, the Institute of Literary Studies has regularly organized colloquiums under the responsibility of one of its members. These colloquiums bring all of its members together around a common research programme. Examples include Yves Bonnefoy's annual colloquium on 'Poetry's self-awareness', held at the University of Sarrebruck in 2005; Michel Zink's colloquium on *L'œuvre et son ombre. Que peut la littérature secondaire?* (Editions de Fallois, 2002); and Carlo Ossola's colloquium on *Pétrarque et l'Europe* (Editions Million, 2006).

The Institute of Literary Studies recently launched a new programme on translation. A preparatory day will be held in the autumn of 2007 and the first colloquium is scheduled for 2008.

Finally, the Institute of Literary Studies is closely associated with the publication of the *History of the Collège de France,* coordinated by Marc Fumaroli. The first volume was published in 2006.

## The Collège de France's Oriental Institutes

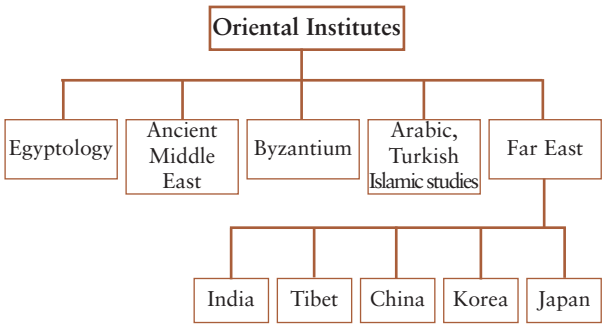
As a pioneer in oriental studies in France and in some cases in the world, the Collège de France has always had very rich libraries in this field. Its collections were enhanced by the transfer in 1973 of the oriental studies institutes from the former Sorbonne. To a large extent, these libraries had always been open to researchers from outside the Collège de France. But their statuses differed considerably, they functioned independently, and they did not belong to the French university library system, which cut them off from an essential source of funding (for staff and operating costs). The development of catalogues accessible via Internet also necessitated the choice and purchase of new management systems, the costs of which exceeded

the means of individual libraries. Finally, most of the libraries were affiliated with a Chair and consequently depended on its existence. In such cases the Collège could be tempted to maintain a particular Chair to ensure the survival of its library, which was often the only one of its kind in France.

The reform adopted on 26 June 2005 by the Assembly of Professors consisted primarily in systematizing a series of measures, most of which had been taken previously by the Collège to remedy this situation.

1. The Oriental Institutes now form a federation of five Institutes with a large degree of managerial independence and no legal ties with the Chairs:

2. The Oriental Institute's documentary collections are considered to be specialized sections of the general library. This will eventually lead to the unification of the catalogues and to a coordinated procurement policy. The collections are currently part of the university documentation system (SUDOC).




3. It is primarily the institutes, that is, institutions devoted to research and managed jointly with researchers, most of whom are from outside the Collège, that use the libraries. These institutes have the means to publish. Each of them is run by a Director and a Scientific Committee appointed for three years. The Federation of Institutes is headed by the Council consisting of Collège de France professors and a Scientific Committee with diverse outside personalities.

4. Although the collections are considered to be 'classical', and the researchers are often specialists in Antiquity or the Middle Ages, the contemporary world falls within their research field. This is not only because classical India ended with the arrival of the British, and the chronological limit of China was the end of the Manchurian Dynasty (1912). The linguistic collections have no chronological limit and the Bible, the Koran, the Veda, and Buddhist and Confucian texts are all too often at the crux of contemporary issues or violence for their current importance to be denied.

5. This reform has been endorsed by agreements with the Collège de France's main partners (the Under-directorate of libraries of the Ministry for Higher Education and Research, the General Directorate of the CNRS, the BULAC (university library of languages and civilizations), the national institute for living oriental languages and civilizations, and the institute for research on the history of texts). The sharing of competencies and funding has thus been defined. ■

# Collège de France Websites – Podcasts

Since its creation in 2000 the Collège de France website has grown considerably. The Institution's lectures are thus disseminated more widely, both nationally and internationally, and Internet users are offered a technically efficient and aesthetic tool. This process has been enhanced by the use of new technologies.

In November 2006 the French website was redone completely: clearer navigation; a more informative home page on the Institution's current news; more modern site, with quality iconography; an architecture that affords rich possibilities for the presentation of content; the integration of new media: podcasts, audio and video; an RSS feed (system of subscription to a selected site); a relevant search engine and optimized referencing of all contents for specialized search engines and directories (insertion: keywords, scientific abstracts, titling of downloaded documents, etc.).

In this new version, some sections have been highlighted, e.g. publications (these pages are very frequently consulted) and research. In the latter section one of the Institution's main purposes is highlighted, as well as its main mission: the professors' own original research. Each professor has his or her own space of at least six web pages.

The website does not only describe the Collège de France's history and functioning. It is designed essentially to make this Institution known, in order to promote the diversity and quality of its teaching and research work. Implicit therein is the objective of disseminating this scientific material as widely as possible, in a spirit of openness, free-of-charge access, and scientific sharing. Over one thousand scientific documents (lecture notes, abstracts, bibliographies, etc.) are currently available for downloading.

The website is also a tool made available to all the professors and emeritus professors for disseminating scientific documents (PDF or audio) to an audience close to their research field (students, researchers, lecturers, etc.) and for presenting their bibliography and/or biography to other colleagues or organizations.

Since November 2006, over a period of eight months, there have been 693,675 connections to the Collège de France website.

Since January 2007, in order to increase the dissemination of lectures and to enable more people to have access to their audio transmissions, a system of audio podcasting was set up for 16 professors' lectures. In six months, they have been downloaded 700,000 times and classified first by the 'iTunes' podcast reader. Internet users can also download them directly from the website; there have been 50,000 downloadings during the same period. During the coming year we hope to double this dissemination. As regards the scientific Chairs, the documents projected during lectures are also available, as it is often essential to a sound understanding. This technology has a considerable educational value and caters mainly for students.

Some videos are also available and we are planning on offering Internet users short interviews with Collège de France professors.

In May 2007 an English-language website was created, with the following sections:

- Professors: a presentation of their research domain, a biography and bibliography, a list of professors and Chairs, honorary professors and deceased professors
- Research: presentation of the research laboratories, the Institutes and the teams hosted
- Institution: history of the Collège de France, functioning of the Institution, archaeology, projects and libraries
- Lecture agenda, news
- International: presentation of conventions with foreign partners
- Publications: presentation of all the Institution's publications
- Search engine.

This site is designed to meet an international public's expectations. The ergonomics are however identical to the French one, to preserve the unity and identity of both sites. The English site will be developed further during the next few months. ■

# Publications – 2006-2007

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 College's colloquiums.

## Éditions Fayard

**Collection "Leçons inaugurales"**

- Antoine COMPAGNON, *La littérature, pour quoi faire?*, 2006, n° 188.
- Daniele VITALI, *Les Celtes d'Italie*, 2006, n° 189.
- Jean-Paul CLOZEL, *La biotechnologie : de la science au médicament*, 2007, n° 190.
- Pascal DUSAPIN, *Composer. Musique, paradoxe*, flux, 2007, n° 191.
- Guy ORBAN, *La vision, mission du cerveau. Les trois révolutions des neurosciences cognitives*, 2007, n° 192.

## Éditions Odile Jacob

- Raymond BIRN, *La Censure royale des livres dans la France des Lumières*, 2007 (foreword by Daniel ROCHE).
- Jean-Pierre CHANGEUX (ed.), *L'homme artificiel au service de la société*, 2007.
- Jean-Pierre CHANGEUX, Jacques REISSE (eds.), *Un monde meilleur pour tous*, forthcoming.
- Jon ELSTER, *Agir contre soi. La faiblesse de volonté*, 2007.

## Yearbook

- *Cours et travaux du Collège de France. Résumés 2005-06*. Annuaire 106e année.

## DVDs

Coproduction College de France / CNED / Doriane Films

- Pascal DUSAPIN, *Composer. Musique, paradoxe, flux*, juin 2007.
- Antoine COMPAGNON, *La littérature, pour quoi faire ?*, mars 2007.

The inaugural lectures of Profs. D. Vitali, J.-P. Clozel, G. Orban and M. Devoret can be downloaded on the website of the College de France (www.college-de-france.fr).

# Collège de France Autumn Symposium – 2007-2008

## ON AUTHORITY
18 and 19 October 2007

"Authority. Right or power to command, to be obeyed." From antiquity through to our contemporary world, in all cultures, authority – sovereignty, the sacred, the book, dogma – has underpinned the social order. But what about today? In virtual space, who or what has authority?
Authority is everywhere and nowhere. Law, philosophy, religion, political science, economics, sociology: all these disciplines will be questioned on the function that they have attribute and still do attribute to authority, to the need for authority, to the effects of its absence, and to laissez-faire and regulation.
Science has taken a stand against the argument of authority, but there is an authority of science and authority in the sciences. All the exact, human and social sciences deal with authority. How is consensus built in research? How is scientific authority defined? What submission does it demand? What protest does it allow?
The number of independent authorities is multiplying today. Is this the result of our growing mistrust of the state's authority?
*Nulla auctoritas nisi a Deo*, goes the medieval saying that originated with Saint Paul. 'There is no authority that does not stem from God.' How can authority be established in the 21st century? ■

## Program

**Thursday 18 October**

Sovereignty and democracy
- The authority of the Constitution

Pierre Mazeaud, Académie des Sciences Morales et Politiques
- The metamorphoses of legitimacy

Pierre Rosanvallon, Collège de France

Culture and history
- What makes statements of tradition imperative: a pragmatic analysis

Carlo Severi, École des Hautes Etudes en Sciences Sociales
- Auctor et auctoritas in the Middle Ages

Michel Zink, Collège de France

Norms and behaviours
- The ethics of belief and the question of the 'weight of authority'

Jacques Bouveresse, Collège de France
- Understanding the authority of moral standards

Catherine Audard, London School of Economics

Sciences and beliefs
- The adoption of a scientific theory: plate tectonics, the greenhouse effect

Xavier Le Pichon, Collège de France

Reasons and passions
- Autority and decision-making

Bertrand Saint-Sernin, Université Paris IV-Sorbonne
- Interactions between emotion and cognition in decision-making

Jonathan D. Cohen, Princeton University

**Friday 19 October**

Experiences and sanctions
- How to justify scientific authority?

Jean Bricmont, Université Catholique de Louvain
- Science and the nature of mathematical theorems

Édouard Brézin, École Normale Supérieure
- The authority of the leading scientific journals

Denis Jérome, Université Paris-Sud Orsay

Texts and traditions
- The limits of royal authority in Mesopotamia: customs, the Ancients, taboos, the Gods' demands

Jean-Marie Durand, Collège de France
- The origin of the Biblical canon and the invention of scriptural authority

Thomas Römer, Lausanne University

Laissez-faire and power
- The supremacy of share-holders called into question

Roger Guesnerie, Collège de France
- Authority without a state: the Palestinians since the inter-war period

Henry Laurens, Collège de France

Regulations and appeals
- What is an independent high authority?

Louis Schweitzer, Haute Autorité de Lutte Contre les Discriminations et Pour l'Egalité
- Medical authority

Joël Ménard, Université Paris V
- Authority of judgement

Guy Canivet, Conseil constitutionnel

# AGENDA

COLLÈGE DE FRANCE
1530

## Academic Year 2007-2008

New Chairs Created

- Microbiology and infectious diseases
- Human Paleontology
- Biblic communities

New Professors

- Gérard BERRY, Chair of Technological Innovation - Liliane Bettencourt 2007-2008
- Roger CHARTIER, Chair of Writings and cultures in modern Europe
- Michel DEVORET, Chair of Mesoscopic Physics
- Manfred KROPP, European Chair 2007-2008
- Pierre MAGISTRETTI, International Chair 2007-2008
- Ariane MNOUCHKINE, Chair of Artistic Creation 2007-2008
- Alain PROCHIANTZ, Chair of Morphogenetic Processes

The Inaugural Lectures will take place at 6 pm in the Marguerite de Navarre Lecture Hall.

- 4 October 2007: Alain PROCHIANTZ
- 11 October 2007: Roger CHARTIER
- 15 November 2007: Manfred KROPP
- 17 January 2008: Gérard BERRY
- 14 February 2008: Pierre MAGISTRETTI
- 13 March 2008: Ariane MNOUCHKINE

Guest Conference Speakers

- Maria Giovanna BIGA, professor, University of Rome (Italia)
- Philippe BORGEAUD, professor, Geneva University (Switzerland)
- Jean COHEN, professor, Columbia University, New York (USA)
- Elaine FUCHS, professor, Rockefeller University, New York (USA)
- Diego GAMBETTA, professor, Nuffield College, Oxford University (Great Britain)
- Peter GOLDEN, professor, Rutgers University, Newark (USA)
- Orly GOLDWASSER, professor, Hebrew University, Jerusalem (Israel)
- Geoffrey HILL, emeritus professor, Boston University (USA)
- Albert de JONG, Dr., Leiden University (Netherlands)
- Nicholas PURCELL, professor, St. John's College, Oxford (Great Britain)
- Dong-Hyun SON, professor, Sungkyunkwan University, Seoul (Korea)

WWW.COLLEGE-DE-FRANCE.FR

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