INSTITUT DE FRANCE
Académie des sciences

With the Académie des Sciences
in 2013-2014

- Encouraging the Scientific Community
- Promoting Science Teaching
- Transmitting Knowledge
- Fostering International Collaboration
- Performing the Role of an Expert and Advisor

EDITORIAL

On its creation in December 1666, King Louis XIV entrusted the Académie des Sciences with the mission of establishing exchanges of discoveries with the foreign academies (entrer en commerce de découvertes avec les académies étrangères). The presence of a stranger among the first members of the Académie – the physicist, mathematician and astronomer Christian Huygens – is indeed symbolic of this.

In the middle of the 18th Century, as science was booming, most notably in Europe, the international reputation of the Académie was at its highest. King Frederic II of Prussia thus asked Académie Member Pierre Louis de Maupertuis to rejuvenate his Academy in Berlin, taking as an example the Academy France had put into place. The Académie also stood out when Maupertuis and Charles Marie de la Condamine made the prestigious expeditions to Lapland and Peru, where studied the shape of Earth and confirmed Newton's theory on the oblateness of our planet. In 1790, it was again the Académie des Sciences that was entrusted by the Assemblée Nationale Constituante (French National Constituent Assembly) with the difficult task to unify the systems of weights and measures that coexisted in France. Under the direction of Antoine Lavoisier, the Commission des Poids et Mesures (Commission of Weights and Measures) of the Académie would achieve such unification, thus giving birth to the metrical system.

Century after century, the international influence of the Académie is still there for all to see: the Académie is now one of the five most highly regarded academies in the world. Since the first exchanges of great European scientific figures in the 17th and 18th Century, the Académie has considerably expanded its activities at the international level. It is indeed an active and influent member of the great European and global scientific networks. Through its bilateral agreements, it carries out science diplomacy initiatives, which is essential for promoting science and, also, fostering exchanges among scientists of countries whose diplomatic relations are dwindling. Lastly, the Académie has traditionally been proactive, and is ever more resolutely so, in the whole sphere of actions that aid the development of Southern countries. The present document provides a detailed account of this crucial task in international relations, carried out by the Académie as a reminder that science knows no boundary – is universal.

Bearing this in mind, the Académie des Sciences will, in autumn 2016, as a key moment in the celebration events of its 350th anniversary, gather the leaders of all the foreign academies with which it has set cooperative agreements. On this occasion, delegations of more than 50 countries will have the opportunity to deliver a message with the Académie des Sciences that will highlight the vital role of science in the progress of humanity.

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Catherine Bréchignac

Secrétaires perpétuels
of the Académie des sciences

A Word from the President

The Académie des Sciences has unique assets to achieve its tasks.

We have indeed lowered the mean age of our Company, as 50% of our new members are now elected before the age of 55. In 1995, the mean age of our members was 70.4 years; the current mean age of our new members is now 63.5 years, which is below the age of retirement from University or French public research institutions. As such members are in active employment, they enable the Académie to retain close connections with the life in the laboratories.

As for the election process, it is resolutely multidisciplinary, thus avoiding appointments to be the results of decisions made in very closed circles: elections within a given section indeed involve members of other sections, each discipline therefore debating, beyond its own perspective, the merits of the different candidates. As regards the elections that concern several disciplines, they are held by multidisciplinary commissions.

The Académie's contributions and communications are meant to last. Its working groups, assisted by external experts chosen for their skills, draw up high-quality documents in many areas, which are promptly disseminated and read by the widest audience possible thanks to digital information. Our time horizon, however, is not the instant and its tyranny: we assume responsibility for the advice we give, even years later, unlike numerous committees whose evanescence lead to abide by the doxa of their time.

Collegiality, lastly, is vital to the Académie. Now more than ever. For, in this rather troubled period, knowledge and reason are too often replaced by emotions and superficiality. Accountable to the younger generations, the Académie is the active witness of the scientific approach, against those who call for a return to the irrational as a means of action in this world already complicated enough.

© DR

Bernard Meunier
President of the Académie des Sciences

SOMMAIRE

THE ACADÉMIE: ALWAYS IN TUNE WITH ITS TIME

Soon 350 years old

On 22 December 1666, Colbert introduces about fifteen savants to King Louis XIV, who bestows upon them the task of *driving and fostering science for the public good and glory*. In return, he grants them his protection and funds their work.

Today, despite the trials and tribulations brought about over the centuries by the instability of power relations, the Académie remains the enlightening institution it was at the end of the 17th Century. Still protected by the highest magistrate of the country, it has however won independence: it administers itself independently, under the sole control of the *Cour des comptes* (French Court of Audit).

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From Louis XIV onwards

1666 - Birth of the *Académie des Sciences de Paris*, at the initative of Colbert

1699 - Birth of the *Académie Royale des Sciences*, with Statutes established by the king

1793 - Termination of the three Académies: *Française* (founded in 1635), *Inscriptions et Belles-Lettres* (1663) and Sciences (1666)

1795 - Foundation of the *Institut National des Sciences et des Arts*, composed of the three Académies

1805 - Napoléon moves the *Institut National des Sciences et des Arts* to the premises of the former *Collège des Quatre-Nations*, on the Quai de Conti in Paris

1816 - The three Académies become independent within the *Institut de France*. They are joined by the *Académie des Beaux-arts* (founded in 1816) and later the *Académie des Sciences morales et politiques* (1832)

Today - The *Académie des Sciences* is a legal person governed by public law with a particular status under the Research Programme Law of 18 April 2006

Adapting to the evolution of science

Faced with an unprecedented boom in science and the birth of new disciplines, the Académie has revamped itself. In the early 2000s, it has adopted new statutes that, in particular, have seen its membership increased – on 1 June 2015, the Académie is composed of 264 members, 126 foreign associates and 93 correspondents – and rejuvinated: at each session of elections, at least 50% of the new members – junior members – are less than 55 years old on 1 January of the year of their election, and therefore engaged in professional activities. In doing so, the Académie covers as widely as possible the whole range of scientific disciplines, including the most emerging ones.

Two sessions of elections in 2013 and 2014

Each election is the result of a multistep process that lasts almost one year and involves all the members of the Académie. With its two sessions of elections in 2013 and 2014[1,2], the Académie des Sciences has included 27 new members, among which 14 *junior members*. Once their elections approved by the President of the French Republic and the official decree published, the new members of the Académie joined the disciplinary sections of their choice, within one of the two divisions. The members elected in 2013 were solemnly greeted under the Cupola of the Institut de France on 17 June 2014. The members elected in 2014 shall be so on 23 June 2015.

The Plenary Assembly of 18 November 2014 also elected Bernard Meunier as Vice President of the Académie des Sciences and President for 2015-2016. He took office on 6 January 2015, as successor to Philippe Taquet who was President in 2013-2014. The same Plenary Assembly elected Sébastien Candel as Vice President for 2015-2016.

Five missions supporting the progress of science

Gathering some of the most eminent French and foreign scientists, the Académie des Sciences is a multidisciplinary assembly with an open international outlook. It carries out five critical missions:

- encouraging the scientific community;
- promoting science teaching;
- transmitting knowledge;
- fostering international collaboration;
- playing an expert and advisory role.

Its members conduct their work within thematic committees undertaking reflections in close interaction with its statutory governing bodies, which all have voting rights.

Bodies for decision making and reflection

*as of 1 June 2015

ENCOURAGING THE SCIENTIFIC COMMUNITY

The Académie des Sciences carries out actions to support scientific research. It thus holds scientific colloquia and sessions on various themes in order to promote high-level exchanges. Moreover, it honours the best scientists by awarding them prizes for their work. Lastly, it publishes the review *Les Comptes Rendus de l'Académie des sciences* with the aim of contributing to the diffusion of knowledge among the international community.

Colloquia by and for the scientific community

Confronting knowledge and skills is crucial to scientific progress. Boosted by its interdisciplinary approaches and close connections with the forces of research, both in France and abroad, the Académie des Sciences organizes every year a series of scientific meetings focused on research fields that delve into the boundaries of knowledge[3].

Conference Debates

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Shale Gas

In its report *La recherche scientifique face aux défis de l'énergie [Scientific research rising to the challenges of energy] (EDP Sciences Ed., December 2012)*, the Académie des Sciences recommended that a study be conducted before any decision should be taken on shale gas exploitation, to explore its benefits, drawbacks, economic issues and impacts on the environment. To this end, it has decided to gather the best French and international experts regarding these unconventional gas resources so as to provide all those interested in the issue with the most up-to-date pieces of scientific and technical information. Following this conference debate, the work of the Standing Committee for Prospects in Energy Procurement has lead the Académie des Sciences to publish the advice note *Elements to Clarify the Shale Gas Debate* (26 February 2013).

Calculation, Computer Science and Quantum Computers

Calculation, Computer Science and Quantum Computers constitute Quantum Computing (QC), whose general principle is to use the laws and phenomena of Quantum mechanics for the best profit of information processing. During this conference at the Académie des Sciences, experts from this emerging discipline, which is still little known to the general public and many scientists, have described the physical and mathematical bases, the circuits and the algorithmic aspects of QC (2 April 2013).

Mass Data: Directions and Issues Regarding Big Data

Digital data is now being produced in ever bigger quantities. Such quantities of informations paves the way for new perspectives, both in the exact and the human sciences. Now how may such "mass data" be best managed and used? The conference at the Académie des Sciences gave the opportunity to consider the critical management issues: warehousing, analysing, sorting and optimizing data, respecting privacy, ensuring availability to all (18 February 2014).

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Planetary Climate Engineering

In addition to the necessary policies aiming at reducing greenhouse gas, the possible input of "planetary climate engineering" techniques remains under discussion. The session organized by the Académie des Sciences gave the opportunity to present the state of research on the different methods through which solar radiation is managed – cloud seeding – and on atmospheric CO_2 reduction techniques, such as ocean fertilization, CO_2 uptake by the continental biosphere or CO_2 geological storage (25 June 2013).

Climate System Observation

To assess the impact of human activity on climate, a most critical and thorough understanding of the Earth's climatic past on geological, millenary, secular or decennial time scales is needed. Its evolution since the beginning or the 20th Century is well documented, thanks to the measurements taken within the global meteorological network and, now, to the global coverage that satellite observations offer. These observations constitute an exceptional database, which allows the behaviour of this complex system to be analysed and the physical and chemical interaction mechanisms occurring in the coupled ocean-atmosphere-ice-continental surface system to be studied - a system which is often designated as a synthetic "climate system" (16 December 2014).

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Star Formation: from Small to Large Scales

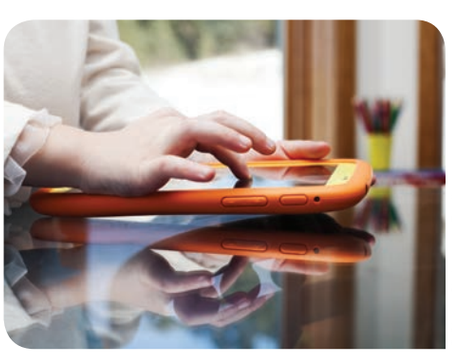
Research on the mechanisms that account for the formation of stars is crucial to understand the origin of our own sun, as well as to study the formation of planetary systems and the evolution of galaxies. Despite the great number of physical effects involved, it seems that these phenomena are governed by quite simple and virtually universal laws. Building on the most recent data, including data gathered by the Herschel Space Observatory, this session of the Académie des Sciences was an opportunity to provide an overview of the star formation mechanisms and question their universality (1 April 2014).

Major Questions of Cosmology and Fundamental Physics

Cosmology, the science of the origins and evolution of the universe, is now experiencing spectacular developments through ever more accurate observation tools. The conference of the Académie des Sciences took stock of the current state of knowledge on this topic, in light of the most recent experimental findings and their theoretical interpretation, and underlined the scientific analogies that link cosmology and fundamental physics (3 June 2014).

Children and Screens

The construction of the brain functions depends upon the nature of the external stimulations it receives, whether sensory, emotional or sociocultural. Children's exposure to digital screens has therefore a critical impact. The conference held by the Académie des Sciences in parallel to the publication of its advice note *L'enfant et les écrans* [Children and Screens] *(Le Pommier Ed., January 2013)* gave the opportunity to focus on the benefits, in terms of learning, of using screens with children and teenagers but also the risks of addiction or regressive phenomena (22 January 2013).



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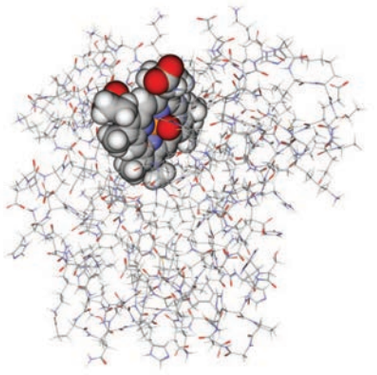
Exploring the Interface Between Chemistry and Physics

The interactions shared between chemistry and physics are sometimes little known, while many a research project takes place on the interface between these two disciplines. The conference of the Académie des Sciences has focused on how they mutually feed one another, through several examples: molecular conductors and rotors, submicrometric devices from the field of organic electronics, the electronic properties of transition metal oxides, and vitrimers, a new class of materials sharing properties with glass and plastic (12 February 2013).



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Modelling and Molecular Dynamics: How do they Impact on Life Sciences?

The processes of modelling and simulating at the molecular scale play an ever greater role on the interface between life sciences and chemistry and are now as key partners to the experimentation phase. Speakers invited by the Académie des Sciences, notably Martin Karplus, 2013 Nobel Prize in Chemistry, have shown how simulation makes it possible to "visualize" the molecular interactions that occur in complex biological functions, and thus constitutes a precious tool for interpreting experimental observations and guide new experiences (27 May 2014).

Members of the Académie pay tribute to their predecessors

On a regular basis, sessions are devoted to disappeared members of the Académie. In 2013 and 2014, the memory of the following members has thus been honoured:

- Alexis Clairaut (1713-1765), one the great mathematicians of his time along with such eminent scientists as Euler, Bernouilli and D'Alembert. His work gave a decisive impulse to the new style of physico-mathematics, in which mathematics (differential and integral calculus, differential equations, partial derivative equations) and physics (astronomy, mechanics, optics) progress side by side. *The tercentenary of Clairaut, a Mathematician and Geophysicist* (14 May 2013); *The Tercentenary of Clairaut, a Scientist of the Enlightenment* (13 and 14 May 2013);
- Antoine Parmentier (1737-1813), a pharmacist, agronomist, nutritionist and hygienist, who promoted the introduction of potato into human diet, especially to fight food shortage. He also distinguished himself by the positions he took as a man of science within society. *Science in the Service of Public Good, a Joint Session of the Académie des Sciences and Académie d'Agriculture de France* (16 October 2013);
- Louis Pasteur (1822-1895): 150 years after his election to the Académie des Sciences, this tribute to Louis Pasteur revisited his fundamental contributions to the understanding of living beings and outlined the new microbiology that is heir to his most momentous work. *Louis Pasteur: What Answers for the Future?* (9 April2013);
- Maurice Tubiana (1920-2013), a cancer physician and physicist of worldwide reputation for his expertise in anticancer radiation therapy, was on the clinical side a pioneer in translational research, and, regarding public health, an expert in analyzing the relations between cancer and the environment – which gave rise to the initiatives he carried out, leading to the French anti-tobacco laws. *A Joint Session of the Académie des Sciences and Académie Nationale de Médecine* (2 December 2014);
- Michel Durand-Delga (1923-2012), a geologist who devoted his career to studying the chains of the Alps near the Western banks of the Mediterranean Sea: he notably defined the Maghrebian Chain, which is 3000 km long from the Rif mountains to Calabria, and highlighted the complex situation, from a tectonic point of view, of the Gibraltar Arc. *Colloquium held in cooperation with the Société Géologique de France* (3 December 2013).

Partner Sessions and colloquia

Genetically Modified Plants

The genetic modification of plants involves a whole set of scientific and technological tools, which is available to the scientific community. In 2012, the Académie des Sciences launched a internal reflection on the topic, focusing on the techniques that improve plants (quality, herbicide- and insect-resistance), the potential impacts of genetically modified plants (GMP) on human or animal health and the ecological issues raised by their use. This reflection added to the considerations of other academies sharing an interest in this topic, on the occasion of a joint colloquia widely open to civil society and organized around what preliminary discussions had been pointed as crucial issues (19 November2013)[4].

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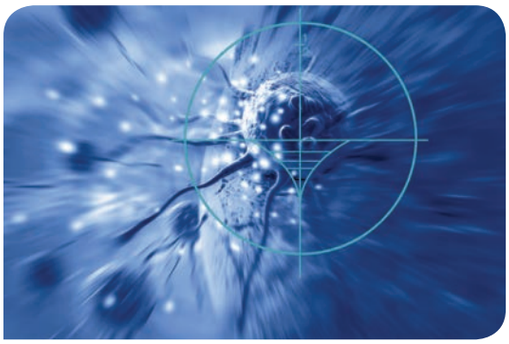
Académie des Sciences - Académie d'Agriculture de France - Académie des Technologies Colloquium

Personal Genome and the Practice of Medicine

Genomics, which revolutionized the practice of biological sciences, are now entering the clinical field. While the notion of a personalized medicine is not entirely new, the considerable progress of genomics should provide the means for reaching individual variability where human health is concerned, whether in diagnosis, prognosis or treatments. However, before such medical practice based on the study of the genome spreads, economic and ethical issues remain, as well as issues related to the training and information of the practitioners and populations (12 November 2013).

Académie des Sciences-Académie Nationale de Médecine Joint Session



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Personalized Medicine in Cancer Oncology

In oncology, the molecular profiling of tumours may help fight them better. However, while major progress have been achieved in the field, limits yet remain. Certain targeted treatments are effective against rare forms of cancer, whose mechanisms are well understood because they derive from simple molecular lesions. It remains uncertain whether they may be relevant against more common cancers (breast, intestine, lung, kidney,…), which result from cumulative lesions (23 April 2013).

Académie des Sciences - Académie Nationale de Médecine Joint Session

Therapeutic Innovation

Considerable progress has been achieved in the last thirty years at all stages of research for new drugs: molecule synthesis and assessment, pharmacology, toxicology, pharmacokinetics and metabolism, formulation and targeting, clinical trials. However, the number of really innovative molecules on the market remains small in comparison to such progress. New avenues may be explored to overcome the hindrances to such innovation, whether they pertain to the field of science, to ethics or law (11 June 2013).

Académie des Sciences-Académie Nationale de Pharmacie-Académie des Technologies Joint Session

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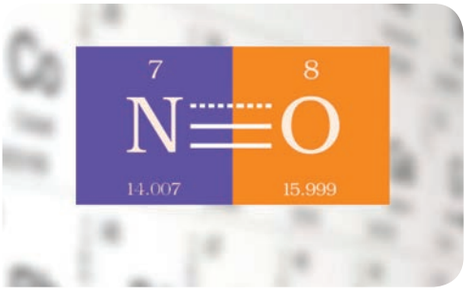
Multiple Drug Resistance in Infection and Cancer

The Darwinian adaptation of bacteria to selective pressures from antibiotics is a phenomenon that has been long recognised. More recently, the emergence of resistance to treatments has also been evidenced on cancer cells, which, as bacteria, grow fast and have a high genomic plasticity. This conference gave the opportunity to discover the role played by certain mechanisms that have been identified in the resistance process to anticancer (clonal evolution, kinase) and anti-infection (virus, efflux pumps) drugs (29 April 2014).

Académie des Sciences - Académie Nationale de Médecine Joint Session



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Gas mediators

About thirty years ago, nitric oxide (NO), carbon monoxide (CO) and hydrogen sulphide (SH_2) were only known for their ligand properties on transition metals and their toxic effects. Nowadays, multiple physiological roles are attributed to them, as they regulate such complex and fundamental biological systems as immunity, the cardiovascular system or the central and peripheral nervous system. The most recent work allows for profiling double-facet molecules, which are beneficial at low dose and harmful at high (6 February 2013).

Académie des Sciences - Académie Nationale de Pharmacie Joint Session

International Colloquia

Genetics, Epigenetics and Psychiatric Diseases

Although the human and financial costs induced by mental disorders are considerable, research in this field remains hindered: society is still reluctant to recognize that the brain may be “ill” and that metabolic anomalies may be responsible for psychiatric diseases. The colloquium held at the Académie des Sciences reviewed the place of heredity in the occurrence of mental disorders, whether involving genetic mutations, which in most cases affect, not one gene, but a multiplicity of genes, or epigenetic modifications, which may durably affect the expression of genes and be transmitted from one generation to the other (3 December 2013[5]).

Hypotheses on the Origins of Life

Despite the great deal of knowledge that has been acquired, vast grey areas remain regarding the origins of living beings. The colloquium held at the Académie des Sciences was the opportunity to ask a few crucial questions and to provide elements of answers: how did the building blocks of life formed from the elements of the universe? How were proteins and nucleic acids recruited inside the lipid vesicle, favouring molecule interactions? How did the forming cell manage to master the production of energy? (16 and 17 September 2013)

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Awards and medals

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Thanks to the generosity of private donors, state organisms and enterprises, the Académie des Sciences awards about 80 prizes every year, in basic or applied research fields. Laureates are selected within a regulatory framework that ensures there is no conflict of interest. The juries of prizes that amount to less than €7,500, so-called Thematic Prizes, are composed by the members of the relevant sections. The Grand Prizes, exceeding €15,000, fall under ad hoc juries that include members from different sections and, should the need occur, personalities from outside the Académie. In 2013-2014, 65 Grand Prizes, corresponding to a total sum of €2,044,951.50, and 78 Thematic Prizes, amounting to €322,485 in all, have been awarded by the Académie des Sciences. All these prizes are awarded to the laureates during solemn ceremonies under the Cupola of the Institut de France[6].

The *Grande Médaille* of the Académie des Sciences

Created in 1997, the Grande Médaille singles out every year a scientist in the international landscape for making a decisive contribution to the development of science, as testified both by the originality of his/her personal research projects and by its international standing and stimulating influence, so seminal indeed as to gain proper following from researchers.

2013 laureate

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- Joan A. Steitz, a member of the Howard Hughes Medical Institute and professor in biochemistry and molecular biophysics at Yale University (United States of America)

2014 laureate

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- Joel L. Lebowitz, a professor in mathematics and physics at Rutgers University (United States of America)

The *Fondation Générale de Santé* Prize for Cell Therapy and Regenerative Medicine

The Fondation Générale de Santé and the Académie des Sciences have been awarding since 2012 a prize to reward scientific excellence in the field of tissue regeneration. Amounting to a sum of €100,000 (one part for the laureates, the rest for the work of their teams), the prize rewards:

- basic research, in order to encourage the growth of scientific knowledge;
- translational and clinical research, in order to encourage the fast transfer of knowledge into applications for diagnosis and therapy.

Through these two categories of prizes, the Fondation Générale de Santé and the Académie des Sciences support each and every step of biomedical innovation from the investigations undertaken to deepen scientific knowledge, to the clinical applications developed for the patients' benefits.

Fundamental Research Laureates

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- 2013: Patrick Collombat, a research director at INSERM (French Institute of Health and Medical Research), Diabetes Genetics Team, Nice

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- 2014: Shahragim Tajbakhsh, the director of the Developmental & Stem Cell Biology Department, Institut Pasteur, Paris

Clinical and Translational Research Laureates

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- 2013 : Daniel Aberdam, directeur de recherche à l'Inserm, unité *Immunologie, dermatologie, oncologie*, hôpital Saint-Louis, Paris ;

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- 2014 : Jérôme Larghero, professeur des universités et praticien hospitalier, directeur du département *Biothérapies cellulaires et tissulaires*, hôpital Saint-Louis, Paris.

In June 2014, this prize received the high patronage of the French Ministry of National Education, Higher Education and Research.

Lamonica Prize

Awarded since 2009, the two Académie des Sciences - Fondation pour la Recherche Biomédicale-PCL Lamonica Prizes in neurology (€100,000) and cardiology (€60,000) are intended for a French or foreign scientist working in a French laboratory. Part of the funding is to be used by the laureate, the rest of it enabling him/her to fund his/her research.

Neurology Laureates


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- 2013: Jean-Antoine Girault, a research director at INSERM, director of the Institut du Fer à Moulin, Paris


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- 2014: Christophe Mulle, a research director at CNRS (National Center for Scientific Research), Physiology of Glutamatergic Synapses team leader, University of Bordeaux

Cardiology Laureates


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- 2013: Xavier Jouven, a university professor and hospital practitioner in cardiology (Georges Pompidou European Hospital, Paris), and a professor in epidemiology and public health


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- 2014: Jacques Barhanin, a research director at CNRS, director of the Laboratory of Molecular PhysioMedicine at the Faculty of Medicine, Nice

Institut de France Awards

In the field of science, the great annual awards of the Institut de France - del Duca, Louis D, Lefoulon-Delalande, NRJ, Allianz/Institut de France, Victor Noury, Danièle Hermann prizes - are granted by decision or at the proposal of the Académie des Sciences.

The most important ones are the scientific eminent awards of the Louis D. Foundation (€750,000) and the Simone and Cino del Duca Foundation (€300,000). In both cases, part of the grant is for the scientific team leader, while the other is intended to fund the research team's work, including the recruitment of French or foreign post-doctoral researchers.

Fondation Louis D. Laureates


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- 2013: Thibault Cantat, CEA (French Alternative Energies and Atomic Energy Commission), CNRS, for his work on the theme of CO2 Valorization: Chemical and Biotechnological Approaches


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- 2014: François Bouchet, Astrophysics Institute of Paris, for his work on Cosmology and its Links to Physics: Beyond the Standard Model

Scientific Awards of Simone and Cino del Duca Laureates


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- 2013: Michel Campillo, Joseph-Fourier University, Earth Science Institute, Grenoble, for his work on the theme of Chemistry and Physics in the Earth Dynamics


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- 2014: Stanislav Dusko Ehrlich and Joël Doré, INRA (National Institute for Agricultural Research, for their work on the theme of Microbiome and Homeostasis

Irène Joliot-Curie Prizes

Created in 2001 by the French Ministry of Higher Education and Research and organized in coordination with the EADS corporate Foundation since 2004[7], this award is designed to promote women's position in research and technology in France. On the occasion of its tenth anniversary, its scientific relevance has been highlighted by its partnership with the Académie des Sciences and the Académie des Technologies, in charge of empanelling the members of the jury who designate the laureates. The Joliot-Curie Prize comprises three categories: Female Scientist of the Year (€40,000), Young Female Scientist (€15,000) and Women in Enterprise (€15,000).

Female Scientist of the Year Laureates


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- 2013: Valérie Masson-Delmotte, a research director at CEA, Laboratory for Climate and Environment Sciences, Saclay.


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- 2014: Hélène Olivier-Bourbigou, who leads the research conducted on molecular catalysis at the French Institute of Petroleum (IFP Énergies Nouvelles), Lyon

Young Female Scientist Laureates


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- 2013: Wiebke Drenckhan, a researcher at the CNRS Laboratory of Solid State Physics in Orsay, and Claire Wyart, the leader of the Optogenetic dissection of spinal circuits underlying locomotion team, Brain & Spine Institute (Institut du Cerveau et de la Moelle Épinière), Paris


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- 2014: Virginie Orgogozo, a CNRS research associate and the leader of the Drosophila Evolution group at the Institut Jacques-Monod, Paris

Women in Enterprise Laureates


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- 2013: Véronique Newland, the general manager of the New Vision Technologies company


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- 2014: Séverine Sigrist, a researcher at the European Center for the Study of Diabetes, Strasbourg, and president-founder of Defymed,Inc.

New awards in 2013 and 2014

INRIA - Académie des Sciences Prizes

Since 2013, INRIA (French National Institute for Computer Science and Applied Mathematics) and the Académie des Sciences jointly single out the laureates of the three following INRIA-Académie des Sciences scientific awards: the Great Prize, Young Researcher Prize (under 40 years old) and Innovation Prize (in partnership with Dassault Systèmes). Such a partnership gives a new impetus to the set of Inria Prizes, as it highlights their primary purpose: promote the contributions and success of the men and women who, within a French institution but regardless of their nationality or affiliation, drive computer science and mathematics forward, thus participating to the development of the digital world.

INRIA - Académie des Sciences Great Prize Laureates (€25,000): for their outstanding contribution to the field of computer science and mathematics


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- 2013: Jean-Michel Morel, a professor at the Centre for Mathematics and their Applications of the École Normale Supérieure-Cachan


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- 2014: Nicholas Ayache, a research director at INRIA, Asclepios team & project leader, Nice

INRIA - Académie des Sciences - Dassault Systèmes Innovation Prize Laureates (€20,000): for their specific initiative in transfer and innovation in the field of computer science and mathematics


© Brigitte Eymann

- 2013: Pascale Vicat-Blanc, a research director at INRIA, CEO of Lyatiss SJSC (France) and Lyatiss Inc. (USA)


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- 2014: Patrick Valduriez, a research director at INRIA, Zénith team & project scientific leader, Montpellier

INRIA - Académie des sciences Young Researcher Prize Laureates (€20,000): for their outstanding contribution, in terms of research, transfer or innovation, to the field of computer science and mathematics


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- 2013: Anatole Lécuyer, a research director at INRIA, Hybrid team leader, Rennes Bretagne-Atlantique


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- 2014: Paola Goatin, a research director at INRIA, Opale team & project, Nice

Philippe and Maria Halphen Prize

Amounting to €15,000, this prize, created in 2014, rewards research projects conducted on the physiopathology of psychiatric diseases. The goals of the Philippe and Maria Halphen Foundation are innovation and the progress of knowledge and scientific research in the field of mental illness, fostering partnerships among researchers, clinicians and affected persons.


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2014 Laureate: Marie-Odile Krebs, a university professor and hospital practitioner in psychiatry, and a research director at the Neurosciences School Paris Île-de-France

Georges-Morel Prize

The Georges-Morel Prize, awarded for the first time in 2014, rewards the author of research project conducted in a French laboratory, for his/her outstanding work in plant biology.


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2014 Laureate: Abdelhafid Bendahmane, a reasearch director at INRA, Plant genomics research unit, Evry

AXA- Académie des Sciences Award

The Académie des Sciences fosters the dynamism and creativity of young French researchers. Every year, on the initiative of Académie Member Pascale Cossart, Great Breakthroughs in Biology gives the floor to six young biologists whose discoveries are of major importance, accompanied by their research directors. Speakers are selected by a jury following a national call for applications and each laureate receives a prize (€2,500) from the Axa Research Fund.

2013 Laureates (4 June 2013)

From left to right: Céline Bellard, Filipe de Vadder, Marianne Bjodal, Ana Jimenez, Irène Dang and Benjamin Ezrati.

- Céline Bellard and Franck Courchamp, ESE Lab, Orsay: *The impacts of climate change on biological invasions;*
- Filipe De Vadder and Gilles Mithieux, Claude Bernard University, Lyon: *Neuronal dialogue between the intestine and the brain, as initiated by the intestinal microbiota;*
- Marianne Bjordal and Pierre Leopold, Institute of Biology Valrose, Nice: *Nutrient perception in the brain and food intake control;*
- Ana Jimenez and Franck Perez, Institut Curie, Paris: *On the repair of damaged plasma membranes;*
- Irene Dang and Alexis Gautreau, Structural enzymology and biochemistry laboratory, Gif-sur-Yvette: *Discovery of Arpin, a protein which slows down the migration of the cell and enables it to spin;*
- Benjamin Ezraty and Frédéric Barras, Mediterranean Institute of Microbiology, CNRS - University of Aix-Marseille: *The role played by iron in bacterial resistance to antibiotics.*

2014 Laureates (10 June 2014)

From left to right: Thomas Sexton, Michael Lang, Monica Rolando, Nicolas Garreau de Loubresse and Mariana Alonso.

- Thomas Sexton and Giacomo Cavalli, Institute of Human Genetics, Montpellier: *A three-dimensional map of the genome of the drosophila;*
- Michael Lang and Virginie Orgogozo, Institut Jacques-Monod, Paris: *The dependency mechanisms of drosophila on a cactus;*
- Monica Rolando and Carmen Buchrieser, Institut Pasteur, Paris: *An unforeseen reprogramming of host cells by Legionella pneumophila;*
- Nicolas Garreau de Loubresse and Marat Yusupov, Institute of Genetics and Molecular and Cellular Biology, Strasbourg: *A pioneer analysis of the structure of yeast ribosome;*
- Elphège Nora and Edith Heard, Institut Curie, Paris: *A new operating principle for the architecture of chromosomes;*
- Mariana Alonso and Pierre-Marie Lledo, Institut Pasteur, Paris: *The role played by neo-neurones in the learning process and memory of the adults.*

The *Comptes Rendus de l'Académie des sciences*

Created in 1835 by the French physicist Arago, who was then the Secrétaire perpétuel of the Académie, the *Comptes Rendus de l'Académie des sciences* is a review in French and English that enables researchers to make their research promptly known to the wide international scientific community.

This set of seven publications spans the whole field of scientific research, as its titles make it obvious: *Mathematique, Mecanique, Chimie, Biologies, Geoscience, Physique* and *Palevol*. Each series is driven by its editor-in-chief with the assistance of its editorial board. The articles submitted are evaluated by two scientists of recognized expertise in the field. These may be notes, announcing significant, new results, or summaries that provide clarification, or conference proceedings, or other publications such as thematic issues, under the direction of guest editors-in-chief from France or abroad.

Altogether, close to 730 articles have been published in the 2013 and 2014 *Comptes Rendus* and 28 thematic issues have come out (15 from the *Physique* series, 6 from *Mécanique*, 5 from *Chimie*, 2 from *Geoscience* and 2 from *Palevol*).

The *Comptes Rendus de l'Académie des sciences* are available for hard copy or online subscriptions for individuals (EM Consulte) or groups (ScienceDirect), abstracts being published for open access on these two websites. Besides, the *Bibliothèque Nationale de France* is completing the digitisation of the older issues of the *Comptes Rendus*, with the 1835-1995 years already open to free access on its website www.gallica.bnf.fr.

PROMOTING SCIENCE TEACHING

Learning scientific reasoning skills, gaining access to knowledge and being taught scientific methods – these are essential steps for citizens of the future to develop critical thinking and for excellence to transmit within the scientific community through time. The Académie des Sciences has a long-standing tradition of advising on these matters: today, it takes action, even on the international level, to strengthen initial and ongoing teacher training, renew science teaching at all school levels and ensure all young people with equal opportunity in this field.

The initiatives of the Académie on science teaching are grounded on two pillars of action: the *Delegation for Education and Training*, directed by Académie Member Christian Amatore, is in charge of keeping a watch on topical issues of science teaching, all scientific, administrative and legal dimensions being considered; the *Standing Committee for Science Education,* chaired by Académie Member Étienne Ghys, delves into the major science education issues the Académie wishes to take hold of, most often with long term vision as a goal.

In close cooperation with the Foundation for Scientific Cooperation *La main à la pâte - Pour l'Éducation à la science*[8], which is chaired by Académie Member Daniel Rouan and of which the Académie is a founding member, the Académie des Sciences continuously promotes, through its initiatives, science teaching at primary and middle school.

Rewarding the youngest generation[9]

The Foundation *La main à la pâte* - Pour l'Éducation à la science carries on its initiatives in continuity with the hands-on science operation La main à la pâte®, launched in 1995 at the initiative of Académie Members Georges Charpak, 1992 Nobel Prize in Physics, Pierre Léna and Yves Quéré. It gives first priority to inquiry-based science teaching, using exploration, experimentation and discussion. First developed at primary school level, *La main à la pâte* has now been successfully implemented in middle schools with great success.


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Young laureates welcomed to the Académie des sciences (10 March 2015)

The annual La main à la pâte awards ceremony, in the Great Hall of Conferences, is a reminder of this commitment, whose 20th anniversary will be celebrated in 2015:

- Since 1997, the *Prix Écoles primaires [Primary Schools Awards]* of *La main à la Pâte* are awarded every year under the auspices of the Académie des Sciences. They single out classes from public or private primary schools for having carried out, over the previous year, experimental scientific initiatives which reflect particularly well the spirit and investigation method endorsed by *La main à la pâte;*
- created in 2009, the *Prix Que faire dans le monde ?... un métier ("What to do?...a job!" Award)* of *La main à la pâte* highlights the extent and quality of a partnership that links together a school and one or more companies sharing a common project. It singles out experimental scientific initiatives from middle school classes which carry out integrated science and technology education in partnership with a company during the 2012-2013 academic year;
- created in 2007, the biennial *CAFIPEMF Award* singles out one of the laureates from the CAFIPEMF (Certificat d'aptitude aux fonctions d'instituteur ou de professeur des écoles maître formateur), a qualification exam which demonstrates primary school teaching & master training qualification. Such laureate is rewarded for the dissertation on the renewal of science teaching which he/she would have written and defended in an attempt to be admitted;
- The *Prix Master enseignement et formation (Master of Education in Teaching and Training Award)*, which replaced in 2011 the *Prix Mémoires professionnels (Vocational Dissertation Award)* of *La main à la pâte*, rewards two dissertations written by students in their second and final year of the Master's Degree (Master 2), in fields of study that prepare them for teaching/training professions by adopting, in the spirit of *La main à la pâte*, a renovated approach to the teaching of science and technology or by training science and technology teachers at primary school levels (nursery school level included).


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Bernard Meunier, President of the Académie des Sciences, and Najat Vallaud-Belkacem, French Minister of National Education, Higher Education and Research

The 2013 Awards Ceremony took place on 4 February 2014 in the Great Hall of Conferences of the Institut de France, in the presence of Jean-Paul Delahaye, the managing director of school education. The 2014 awards have been bestowed in the presence of Najat Vallaud-Belkacem, the Minister of National Education, Higher Education and Research.


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The Member of the Académie des Sciences Daniel Rouan, President of the Foundation La Main à la pâte-Pour l'éducation à la science

Promoting science among high school students

In order to secure the contingent of researchers, engineers and technicians that the country requires, the French education system must take up a double challenge: put science and technology back into the students' minds and boost their appetite for science and technology courses and professions. The Académie des Sciences provides support to this twofold objective through initiatives that promote science, especially in high schools.

Conferences intended for high school students

Since 2006, high school students from Paris are invited by the Académie des Sciences on the occasion of the Fête de la Science [Science Festival] to hear a conference held by one of its members. Given the success of these meetings, specially organized for the pupils, the Académie and the Rectorat de Paris [National Education local Authority of Paris] have jointly decided to increase meeting opportunities, with, from 2014, two additional conferences proposed during the Semaine des Mathématiques [Maths Week] and Semaine du Développement Durable [Sustainable Development Week]. Each of these conferences gathers a little more than 150 high school students. Given the public for which they were prepared, these conferences, filmed and available for consultation on the website of the Académie[10], are a useful collection of resources for a wide audience.

Water, a Common Treasure

Water is arguably the major issue of the 20th Century. This conference was an invitation to anticipate 2050 and answer crucial questions: what are the probable impacts of climate change on hydrology (shortage, flood, drought)? What volume of water will be necessary to produce enough food for a growing global population? What consequences will the rise in food production have on the conservation of ecosystems and biodiversity?

A Conference by Ghislain de Marsily, on the occasion of the Fête de la science [Science Festival], 11 October 2013.

When Earth was too Young for Darwin

This conference reviewed the heated argument which divided physicians and evolutionary biologists at the end of the 19th Century regarding the age of Earth and what mathematics had to offer there.

A Conference by Cédric Villani on the occasion of the Semaine des Mathématiques [Maths Week] (18 March 2014).

The Contributions of New technologies to Animal Population Biology

New methods of investigation, using ultra-miniaturized measuring tools and sensors, as well as space technologies, now revolutionize our approach to animals in their natural habitat. During this conference, high school students had the opportunity to discover first, and many months before publication, a small robot created in the image of the emperor penguin, able to circulate incognito within a colony, which it can thus study from the inside, without disturbing its fellow creatures (Le Maho Y, *et al. Nat Meth* 2014;11 (12):1242-4).

A conference by Yvon Le Maho on the occasion of the Semaine du Développement Durable [Sustainable Development Week] (1 April 2014).

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Recounting the Thousand and One Exoplanets

The quest for other planetary systems than ours is an ever more intense and fruitful one. The progress achieved already allows the mechanisms by which such systems form and develop to be understood, and in particular the birth and history of the solar system to be described, or indeed its future foreseen. In the medium term, it may even be possible to answer the question of how frequent life is in the universe. This conference took stock of the different methods used to "hunt down" these planetary systems, as well as the hit list of these methods, and presented the space/ground projects now under consideration.

A conference by Daniel Rouan, on the occasion of the Fête de la Science [Science Festival] (9 October 2014).

Supporting the Cast

Prompted by the Académie des Sciences, the Managing Direction of School Education (Direction Générale pour l'Enseignement Scolaire) of the French Ministry of National Education has asked each local authority of the Ministry of National Education (Recteurs), to recruit an Academic Corresponding for Science and Technology (Cast), to *"facilitate the implementation of the actions of the Delegation for Education and Training of the Académie des Sciences and those of the Foundation La Main à la Pâte La Main à la Pâte"*[11].

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The Académie accompanies this initiative by convening the Cast once a year at national level, as it did on 16 June 2014 in its Ry-Chazerat estate, in the Vienne department. Two topics, prepared with the local authority of the Ministry of National Education (Rectorat) in Poitiers and the Espace Mendès-France (the Cultural, Scientific, Technical and Industrial Centre of Poitiers) have specially drawn the attention of the Cast:

- the Biodiversity Sentinels: the academic delegate for biodiversity, appointed by the Recteur, presented the experience of Poitiers and provided valuable reflections for creating a national network of biodiversity sentinels;
- Measuring Time, an operation which received the label « La Science se livre » [Science Opens Up] and started in 2014 in cooperation with the Espace Mendès-France.

Scholarships for deserving students

Awarded by the Académie des sciences since 1991, the Rogissart scholarships are aimed at rewarding high school students for their outstanding achievements in their education and who were born or have at least one parent born in the Department of the Ardennes, where Jean Rogissart, their founder, was a native. The Rectorat of Reims provides support for the laureate selection process, in such a way that every high school of the Department of the Ardennes may enter one or several candidates for the scholarship, who should meet the following profile:

- match the geographical criteria stated by the founder;
- be selected by a jury empanelled at the level of the Rectorat, based on criteria of education (year 12 and final year of A levels) and social background;
- achieve outstanding success in education and pass the baccalaureate (A level final exam), whether general (with maths as a major in the "S" scientific section), vocational (sections with technical or industrial majors) or technological ("STI", "STL" or "ST2S" sections) with honours;
- have a higher education project in view, in the field of science - whether general, technical or industrial - of such nature as to account for the allocation of a scholarship (the benefits of higher education scholarships are completely compatible with the allocation of a Rogissart scholarship).

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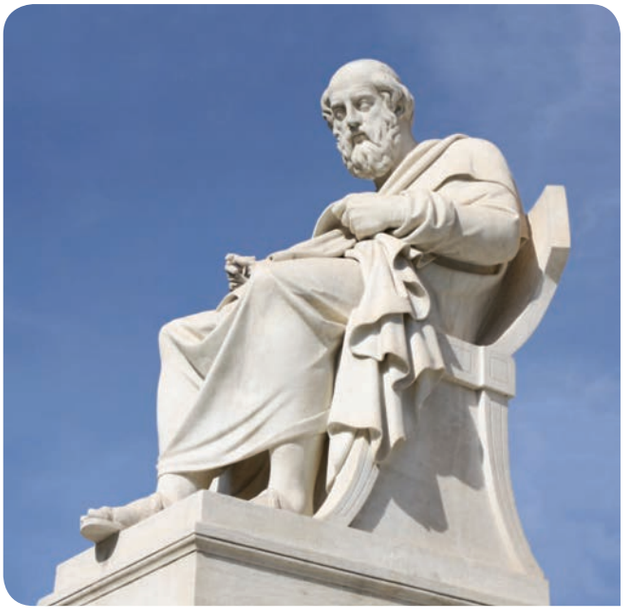
Each scholarship amounts to €6,000 in all, paid in six times during two successive scholar years at the University (as an example, a 2014 scholarship laureate receiving €1,000 in 2014 would receive €3,000 in 2015 and €2,000 in 2016). At the end of his/her first year of higher education studies, the scholar should provide the Académie des Sciences proof of his/her work and attendance to class, as the necessary condition for scholarship payment to continue until its ending. When payment ends, the scholar is asked to draw up a report.

Colloquia on science education

Philosophy Teaching and Sciences: New Prospects

The Académie des Sciences has also pursued its investigation into the means that may make science more prominent in the students' minds during the final year of A levels - and not only for students of the scientific sections. One fruitful avenue is to boost philosophy courses on this topic and promote closer ties between secondary school philosophy teachers and their scientific colleagues. Following a first colloquium in 2012, the *Standing Committee for the Science History and Epistemology and the Standing Committee for Science Education and Training* of the Académie, in close cooperation with the Académie des Sciences Morales et Politiques and the Inspection Générale de l'Éducation Nationale [General Inspectorate of the French Ministry of National Education], have held in 2013 a new colloquium on Philosophy Teaching and Sciences, which has focused in particular on computer science and economic and social sciences[12] (13 November 2013).



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The professional development of science teachers

Professional development enables teachers to question their own skills and professional backgrounds and prospects. Organized by the Académie des sciences and the Foundation *La main à la pâte - Pour l'Éducation à la science*, this colloquium convened stakeholders from the areas of business, research and higher education: their analysis was specially underpinned by the change brought by the creation of the seven *Houses for Science to the Benefit of Teachers*, which provide teachers with professional development offers in science, with a strong emphasis on living and contemporary science. A white paper, as a preparatory document to the colloquium, had been written beforehand to prepare the discussions and feed the debates (22-23 May 2013).

Museums with an educational purpose

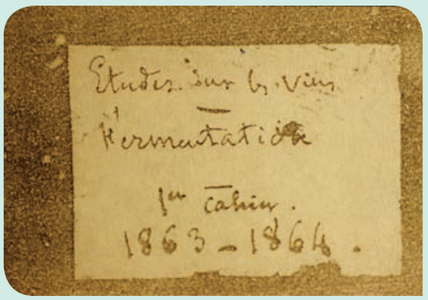
Louis Pasteur's house

© Catherine Bréchignac

Louis Pasteur's (1822-1895), family house, located in Arbois in the department of Jura, is a memorial site, both as a typical example of a 19th Century bourgeois residence and because of its laboratory, where Pasteur used to work in the summer, and where all his instruments have been kept. Here, in particular, did his experiments definitely put an end to the theory of spontaneous generation. Owned by the Académie des Sciences since 1991, Louis Pasteur's house, which received the label *Maisons des illustres* [Houses of the Illustrious] from the Ministry of Culture and Communications in 2011, is open for visits all year long and hosts events, particularly intended for school audiences. On 21 November 2013, the Académie des Sciences created, with the Conseil général du Jura [Departmental Council of Jura] and the communes of Arbois and Dole, the Établissement public de coopération culturelle [Public Institution for Cultural Cooperation, EPCC] *Terre de Louis Pasteur*. The house of Pasteur in Arbois, which is a central part of it, has been at the disposal of this EPCC since July 2014. As for the Académie des Sciences it has refocused its activity on Louis Pasteur's historic vineyard, near Arbois. It will host, from 2015, a major research programme devoted to vine wood diseases, which affect about 13% of French vineyards.

Louis Pasteur, Memory of the World

Because of the importance of Louis Pasteur's bequest (in science and medicine), the Académie des sciences and Bibliothèque nationale de France (BnF) have filed an application for the inscription of its archives in the Memory of the World Programme created in 1992 by UNESCO. The documents concerned range over a period of time of almost fifty years (1838 -1895):



© Maison Louis Pasteur

- his training period (1838-1849): documents from school (exercise books, notes and class work); course notes taken as a student at the École Normale Supérieure, then as an agrégé-préparateur there; lessons taught at Lycée Louis-le-Grand and École Normale Supérieure;
- his teaching activities (1849-1857): lessons in chemistry, geology and physics in Strasbourg, Lille and Paris;
- his laboratory records and various notebooks (1848-1877): experiments relating to crystallography and molecular dissymmetry, experiments on fermentation, notebooks on wine, *Cholera Commission*, research investigations on the silkworm, research on beer, research on virulent diseases (anthrax, rabies, vaccination);
- work and research notes: lectures, conferences, articles;
- his correspondence (1840-1887);
- his notes, reports and other presentations before the Académie, in particular on his main discoveries.

An inventory of Louis Pasteur's archives held by the Académie des sciences has been made and these have been digitised in 2014. They shall be fully available for consultation on the website of the Académie in the course of 2015. As for the outcome of the application to the Memory of the World Programme, it shall be known in summer 2015.

Abbadia castle observatory

Antoine d'Abbadie (1810-1897) was an explorer, geographer, linguist and astronomer. His castle was built by Viollet-le-Duc up above Hendaye, in the Department of Pyrénées-Atlantiques, between 1864 and 1884. It was then bequeathed by its owner to the Académie des Sciences, of which he was a member, and now hosts an astronomic observatory, which has remained operational until 1976. A listed historic monument, the castle has been the object of a vast restoration programme from 1997 to 2008. Benefitting from the label *Maisons des illustres* since 2011, the castle is now managed by the Hendaye Tourist Information Centre, according to the terms of a service concession arrangement. Partnership agreements on joint educational activities have been concluded in 2014 with the Rectorat of Bordeaux and the CPIE (Permanent Centre of Initiatives for the Environment) *Littoral basque*.

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Ry-Chazerat Estate

© DR

Adolphe Godin de Lépinay (1821-1888) is the often unknown designer of the Panama Canal as it was finally built after the failure of operation led by Ferdinand de Lesseps. An engineer from the École des Ponts et Chaussées, he was also behind the maps of many railway lines in France and Algeria. He bequeathed his Ry-Chazerat manor house and lands to the Académie, in the commune of Journet, in the Vienne Department. In 2013, the Académie ratified a partnership framework-convention with the Conseil Général de la Vienne [Council of the Vienne Department] and the communes of Journet and Montmorillon. The same year, in April, as part of the "FuturS en Vienne" Seminar Series, a conference was held by Académie Member Georges Pelletier on the agriculture of the future faced with the challenge to feed the world. The Académie des Sciences has also taken part to the Salon du Livre de Montmorillon [Montmorillon Book Fair] during the mid-June weekends of 2013 and 2014. It presented there a good number of its publications (Lettre de l'Académie, books, reviews, etc.) and Bernard Meunier, its Vice-President, gave a lecture on the place of books under the sway of the Internet. Moreover, an application for the Ry-Chazerat manor house to receive the *Maisons des illustres* label is underway.

In favour of a scientific universalism

Scientists have well understood the necessity to improve the transmission of knowledge to the public. Contradictions nevertheless remain: citizens have strong expectations regarding science and medicine, yet they also fear technological progress; sciences are prodigious drivers of social progress and economic growth but the number of scientific vocations is tailing off; and although many high technology tools are used on a daily basis, few users know what their operating principles are.

Such a situation is an image of how terribly isolate the world of research remains: a new relationship between science and society should thus be invented. In this context indeed, the Académie des Science has laid in 2014 the foundations of its programme in favour of a scientific universalism: *Pour un universalisme scientifique*. This ambitious programme, which will expand rapidly from 2015, is based on the scientist/heritage site/scientific discipline triangle, with:

- Louis Pasteur, his house (Arbois, Jura), life sciences;
- Antoine d'Abbadie, his castle observatory of Abbadia (Hendaye, Pyrénées-Atlantiques), earth sciences;
- Adolphe de Lépinay, his Ry-Chazerat estate (Journet,Vienne), sciences in the service of the environment.

The actions proposed on each site will be inspired by the personal background and scientific inputs of these personalities, and fit nicely into the economic, environmental and cultural specificities of the regions where they used to live.

INSTITUT DE FRANCE
Académie des sciences
Pour un universalisme scientifique

Supporting a transforming of teaching methods in Haiti

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The programme in favour of transforming teaching methods in Haiti, *Transformation de l'enseignement* en Haïti (TEH), fostered by the Académie des sciences, the Centre national d'études spatiales (National Centre for Space Studies, CNES) and Haitian Ministry of National Education and Vocational Training, has continued, for the fourth year, providing lifelong vocational training to primary school teachers.

The 2014-2015 academic year has been placed, since its beginning, under the sign of autonomy for Haitian educators. Indeed, a one-week training programme has been organized in order to fortify the skills of about ten school counsellors (SC) who shall themselves train their counterparts on sites that will implement the TEH policy at the beginning of the next term. In 2013, the TEH programme involved 11 training sites, with 33 SC on a total sum of 675 trained teachers. In 2014-2015, there will be 15 training sites, their 45 SC and a total sum of 770 trained teachers, for a mean number of 38,500 pupils benefitting from the newly taught pedagogical methods.

The TEH programme receives support from the French Ministry of National Education, the Académies de Montpellier et de Versailles [local authorities of the Ministry of National Education in Montpellier et in Versailles], the Institut d'Enseignement Supérieur et de Recherche [Institute for Higher Education and Research] *Handicap et besoins éducatifs particuliers* [Handicap and Special Needs] and the Inter-American Development Bank (IDB) in Haiti.

TRANSMITTING KNOWLEDGE

The scientific community owes society explanations and knowledge sharing. As part of its mission, the Académie des Sciences is committed to disseminating the scientific culture and, in this context, organizes public session meetings, at which great scientific problems are presented. The *Delegation for Scientific Information and Communications*, directed by Académie Member Alain-Jacques Valleron, fosters communications at the Académie by means of its website, which offers open access to the general public, media relations, a biannual Letter, meetings with the youth and twinning arrangements involving researchers, members of the Académie and members of the Parliament.

Public sessions, civic culture

The unprecedented technological rise the world has been experiencing since the middle of the last century has made more complex society's relations to science: innovation seduces but inspires fear, ethical questioning is now involved in every process of scientific research. In such a context, the Académie des Sciences invites the broad, enlightened public to conferences presented by the great figures of science, aimed at providing topical knowledge on major science themes bearing strong societal repercussions[13].

Juggling with Photons in a Box

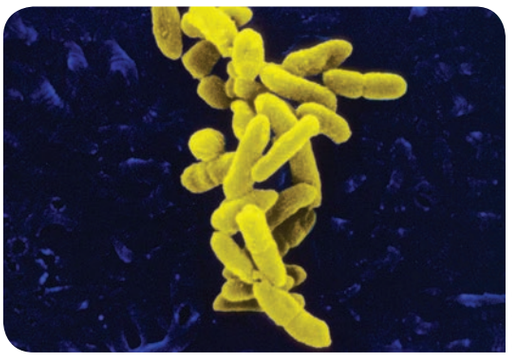
In 2012, the Nobel Prize in physics singled out research projects dealing with the control and non-destructive handling of material or light particles. The member of the Académie des Sciences Serge Haroche drew an account of the experiments which awarded him this Nobel Prize and, in particular, of the results he obtained with small systems of a few photons in quantum superpositions of states that have been called "cats of Schrödinger" out of reference to the famous thought experiment the Austrian physicist had imagined to describe how strange the microscopic world was (8 January 2013).

Is Solar Energy the Energy of the Future?

To help better understand the issues at stake in the debate on energy transition, the member of the Académie des Sciences Didier Roux reviewed the evolution of technologies that make it possible to transform solar energy into electricity, either through heat (concentration solar plants) or directly (photovoltaic modules) (15 January 2013).

The Microbiota, an (Almost) Absolute Symbiosis

Every multicellular organisms host microbial communities. In the course of the evolution, such an interface has given rise to a symbiosis whose mutualistic dimension is just beginning to appear. The member of the Académie des Sciences Philippe Sansonetti shows how the human microbiota is involved in such major functions as immunity, nutrition or metabolism and how it could also be so in the late phases of brain and vascular development or even epithelium and other tissue repair (19 March 2013).



Are Mathematics Useful to Explore the Human Brain?

The developments of physics and biology allow the anatomy and functioning of the brain to be better understood, thus enabling scientists to model and emulate them on ever more efficient computer systems. But what about the role of mathematics? Drawing on some examples from the field of brain imaging, the member of the Académie des Sciences Olivier Faugeras showed that data interpretation strongly depends on mathematical tools that use geometry, and that techniques developed in probability theory make it possible to explain certain organisational aspects underpinning the activities of great populations of neurons (28 May 2013).

Académie des Sciences Days in Brittany

The Académie at the *Espace des Sciences* of Rennes

Since 1996, on a biennial basis, the Académie holds one of its Tuesday Sessions outside Paris in order to communicate its work and strengthen its relationships with the local scientific community. In 2014, it was in the Britanny:

- on 12 May at the marine biology station of Roscoff for a plenary session focused on biology and marine ecology;
- on 13 May at the Espace des Sciences (the Cultural, Scientific, Technical and Industrial Centre) of Rennes, for a public session to which the 6 laureates of the Young Researcher Brittany Awards had been invited to introduce their work;
- on 14 May at Lycée Descartes in Rennes, for a conference focused on teaching and training.

The Primordial Universe and Planck's results

The space mission Planck has observed the microwave radiations that give, with unrivalled precision, an image of the universe at a very young age. These observations became public at the end of March 2013. They allow researchers to test the hypotheses that concern the origins of the expansion and of matter. The member of the Académie des Sciences Jean-Loup Puget especially reviewed the validity of a simple paradigm which provides answers to the difficult questions arising from the classical Big Bang model. This paradigm develops into multiple models, all sharing the idea that a phase of inflation was at the origin of the expansion and quantum fluctuations that gave birth to all the structures now visible (28 May 2013).

Lectures by the laureates of the Grands Prix 2012 [2012 Great Prizes]

Philippe Bouyer, the laureate of the Fondation Louis D. Award: Creating and Handling Waves of Ultracold Matter

At temperatures in the order of a few nanokelvins, atoms do not behave any more like material particles but as waves whose propagation may lead to interference phenomena. Philippe Bouyer shows how one may observe interferences that reproduce the phenomena that occur, in particular, in semiconductors. The very same interferences may also be used to build highly accurate measuring devices and use them as guides, study the underground or test the great law of physics (12 March 2013).

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Philippe Bouyer, the Member of the Académie Alain Aspect and Christophe Salomon

Christophe Salomon, the laureate of the Fondation Louis D. Award: From Ultracold Fermi Gases to Neutron Stars

Ultracold atoms offer the possibility to tune the amplitude and polarity of the force of interactions between atoms. They thus give us access to a strong correlation regime, very difficult to describe theoretically, in particular with regards to fermions. Christophe Salomon describes some recent experiments on the thermodynamics of highly correlated fermion gases. Superfluidity takes place at a temperature which, compared to Fermi energy, is remarkably high and is not without similarities to the superconductor solid systems that reach high critical temperatures. Although there are several tens of orders of magnitude from the parameters of cold gases to those of neutron stars, the laboratory-measured thermodynamic quantities make it possible to deduce the equation of state of the outer layer of neutron stars (12 March 2013).

Olivier Pourquié, Lounsbery Prize: The Musculo-Skeletal Axis and the Segmentation Clock

The vertebrae and skeletal muscles originate from somites, transient structures that are produced by pair, rhythmically, in the course of development. Olivier Pourquié looked back at his discovery: the segmentation clock, a molecular oscillator involved in the wave-like expression of cyclic genes, before the formation of each pair of somites. Such work helped the formation (and malformation) of the vertebral column to be better understood and suggests that protocols may be developed allowing for the in vitro differentiation of human muscular and skeletal tissues, with cell therapy as an objective (15 January 2013).

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Listeria monocytogenes: a Model System and a Reference

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The *Listeria monocytogenes* bacteria may lead to serious foodborne infections and increased risks of meningitis and premature childbirth. In her research, Pascale Cossart, the 2013 laureate of the prestigious international Balzan Award, has elucidated the strategies a bacteria implements to invade cells that do not normally act as phagocytes, multiply there, avoiding the host's defences, disseminate within the tissues and cross the intestinal or fœtoplacental barriers (14 January 2014).

From the Bohr-Einstein Debate to Quantum Information: the Second Quantum Revolution?

The Bohr-Einstein debate, initiated in 1935, has been rekindled by Bell's discovery, which led to the invention of new ways to treat and convey information: quantum information. The 2013 laureate of the Balzan Award, Alain Aspect, looked back into the pioneer experiments, including his own, that have been conducted on the extraordinary nature of quantum intrication, as well as into the possibility to observe, isolate and control unique microscopic objects, which was absolutely unconceivable for the founding fathers of quantum physics (14 January 2014).

The Evolutionary Story of the Coelacanth: an Overview vs. Clichés

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Long considered a mere fossil, the coelacanth is very much alive as a matter of fact, as evidenced by the specimen hauled up from the depths 75 years ago offshore the coast of South Africa. The actual coelacanth, *Latimeria chalumnae*, does not have any fossil representative and is the unique outcome of an evolutionary story that lasted more than 400 million years. Gaël Clément, a palaeontologist and professor at the Muséum National d'Histoire Naturelle, reviewed the results of study focused on this great fish from the depths, which is a unique source of information on the "terrestrialization" of vertebrates (11 March 2014).

When the Académie gives the floor to its new members

Concepts and Applications of Functional Ecology

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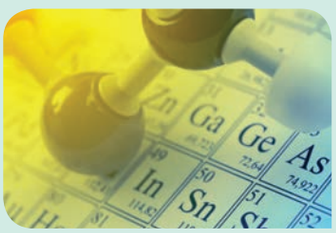
Functional ecology focuses on the physiological, morphological, reproductive or behavioural characteristics of the species, commonly named "functional traits". Sandra Lavorel has highlighted how much functional ecology was useful to take on the great global environmental challenges, understand and predict how climate change and change in land use may impact biodiversity and ecosystems (21 January 2014).

Using Theoretical Chemistry to Better Understand Chemical Reaction?

Chemical reactions may be described through the analysis of the properties of electrons and atomic nuclei. Such a perspective, however, implies to simplify beforehand the systems under study, which in turn requires preserving the key chemical groups controlling the investigated properties. Odile Eisenstein gave a lecture on the identification of these famous key factors within her field of research, viz. the catalysis of organometals, and showed that it is based on close cooperation between theoreticians and experimenters (11 March 2014).



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The importance of disordered systems

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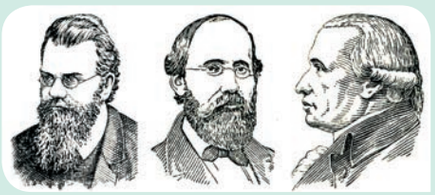
Although sometimes perceived as a nuisance one must get rid of, disorder is in fact the source of remarkable physical phenomena. Thierry Giamarchi indeed showed that the fundamental modifications induced by disorder on such systems as the magnetic walls of computer hard drives, or bosons cooled down at temperatures close to absolute zero, give rise to new, "glassy" physics, which represents one of the very beautiful challenges of today's physics (11 March 2014).

Optimal Transportation and Curvature : When Monge, Riemann and Boltzmann Meet

The theory of optimal transportation, non Euclidean geometry and static physics have met about 15 years ago, with the discovery that Ricci curvature may be studied quantitatively via entropy and Monge-Kantorovich transportation. Cedric Villani showed how fruitful such an unexpected encounter has been, boosting each of the involved branches towards progress (6 May 2014).



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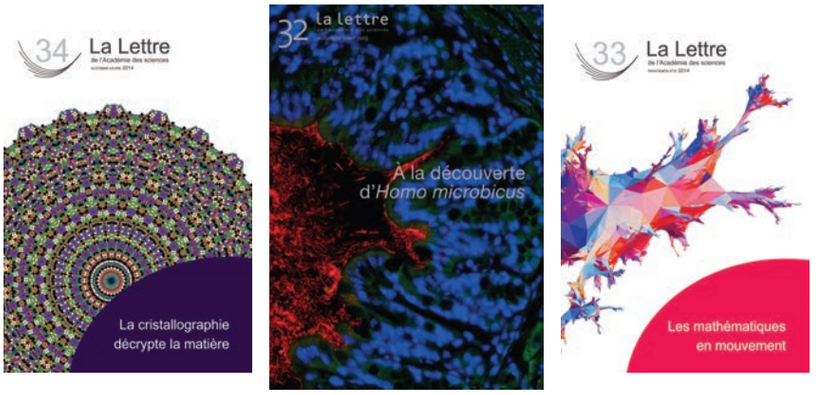
Information resources specifically designed for the public

In the course of 2014, the Académie des Sciences has intensified its initiatives to provide direct scientific information to the general public. Thus, a whole set of contributions from members of the Académie, under the editorial responsibility of the Standing Committee for the Science History and Epistemology, is included in the "Resources" section of the Académie's website. Moreover, the Académie has entered the world of social networks, with the creation of a timeline Tweeter address (@AcadSciences), which enables its registered users to directly receive information on the various events and online available resources of the Académie.



The *Lettre de l'Académie des sciences* is a biannual journal sent to more than 2,000 free subscribers and open to download on the website of the Académie. Issues 32 (2013), 33 and 34 (2014) respectively addressed microbiota, mathematics and crystallography. This Lettre is foremost aimed at providing the non-scientific public with a knowledge review in a given field, adding a historical perspective to it. It also recalls the highlights of the Académie during the last half-year.

The website of the Académie has attracted 417,000 individual visitors in 2013-2014, with 19,700,000 hits and 2,150,000 pages read. The video section provides Internet users with records of all the sessions, conferences and debates organized by the Académie des Sciences. Browsing automatically adapts to the user's device (computer, tablet or smartphone).

As for the e-newsletter of the Académie, it is sent to more than 14,000 subscribers, most of whom are scientists or members of institutions. Its purpose is to alert or remind them on a monthly basis of the most important events on the agenda of the Académie. All Internet users may subscribe from the home page of the website.

In 2010, the Académie concluded a partnership with the publisher *De vive voix* on the launching of an audio book series in which its members share their passion for their disciplines. In 2014, Françoise Combes's *La matière noire* [Dark Matter] joined the list of about fifteen titles already published.

The Académie des Sciences also places a presentation brochure at the disposal of its partners and the interested public, concerning its missions and activities, which has been translated into English, Spanish and Chinese and may be downloaded from its website.

100 Youngsters at the Académie des Sciences

The Académie des Sciences held on 11 October 2014 at the Institut de France the second edition of Speed Sciences, an event aimed at youngsters aged 16 to 20. 100 youngsters from all over France have been selected for their answers to a set of questions on the website of the Académie des Sciences. They have been chosen for the high quality of their answers, the relevance of their reflection and their interest for science. Conceived by the Académie des Sciences, this operation fulfils two main objectives and one ambition: to improve the readability of science despite its often high complexity, and, by explaining the scientific method, inspire vocations for later in life.

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At the morning conference debates, hosted in the Great Hall of Sessions, youngsters may form an ever more accessible notion of the various scientific fields. In 2014, three members of the Académie lend themselves to the exercise: Yves Agid shared his very last neurology research studies on abnormal involuntary emotions; Étienne Ghys tackled the task to demonstrate that the ball of the Football World Cup was in fact...a cube; and Bernard Roques reviewed the work of pharmacologists to relieve pain.

As for the afternoon face-to-face discussions, they provide researchers with unique opportunities to remind and insist that an appropriate understanding of the scientific method is a prerequisite to developing a critical mind, which is useful to all aspects of the citizens' lives. During these speed meetings, each youngster had the chance to meet about ten scientists: each time a new opportunity for them to ask direct questions

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On the end of the day, both youngsters and scientists answered a satisfaction questionnaire, and success was indeed there. The members of the Académie, in their great majority, are willing to be involved again in this original operation, whose next session shall take place in 2016. They have expressed enthusiasm about their meetings with youngsters - meetings which, in 20% of cases, have led to email exchanges. Thus, the idea emerged to pursue such exchanges during the rest of the academic year, especially with cycles of conference debates in the young participants' high schools.

When youngsters appraise science and their actors...

In preparation for the 2014 *Speed Sciences*, the Académie des Sciences ordered the "Youngsters and Science"[14] survey to the CSA market research agency and consultancy.

A majority of the youngsters expresses interest for science (76%) and considers it useful to society, in the service of everyday life and important for everyone's future (92%), yet 23% of them still feel some indifference to it, or even fear against it. Similarly, although a majority of them (65%) find interesting their science courses, only 33% contemplate scientific careers. Yet researchers win praises: 95% of the surveyed youngsters have a positive image of them and 63% find researchers "open" to the world outside. Certain clichés persist, though: 85% of the youngsters agree with the idea that scientists sometimes play sorcerers' apprentices!

This survey, filled with information, thus concludes on the youngster's hesitant relation to science but confirms that scientists themselves are relied upon. This good opinion probably explains why *Speed Science* raises such an interest, and spurs the Académie des Sciences on to intensify its openness policy towards the non-scientific public.

Adding Value to a Scientific Heritage

The Académie des Sciences holds archives dating to its creation and continuously expands its stock through purchases, donations or bequests from its members. French and foreign researchers, top-level university members, come and consult in the Reading Room these unique documentary sources that make the Académie des Sciences stand as one of the main conservation institutions where today's research in science history commences.

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Historical archives

During the 2013-2014 period, close to 2,400 items (archive boxes, biographic files, award files, etc.) have been communicated, 500 historical research made on demand and 500 different readers greeted and guided in the Reading Room.

Donations and bequests

Several documents have entered the archives of the Académie des Sciences in 2013-2014:

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- the documents of the mathematician Wolfgang Doeblin (1915-1940);
- the letters Pierre-Joseph Macquer (1718-1784), a member of the Académie Royale des Sciences (1772), wrote to Louis-Bernard Guyton de Morveau (1737-1816), a member of the chemistry section from the 1st class of the Institut;
- the letters Alexandre Vandermonde (1735-1796), a member of the geometry class (1785) and then a member of the mechanical arts section of the Institut (1795), wrote to Lavoisier;
- a letter by Abbé La Caille (1713-1762), an associate astronomer (1745);
- a letter by Jean Rodolphe Perronet (1708-1794), a free associate of the Académie (1765);
- a letter by Louis Cotte (1740-1815), a corresponding member of the general physics section from the 1st class of the Institut (1803);
- the archives of Charles de Beauchamp (1883-1977), a corresponding member of the anatomy and zoology section (1944).

Exhibitions

Owing to the high extent its stock of archives, the Académie des Sciences is often asked to contribute in the making of exhibitions by lending documents:

- Paris and the industry, 18th-19th Centuries - Université Pierre-et-Marie-Curie, Paris, 1 December 2013 -7 January 2014;
- Siméon Denis Poisson, mathematics at the service of science - Université Pierre-et-Marie-Curie, Paris, 19 March - 19 June 2014;
- The Humboldt Brothers: the Europe of the mind - Observatoire de Paris, 12 May - 11 July 2014;
- Treasures from the Institut de France. First accounts of Ancient Egypt (1850-1900), Arles photography festival, 7 July - 24 August 2014.

Plis cachetés [Sealed envelopes]: ascertaining the dates of the discoveries


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The *Standing Commission for Sealed Deposits* (*Commission des plis cachetés*) of the Académie des Sciences was created in 1976 at the impulse of its Secrétaire perpétuel Paul Germain to unseal the envelopes deposited at the Académie and being held there for more than 100 years. The first sealed envelope held at the Académie dates back to 1735, although minute books indicate an envelope would have been deposited on 13 April 1697 by Marquis de L'Hospital. On 1 February 2014, the Académie registered 18,090 sealed envelopes as deposited. As stipulated in the Rules and Regulations of 6 July 2004, sealed envelopes "are meant to ascertain the precise dates of the discoveries they are supposed to contain, without requiring any publication". The *Commission for Sealed Deposits*, chaired by Edgardo Carosella, meets to:

- study the sealed envelopes and enclosed letters that are older than 100 years and see which scientific personalities they may be sent to for review (minutes of the 11 July 1977 session);
- open and study the sealed envelopes and enclosed letters that are less than 100 years, at the request of their right holders;
- open and study the contemporary sealed envelopes and enclosed letters at the request of their authors within two years of deposit.

The Commission has unsealed 447 envelopes in 2013-2014: they concerned the 1905-1908 period, with contents most predominantly pertaining to physics, chemistry, techniques and mathematics; 26 such letters have been sent to experts or institutions for advice and information. 57 contemporary envelopes have been deposited in 2013-2014 and 9 opened during the same period.

In order to make research in the history of science easier, the Académie should set a database describing the intellectual content of the envelopes unsealed at the meetings.

Au clair de la Lune, the first audio recording in the world


© Archives de l'Académie des sciences

On 26 January 1857, Edouard-Léon Scott de Martinville (1817-1879) sends the Académie des Sciences a sealed envelope, with a letter entitled Principes de phonautographie [*The Principles of Phonautography*][15], in which he describes a device able to record sounds and produce traces on paper coated with lamp black. A proofreader and typographer at the printing house that edits the *Comptes rendus hebdomadaires de l'Académie des sciences* [weekly minutes of the Académie des Sciences] (CRAS), self-taught in acoustics and physiology, Scott indeed has the ambition to "take a photography of speech". In July 1861, hearing that a foreign scientist was conducting research on the same subject, Scott de Martinville asks the Académie to open his envelope: this letter, published in the CRAS, also includes new recordings realised in 1860, including the French song *Au Clair de la Lune*, which the Académie has been holding since then.

These recordings, though, have remained mute for nearly 150 years because, unlike Thomas Edison's phonograph, presented on 11 March 1878 before the Académie des Sciences, Scott's device was not made to reproduce sound. In 2008, American researchers were able to reconstitute the sounds recorded by Scott de Martinville; they filed an application, in association with the Académie des Sciences and the Institut National de la Propriété Intellectuelle [the French National Institute of Industrial Property] for these first audio recordings to be included in the UNESCO *Memory of the World Register.*

Inscription automatique des sons de l'air au moyen d'une oreille artificielle [The Automatic Inscription of Sounds from Air through an Artificial Ear]. Scott de Martinville, CRAS, volume 53, July-December 1861, pp. 108-111.

Committees dedicated to great scientists

Lavoisier Committee


© DR

The Académie des Sciences holds the vast majority of the archives of the founder of modern chemistry, entrusted by his heirs who had in mind the publication of the Œuvres de Lavoisier. Since Volume 7 of Lavoisier's correspondence (Correspondance) was published in 2012, the eponymous committee has been in charge of creating general tables for the Œuvres and Correspondance and preparing several hundred letters more (Volume 8) that are being dated, transcribed and annotated.

D'Alembert Committee

The d'Alembert Group, a multidisciplinary group of researchers, was created in the 1990s. Endorsed by the Académie des Sciences, which had expressed its wish to see it created, it has first been supported by the French Mathematical Society and CNRS, then integrated as the D'Alembert Committee of the Académie des Sciences, by decision of the 15 January 2013. It is chaired by Académie Member Jean-Pierre Kahane.


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The scope of its missions is to lead the publication *(CNRS Éditions)* and circulation of the complete work of Jean Le Rond d'Alembert (1717-1783), in five book series, each focused on one of the scientist's activities:

- Series I: *Traités et mémoires de mathématiques* [Mathematical Treaties and Memoirs], 11 volumes planned (3 already published);
- Series II: *L'Encyclopédie* [The Encyclopaedia]. D'Alembert's contribution to the Encyclopaedia amounts to a dozen of printed volumes. A digital critical edition of the whole of the Encyclopaedia is in progress, within the ENCCRE project; on completion, it shall replace the current printed Series II Edition;
- Series III: *Opuscules mathématiques* [Mathematical Opuscules], 11 volumes planned (2 volumes already published);
- Series IV: *Écrits philosophiques, historiques et littéraires* [Philosophical, historical and literary written work], 10 volumes planned (1 already published);
- Series V: *Correspondance générale* [General Correspondence], 11 volumes planned (1 already published, the Analytical Inventory).

Diderot and d'Alembert at the time of the Internet

In line with the *Humanités numériques [Digital Humanities]* movement, the ENCCRE project (Édition numérique collaborative et critique de l'Encyclopédie de Diderot et d'Alembert [Critical and collaborative digital edition of the Diderot and d'Alembert's Encyclopaedia]) stems from a simple observation: there is no critical edition of the *Encyclopédie*. The project thus pursues two objectives:

- to grant universal access for the first time to the materiality of such work, allowing for the simultaneous consultation of the original work and its transcription, as well as for perusing the references that the 7,400 articles make to each other and confronting the articles and plates;
- to highlight how closely the original content of the work and the past or present critical studies connect. This edition shall provide innovating annotation tools, casting some light on the complexity of the 2,000 plates of the book. It shall be open and adapted for use by any kind of reader (the well-read, students, researchers...).

The Académie des Sciences and Key Opinion Leaders

The Académie in the media

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2013 and 2014 saw the media reflect the positions of the Académie on recurrent social issues - the climate, energy, GMOs, research financing - and on some of its fields of expertise, such as the teaching of computer science or new business models of scientific publishing.

With more than 3,400 releases in 2013, the presence of the Académie des Sciences in the media has been 60% wider than in 2012 and has remained wide in 2014, with near 3,000 releases. The main media driving this presence remains the written press (47.7% of media visibility), with the Internet following closely behind (46%) - digital versions of newspapers and all-online news websites. The relative shares of the whole written press and Internet media has increased during these two years, compared to broadcasting (6% to 8%). In this sector, the Académie and members of the Académie are often on the radio, while television mostly reports, for its regional channels, on the official ceremonies that take place under the cupola of the Institut de France (presentations of awards and greetings of new members). Finally, the Académie des Sciences increases its visibility in the consumer press, compared to the trade press, now sharing 75%/25%.

Several events occurring in 2013-2014 have specially received media coverage:

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- advice notes or reports being published: *Children and Screens* (January 2013), *Teaching Computer Science in France: Tomorrow Can't Wait!* (May 2013), *Elements to Clarify the Shale Gas Debate* (November 2013), *Inquiétudes dans les laboratoires de recherche* (October 2014), which revived *A Clarion Call on Research Funding from the Académie des Sciences* (December 2013); *The challenges Facing Scientific Edition* (October 2014);
- colloquia: *Hypotheses on the Origins of Life* (September 2013), *Genetically Modified Plants* (November 2013);
- the statutory session held in Brittany (May 2014);
- the election of 17 new members, greeted under the cupola of the Institut (June 2014), including a clear focus on the youngest member of the Académie, the mathematician Laure Saint-Raymond;
- events that honour members of the Académie, such as Alim-Louis Benabid, the Lasker–deBakey Award winner (September 2014) and 2015 Life Sciences Breakthrough Prize (November 2014), Gérard Berry, who received the Gold Medal of the CNRS (September 2014), Alain Aspect and Pascale Cossart, the 2013 Balzan Award;
- the presentation of the great prizes of the Académie des sciences, especially the Grande Médaille awarded to the American Joel Lebowitz (October 2014);
- eulogies for deceased great men of science, also members of the Académie, who left their mark on their times, such as François Jacob (1920-2013), Maurice Tubiana (1920-2013) or Jacques Friedel (1921-2014).

Finally, the newspaper *Le Figaro* and the Académie des Sciences have agreed on a new partnership according to which five members of the Académie have each presented to the readers of this daily newspaper, on the five last days of December 2014, an assessment of the past year and their vision of the near future in their research area.

When scientists and members of the Parliament converse

Politics and science constantly interact. Yet politicians and scientists acknowledge that they do not know each other well enough although they would have much to learn from each other by sharing information and experience. In 2004, the Académie des sciences, at the impulse of Académie Member Dominique Meyer, and the Office parlementaire des choix scientifiques et technologiques (OPECST) [Parliamentary Office for the Evaluation of Scientific and Technological Options] have thus launched a programme arranging for three persons - one member of the Parliament, one member of the Académie des Sciences and one young researcher - on a voluntary basis, to meet and discover their mutual worlds under exceptional conditions. Such "twinning" operations take place in three steps:

© Assemblee nationale

Launching of the 2013 twinning programme (in the centre, Dominique Meyer and Claude Bartolone, President of the French National Assembly)

- members of the Académie and young researchers are greeted into the Parliament (Senate and National Assembly): here, at this initial step organized by the OPECST, the three participants build contacts. Members of the Académie and young researchers are acquainted with the legislative work of the members of the Parliament who introduce them to the role of some standing committees and delegations, as well as to the work of the rapporteurs. They attend a session of questions to the government at the National Assembly and are given the opportunity to meet the presidents of the committees from the two chambers, as well as representatives from all political groups;
- members of Parliament are greeted into laboratories: members of parliament discover there the many aspects of research as an occupation, research in progress, partnerships, all that provide the necessary outreach to Europe and the world, problems related to the management of big laboratories. They visit premises and facilities and talk with staff in order to better understand how researchers lead their daily lives;

ASSEMBLÉE NATIONALE

SÉNAT

Office parlementaire d'évaluation des choix scientifiques et technologiques

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- scientists are greeted into electoral constituencies: the scientists discover there how complex local politics are and how multi-faceted the duties of members of parliament in the field.

Beyond these three steps of the twinning program itself, twinned partners build direct contacts throughout the whole year, which last through time. These sustainable personal contacts do add to the originality and fruitfulness of this programme.

In 2013, fifteen such threesomes have been set up, involving seven senators and eight members of the National Assembly. This session has been launched in the Parliament on 29 and 30 January 2013.

FOSTERING INTERNATIONAL COLLABORATION

Science is universal and the challenges to take on have, for a great part, worldwide implications. The Académie des Sciences has always enjoyed close scientific relations with other nations, whether as personal relationships between historical figures, specific relationships from one State to another, or through its action inside international scientific organizations and other interacademic networks that have been gradually put in place in the course of the 20th Century. It now sustains this cooperative mission within its *Delegation for International Affairs*, under Member and Vice-President of the Académie Daniel Ricquier's leadership.

Playing an Advisory Role on a Global Scale

Within the interacademic networks

The national academies of sciences embody scientific excellence and in this respect have the mission to carry out expertise and promote sciences among the political leaders of their countries. The interacademic network that have formed throughout the world act in the same spirit, on a wider scale, though: such is the case with IAP (the InterAcademy Panel, created in 1993, which now is the InterAcademy Partnership[16]) on a global scale and, for Europe, with EASAC (the European Academies' Science Advisory Council, created in 2001) and ALLEA (All European Academies[17], created in 1994).

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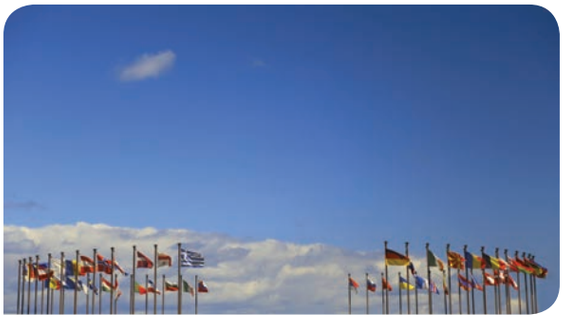
A national role to improve international cooperation

Drawing on its experience in science diplomacy, the Académie des Sciences has created and chairs two Committees of national scope involved in the promotion of scientific interactions at the global level:

- The *French Committee for International Scientific Unions* (COFUSI), chaired by Académie Member Françoise Combes and created by the Académie in 1967: it is in charge of coordinating the French National Committees (CNF), which are the correspondents of the international scientific unions that take part in the International Council for Science (Icsu). COFUSI assesses and reports on the work of the CNF to the French Ministry of Higher Education and Research. Moreover, it manages the funding granted by the Ministry for taking part in ICSU and other various international unions. Lastly, COFUSI spurs the different CNF on to hold joint interdisciplinary meetings and supports their rapprochement with the learned societies;
- The *Academic Standing Committee for Scientific and Technological International Relations* (CARIST), chaired by Académie Member Daniel Ricquier and created by the Académie in 1983: its objective is to bring together the reflections of the different stakeholders of French research - ministries, research organisms, associations and companies. This committee enables its participants to keep informed and share their views on the actions they put in place, or contemplate on putting in place, at the international level: the Académie des Sciences provides, not only a neutral ground making communication easier, but also the expertise of its members - scientists enjoying worldwide credit for the excellence of their work. In 213-2014, CARIST has focused on two themes for reflection: *International Strategy, positioning and dissemination of French Research (2013) and Scientific and Technological Watch, Innovation and Competition* (2014).



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IAP

The *InterAcademy Partnership* gathers 107 national academies of science and regional networks - from Africa, the Americas, Asia and Europe (EASAC) - of academies of science. Its goal is to further cooperation among its members to improve citizen information and advise the political decision-makers on the scientific aspects of critical global issues. In this framework, one of its missions is to promote the creation of academies of science in the countries that do not have one and to foster the young academies into maintaining their expert role with the decision-makers of their State.

The Académie des Sciences is a member of IAP Executive Committee. The Académie hosted the 6 and 7 November 2014 meeting, at which the decision to restructure IAP was taken, and where the need for the activities of the network to gather momentum arised.

EASAC


© Union européenne

The *European Academies' Science Advisory Council* (EASAC) includes the 29 national academies of science of the States of the European Union (EU), each represented by one of its members (Daniel Ricquier for the Académie des Sciences). Its goal is to provide the European institutions with independent and expert advice on the scientific aspects of public policy in the EU, particularly by issuing reports and statements on aspects the network deems crucial. In 2014, the Académie des Sciences has:

- convened the Boards of EASAC and the Académie des Sciences to discuss, in particular, the policies through which consensus may be reached at the European level and the most efficient way to submit such common views to the leading institutions (15 November 2014);
- contributed to the presentation of EASAC's report, *European Space Exploration: Strategic Considerations of Human* versus *Robotic Exploration*[18] - to which Académie Member Jean-Louis Puget has contributed - at a press conference held at the Embassy of Switzerland in Paris (15 september 2014);
- greeted the 9th meeting of the EASAC Energy Steering Panel, on the initiative of one of its members, Sébastien Candel, a member of the Académie (29 April 2014).

ALLEA

The *All European Academies* (ALLEA) network gathers 58 academies - science, human and social sciences, humanities - from 40 countries in the area covered by the Council of Europe. Through its standing committees, it notably devotes its work to the following themes: Ethics and *Science, Science Education and Intellectual Property*. In 2014, the Académie des Sciences was involved in the organization of the 1st conference of the North-South Aemase *(African-European-Mediterranean Academies for Science in Education)* programme of ALLEA.

Through the International Council for Science


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ICSU *(International Council for Science)*, founded in 1931, is the most important non-governmental scientific organization in the world. Comprising 121 national members and 32 international scientific unions, it is responsible for fostering the international scientific and technological community and supporting universal access to science. The Académie des Sciences is a national member of this Council, whose headquarters is located in Paris.

After setting in motion and successfully completing the great programmes on the environment and climate[19], ICSU launched in 2014 *Future Earth*, a new collaborative programme[20] whose goals are directed towards the future of our planet in all of its aspects, including its evolution towards sustainable development. France was chosen to host one of the 5 Boards of this programme. On the scientific side, the patronage of ICSU, ISSC and WMO guarantees that ongoing projects shall be carried on with some continuity. Moreover, the key word to elaborating new projects is *"co-design"*, which implies that all elements, and even funding agencies, have their say in the decisions. This is indeed a new way of working, which shall include all the natural and social scientific disciplines. In addition to Future Earth, two complementary programmes are in operation: *Health and Wellbeing in the Changing Urban Environment and Integrated Research on Disaster Risk*[21].

On the initiative of Marie-Lise Chanin, a member of the Académie who is its representative at ICSU, and under the direction of Académie Member Hervé Le Treut, the Académie des Sciences held a colloquium on 13 and 14 May 2013 in Paris, allowing the European community involved in ICSU to prepare for the implementation of the Future Earth programme. This colloquium convened about 100 persons - scientists from the various programmes for global change, and representatives from social sciences, funding agencies and the political world. Seven similar colloquia have taken place in other regions of the world.

This colloquium is in line with the wider context of actions carried out by the *Group of the European members of ICSU*, founded on the initiative of the French Académie des Sciences and the Royal Society in 2003. Since it was set up, the role of this group has considerably increased, all European countries being now represented there. Moreover, it has been most useful to the Eastern European countries that are less acquainted with ICSU.

More occasionally

A pre-G7 interacademic reflection

Every year, the academies of science of the G7 countries write joint statement focused on topical scientific themes. Such statements are sent to the governments before the summit takes place, in order to direct their attention to these issues the members of the Académie deem most crucial.

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In 2013, the presidents and several members of the 14 academies of science have gathered in New Delhi (India) to draft their joint statements on the role of science, technology and innovation in the implementation of sustainable development policies, and on infectious disease drug resistance, which is a threat to humanity. At the end of the New Delhi meeting, the drafts have been submitted to a vote, with the same wording for all the participant academies, and sent in May 2013 to the political leaders[22].

In 2014, the dramatic events that took place in Ukraine shook up the organization of the summit, which eventually took place in Brussels instead of Sochi. No preparatory interacademic meeting to this summit had been organized.

The STS Forum

The *Science and Technology in Society* (STS) Forum is a network of personalities from the scientific, political and economic world. Every year, STS gathers its members in Kyoto, around invited speakers and a most dense programme focused on the great scientific and technological issues of the goals for the planet. Members of the Académie meet there every year, as did Philippe Taquet, who was the President of the Académie in 2012-2014, on 7 and 8 October 2013, and François Gros, the Secrétaire perpétuel honoraire of the Académie, *Intuitu Personae* Member of the STS Forum, and Alain-Jacques Valleron, the Delegate for Scientific Information and Communications, from 5 to 7 October 2014.

Promoting science diplomacy

The individual journeys of scientists have historically been the traditional way to engage in and bolster scientific cooperation among States. The Académie des Sciences, which has a longstanding commitment to supporting these exchanges, now carries up its actions within the frameworks of cooperation agreements or letters of intent signed with foreign national academies, alongside other collaboration initiatives such as: jointly organizing colloquia, hosting lecturers or visiting delegations. In 2014, the Académie des Sciences is enjoying bilateral relations with more than fifty academies, under as many agreements or letters of intent - the first of them, with the Academies of Poland and Sweden, dating back to 1983, and the last one, with the National Academy of Sciences of Uruguay, being concluded in December 2014.

In parallel, the Académie maintains the relations of friendship that have been highly influential in the construction of an international scientific community, by taking part in the presentation of great international awards.

In Europe

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Franco-German relations: a model

Thanks to the initiatives of rapprochement they have taken in the last decades and to the many cooperation projects on which French and German partners are successfully working, France and Germany share particularly tight links with one another.

2013 was marked by the 50th anniversary of the Élysée Treaty: on 22 January 1963, General de Gaulle and Chancellor Adenauer signed this treaty of cooperation, designed to seal the reconciliation between France and the Federal Republic of Germany:

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- on 6 February 2013, a Franco-German interacademic seminar was held in Paris on the instigation of three academies of the Institut de France - Académie des Sciences, Académie Française, Académie des Sciences Morales et Politiques - and two German academies - *Nationale Akademie der Wissenschaften Leopoldina and Berlin-Brandenburgische Akademie der Wissenschaften*. Entitled *The Enlightenment: Yesterday, Today, Tomorrow*, it reviewed the adventure of the Enlightenment movement - *die Aufklärung* -, a philosophical and cultural inclination towards modernity equally shared by the two countries and which forged the European soul. This philosophy of the Enlightenment demonstrated, from Diderot to Kant, d'Alembert to Leibniz, Voltaire to Formey, their primal spiritual union, commitment and common responsibility in the genesis of the European mind. This seminar was also an opportunity to demonstrate how tightly science intertwines with moral and political reflections in this conception of progress;

- on 15 April 2013, the Académie des Sciences greeted the German and French ministers of higher education and research for a day under the sign of science diplomacy. Johanna Wanka and Geneviève Fioraso jointly inaugurated the Franco-German Week of Science and Alumni organized by the Embassy of Germany in Paris. In the morning, a round-table meeting was held on the value that Franco-German higher education training and research programmes add to youth employment, and on the signatures of seven cooperation agreements involving institutions from these two countries. The Académie des sciences and the *Nationale Akademie der Wissenschaften Leopoldina* have also ratified a cooperation policy that enables them to engage in perennial joint reflections and scientific projects involving a shared leadership. The afternoon was devoted to science itself: once introduced by eminent personalities, each of the four laureates of the 2012 Gay-Lussac Humboldt Prize expounded his/her work, then the session was brought to a close by Ernst-Ludwig Winnacker, from the *Leopoldina*, and Claude Cohen-Tannoudji, a member of the Académie and 1997 Award of the Nobel Prize in physics, who took the floor to look into the joint research perspectives France and Germany share.

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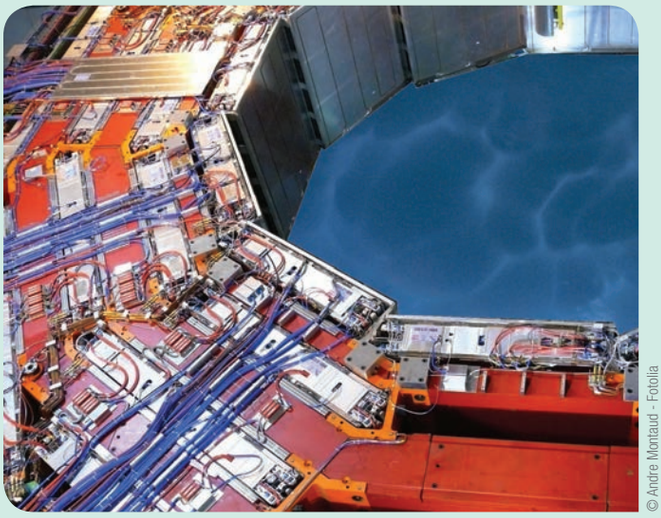
The German and French ministers of higher education and research Johanna Wanka and Geneviève Fioraso, the Secrétaire perpétuel of the Académie Catherine Bréchignac, the presidents of the signatory academies, Philippe Taquet and Jörg Hacker (from left to right and top to bottom)

On 2 April 2014, the Académie des Sciences moreover greeted a visiting delegation from the *Nationale Akademie der Wissenschaften Leopoldina*.

On 26 June 2014, French and German scientists held, at the Embassy of Germany in Paris, a seminar entitled Energy and Europe. Members from the four academies, *Nationale Akademie der Wissenschaften Leopoldina and Deutsche Akademie der Technikwissenschaften* on the one hand, and Académie des Sciences and Académie des Technologies on the other hand, have taken part in the debates. A second round-table meeting on the same theme took place at the Embassy of France in Berlin on 14 November 2014[23].

Celebrating CERN's 60 years of existence

A great success of European, and from now on international, scientific cooperation, the European Organization for Nuclear Research (CERN, as Centre d'études et de recherche nucléaire) is the most important laboratory of fundamental physics in the world. Major progress in the field of particle physics has been achieved there. In 2014, physicists have celebrated the 60th anniversary since the founding of CERN. Such was the case at the Académie des Sciences which, in the name of the French scientific community, devoted a scientific session to this event on 1 July 2014, along with the official ceremony celebrating this anniversary at UNESCO. This session gave the opportunity to look back into the most important fundamental breakthroughs achieved at CERN, with special awards to Higgs boson, but also to remind that the technologies developed at CERN have numerous applications in our daily lives. The session ended with a review of the European strategy on particle physics[24].



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The Large Hadron Collider (LHC) at CERN

Other cooperation events

The Académie des Sciences hosted the physics class of the Swedish Academy of Science from 19 to 21 November 2013: it organized for the class a tour of prestigious laboratories in the region Île-de-France and meetings with physicist members of the Académie on the theme of energy. The Académie also greeted a delegation of members of the Young Academy of Sweden on 17 March 2014.

In line with the interacademic meeting the Académie in 2012 had organized in 2012 with the Croatian Academy of Sciences and Arts, its Secrétaire perpétuel Catherine Bréchignac took part in the symposium held on Nicola Tesla's scientific and technological legacy on 17 December 2013 in Zagreb. This meeting was an opportunity to discuss the challenges of research in Croatia, on the eve of its integration into the European Union.

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The Board of the Académie moreover hosted the presidents of the Royal Society, Sir Paul Nurse, on 5 June 2014, and of the Russian Academy of Sciences, Vladimir Fortov, on 22 October 2014.

On 15 April 2014, at the invitation of HE Alain Le Roy, the Ambassador of France in Italy, of Jean-François Bach, the Secrétaire perpétuel of the Académie des Sciences, and of Lamberto Maffei, the President of the Accademia Nazionale dei Lincei, the members of the Académie Jean-Pierre Changeux and Salvatore Califano have present a conference on Neurosciences and Arts at the Palazzo Farnese in Rome.

In the Middle East

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A French-Israeli-Palestinian colloquium

The first *Sciences, Network, Consciousness* colloquium was held in 2012 under the auspices of UNESCO, with the objective to further rapprochement between the populations of the Middle-East through scientific cooperation.

On 4 April 2013, the *Sciences, Network, Consciousness* #2 emphasised the theme of cooperation in the field of water in the Eastern Mediterranean: the achieved and future projects have been presented by their leaders, Israeli or Palestinian researchers, along with several international initiatives *(the Observatory for the Development of the Mediterranean,* and *the Mediterranean Summer School,* presented by Édouard Brézin, the former President of the Académie des Sciences*)*. Catherine Bréchignac, the Secrétaire perpétuel of the Académie des Sciences and French delegate ambassador for science, technology and innovation, took this opportunity to look back into two major goals of science diplomacy: fostering the conservation of scientific links between the countries, even if a situation of conflict should occur, and using such bi- or multilateral relationships to build a network of strategic influence in support of science.

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Franco-Israeli Colloquia

In 2011, the Académie des Sciences and the Israel Academy of Sciences and Humanities have decided to strengthen scientific cooperation between their two countries. Such collaboration is made manifest by the organization of joint annual colloquia.

On 22 and 23 May 2013, a colloquium on mathematics was held at the Institut de France in Paris. On 19 and 20 March 2014, it was Jerusalem that hosted a colloquium in physics, focused on the interactions between light and matter. Several members of the Académie gave lectures there, including the two Nobel Prizes in physics Claude Cohen-Tannoudji and Serge Haroche.

Supporting the young Academy of Lebanon

The foundation of the Lebanese Academy of Sciences (Académie des sciences du Liban, ASL) has been widely supported by the Académie, 4 members of which are also members of ASL. Bilateral meetings are held on a regular basis to further the development of this young academy. In April 2014, the Académie greeted ASL to a joint reflection, 5 years after its creation, on the initiatives it might implement to better catch the attention of the public authorities of Lebanon. The discussion especially focused on the current drafting of a report on research in Lebanon, which would be in perfect line with the advisory mission any academy should be able to carry out for the government of its country. Other actions, developed by the Académie des Sciences, might also inspire ASL, as parliamentary twinning operations or ASL's participation to the *International Human Rights Network of Academies and Scholarly Societies*. Whether a Franco-Lebanese Prize should be created is also a matter of discussion.

Awards as supports for scientific diplomacy

Franco-Chinese Great Prize of the Académie des sciences

Amounting to €15,000, this new prize has been created on the occasion of the 50th anniversary of the resumption of Franco-Chinese diplomatic relations, at the instigation of General de Gaulle in 1964. It has been awarded to its first laureate under the Cupola of the Institut de France on 14 April 2014.


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- 2014 Laureate: Rixiang Zhu, the director of the Institute of Geology and Geophysics of Beijing and a member of the Chinese Academy of Sciences, in recognition for his outstanding scientific contributions, his success in creating experimental laboratories, his capacity to put in place wide international programmes, his strong initiatives towards cooperation, both for research and student training, with French laboratories and researchers, in the field of geosciences.

French-American Richard Lounsbery Prize

Created in 1978 by Vera Lounsbery in memory of her husband, this prize is placed under the patronage of both the Académie des Sciences and the American National Academy of Sciences. Designed to reward the distinctive achievements of French and American researchers in biology and medicine, this Prize is alternately bestowed to a French and an American researcher. It is endowed with $50,000, and $20,000 would add to this amount to cover the laureate's potential stay in a laboratory of the other country.

- 2013 Laureate: Karl Deisseroth, an associate professor in bioengineering and in psychiatry and behavioural sciences at Stanford, for his work on the study of the central nervous system through optogenetics;


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- 2014 Laureate: Frédéric Saudou, INSERM Research Director at the Institut Curie, for his major contribution to the understanding of the role of the huntingtin mutated protein in the outbreak of Huntington's neurodegenerative disease.

Franco-Taiwanese Prize

Created by the Franco-Taiwanese Science Foundation founded by the Académie des Sciences and the National Science Council of Taiwan in 2003, this €8,200 Prize is awarded every year to French or Taiwanese researchers for their contribution to scientific research projects of interest to both sides and favouring exchanges between them.


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- 2013 Laureates: Hsien-Kuei Hwang (Institute of Statistical Science, Academia Sinica, Taipei), Olivier Bodini (a professor at Paris-Sud University) and Cyril Banderier (left in photo), a CNRS research associate at the Computer Science Laboratory of the Paris-Nord University, for their exemplary cooperation (in their research work, schedule of joint advanced courses, young researcher exchanges, etc.) in the field of computer sciences;

- 2014 Laureates: Jean-Claude Sibuet, a professor at the National Taiwan Ocean University (Keelung City, Taiwan) and his former doctoral student Shu-Kun Hsu, now a professor at the National Central University (Taoyuan City, Taiwan), who have worked in close cooperation during the last 20 years on the theme of Taiwan's tectonics and the geodynamics of the surrounding seas. .


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... Awards as supports for scientific diplomacy

Franco-German Gay-Lussac Humboldt Prize

The French Ministry of Higher Education and Research, with the help of a jury empanelled by the Académie des Sciences, awards this prize every year to German scientists for the great merit of their work and their contribution to Franco-German scientific cooperation. Conversely, the German Alexander von Humboldt Foundation singles out French scientists on the same criteria.


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- 2013 Laureates: Olivier Eickelberg (right in photo), the director and founder of the Comprehensive Pneumology Centre in Munich, and Aloïs Fürstner, the director of the Department of Organometallic Chemistry at Max-Planck-Institut für Kohlenforschung in Mülheim;
- 2014 Laureates: Werner Kunz, Head of the Institute of Physical and Theoretical Chemistry and of the Carl-von-Carlowitz Centre of Sustainable Chemistry at Regensburg University, and Volker Meyer, a researcher at the Department of Economics of the Helmholtz Centre for Environmental Research in Leipzig.

Franco-Dutch Descartes-Huygens Prize

Created in 1995 at the Hague by the French and Dutch governments, this prize is alternately allocated in the fields of science of matter, life sciences and human and social science. Awarded under the auspices of the Académie des Sciences and the Royal Netherlands Academy of Arts and Sciences, it rewards every year two researchers of international level, one being French and the other Dutch, both actively contributing to bilateral scientific cooperation. Amounting to €46,000 (€23,000 for each party), this prize is especially intended to fund the laureate's stay as an invited researcher in the other country.


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- 2013 Laureates (human and social sciences): Bénédicte Fauvarque-Cosson (left in photo), a professor of private law at the Panthéon-Assas Paris II University, and Caroline van Eck, a professor in the history of arts and architecture at Leiden University, Netherlands (Prize awarded with support from the Académie des Sciences Morales et Politiques, Académie des Inscriptions et Belles-Lettres and Académie des Beaux-Arts - Institut de France);
- 2014 Laureates (earth sciences): Ludwik Leibler, the director of the Soft Matter and Chemistry laboratory (ESPCI/CNRS) in Paris, and Willem Vos, who leads the Complex Photonic System (Mesa$^+$) team at the University of Twente, Netherlands.

In Asia

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Southern Korea

The world leader for its R&D spending efforts, Southern Korea is a special partner to the eyes of France. The academies of the two countries support such scientific cooperation by tightening their ties, already enshrined in an agreement that was settled in 1997.


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On 8 April 2014 in Paris, the academies have in particular organized the *Computing Science and BioInformatics* joint colloquium, which was introduced by the two Secrétaires perpétuels of the Académie, Jean-François Bach and Catherine Bréchignac, and the President of the Korean Academy of Science and Technology (KAST), Sung-Hyun Park. Computer science is indeed a subject of growing interest for research in biology: data management and analysis, modelling (growth, brain functioning), imaging, etc. In particular, the objective is to promote this field of research, which lies at the interface between several scientific disciplines. A second colloquium, on *Healthy food*, shall be organized in Korea in 2015.

In November 2014, the Académie des Sciences was the guest of honour of the KAST 20th anniversary celebration events. On this occasion, Catherine Bréchignac gave a lecture at a colloquium devoted to the creative economy.

China


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France and the People's Republic of China have settled in 2007 on a bilateral cooperation agreement on Chinese traditional medicine. The steering committee ("Comité de pilotage" in French, "Copil") of this French-Chinese agreement meets every year and scientific events involving members of the Académie des Sciences are organized on the margins of these annual meetings:

- on 22 April 2013, a seminar devoted to the approaches of Chinese traditional medicine to metabolism and metagenomics was held at the Académie des Sciences, under the supervision of the Secrétaire perpétuel Catherine Bréchignac and Li Malin, the President of the Yunnan University of Traditional Chinese Medicine, within the framework of the 5th Copil;
- on 13 November 2014, Kunming, in China, was the venue for the scientific seminar that was held in the margins of the 6th Copil, devoted to research themes shared by Chinese and Western medicine, such as type 2 diabetes, cardiovascular diseases or obesity.

The *French-Chinese Foundation for Science and its Applications* (FFCSA) was founded by the French and Chinese academies of science with support from universities, French graduate elite schools (Grandes écoles), regions and several French companies. Its mission is to further scientific relations between France and the People's Republic of China in all the fields of science and its applications:

- in 2013-2014, the FFCSA continued supporting scientific cooperation, as it had been doing for more than 12 years, through the organization of post-doctoral exchanges between the two countries, in the activities covered by the two divisions of the Académie des Sciences. Chinese post-doctoral researchers, coming from the best Chinese universities or laboratories of the *Chinese Academy of Sciences* (CAS), have been greeted in France at excellent laboratories that are spread throughout the country. These internships, lasting 18 or 24 months, usually provide the opportunity to publish in international reviews and they often mark the beginning of a sustainable cooperation between the post-doctoral researcher's home laboratory and his/her host laboratory in France;
- the FFCSA gathered the alumni who had come back to China, at Nanjing in 2013 and Harbin in 2014, for the traditional scientific days that have been instituted for some years: these provide the opportunity to take stock of the research conducted by these alumni in their laboratories or in relation with their French colleagues;
- as every year, the FFCSA has awarded its annual Prize in memory of late Gilles Kahn, who co-chaired the Scientific Council of the Foundation until 2006; the laureates were, in 2013, Xie Gaogang, from the Institute of Computer Technology of CAS in Beijing, and in 2014 Huang Jinyan, from the Rui Jin Hospital, affiliated to Shanghai JiaoTong University.

Vietnam

From 15 to 17 October 2014, a joint scientific meeting between the Académie des Sciences and the VietNam Academy of Science and Technology, which are partners since 2013 by a cooperation agreement, was held in Hanoi around *The Chemistry of Natural Substances.*

India

Within the framework of their cooperation agreements, the Académie des Sciences and Indian National Sciences Academy organize the Etienne-Wolff-Ramanujan Lectures: on 18 June, Marthanda Sankaran Valiathan gave a lecture at the Académie on Ayurveda and Modern Science. On 21 April 2014, Nicole Le Douarin, the Secrétaire perpétuel honoraire of the Académie, came to New Delhi to lecture at a conference entitled *The neural Crest, a Source of Stem Cells and its Role in the Development and Evolution of Vertebrates*.

In Latin America

For historical reasons related to migration flows, Francophone culture is particularly present in the Eastern Republic of Uruguay - since 2012, this country has been a member of the International Organisation of La Francophonie (Organisation Internationale de la Francophonie). The special proximity between France and Uruguay is at the core of the scientific cooperation agreement that the Academies of science of the two countries have settled on in 2014. In December 2014, Jean-François Bach and Catherine Bréchignac, the Secrétaires perpétuels of the Académie des Sciences, have taken part to the French-Uruguayan *Sciences, Technologies, Education for a Sustainable Development* seminar that took place in Montevideo on the occasion of the Week of the Committee of the Institut Pasteur of Montevideo.

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In December 2014, the French and Argentinian academies of science, which signed their first cooperation agreement in 2004, gathered in Buenos Aires and settled on a new agreement before a colloquium on immunology was held, to which a delegation of members of the Académie took part, led by Jean-François Bach.

In Africa

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Algeria

The Algerian government wished to endow its country with an academy of sciences and technologies whose statutes would meet the international standards. The Académie des Sciences advised the government in this view and was particularly involved in the empanelment of an international jury to process the applications for the future academy. This selection process of a first wave of academicians, started in 2014, will secure the independence of the Algerian academy and thus ensure its worldwide reputation.

Morocco

France and Morocco have been for a long time involved in initiatives of science diplomacy. In this context indeed, Catherine Bréchignac, the Secrétaire perpétuel of the Académie des Sciences and French delegate ambassador for science, technology and innovation, was invited in February 2013 and February 2014 to take the floor at the opening ceremony of the Solemn Plenary Session of the Académie Hassan II des Sciences et Techniques (Hassan II Academy of Sciences and Techniques) in Rabat. The Académie des Sciences provided its full contribution to the scientific programme of these plenary sessions, through the lectures of Académie Members Serge Haroche (2012 Nobel Prize in physics) and Cédric Villani (2010 Fields Medal) in 2013, and Didier Roux and Daniel Kaplan in 2014.

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Tunisia

Several academies are members of the Académie tunisienne Beït al-Hikma (Tunisian Academy of Sciences, Letters and Arts Beit al-Hikma) created in 1992. A delegation of the Tunisian Academy was greeted by the Académie des Sciences on the occasion of its Solemn Session on 26 November 2013. In order to invigorate the Tunisian Academy, it has been suggested at this meeting that interacademic colloquia should be organized in Tunisia on major social issues, gathering members of the University, industrial and political leaders, each conference being introduced by a member of the Académie des Sciences. The first of these colloquia was held in Carthage on 7 May 2014 on the theme of *Energy: Challenges and Opportunities for Tunisia,* starting with an opening by Académie Member Michel Combarnous.

Benin

The Académie des Sciences provides its support to the young Académie nationale des sciences, arts et lettres du Bénin (National Academy of Sciences, Arts and Letters of Benin), which greeted Catherine Bréchignac, the Secrétaire perpétuel of the Académie des Sciences in April 2014, at its first Solemn Session.

Francophone Countries

Through several of its members, including Catherine Bréchignac, the Secrétaire perpétuel of the Académie, who gave the initial lecture, François Gros, the Secrétaire perpétuel honoraire and Daniel Rouan, the President of the Foundation *La main à la pâte - Pour l'Éducation à la science*, the Académie des Sciences took an extensive part in the debates of the international colloquium devoted to the theme *Francophone Training Offers: Taking Stock and Perspectives* - a preparation for the 15th Summit of La Francophonie which held in Dakar, Senegal, in October 2014.

Actions Targeting Development

COPED: contemplating Franco-African cooperation

Infused with a spirit of close partnership with Africa on its creation in 1997, the Standing Committee for Developing Countries (Comité Pays en Développement, COPED) has gradually enlarged its scope of action to other regions of the world. Under the Presidency of François Gros, the Secrétaire perpétuel honoraire of the Académie des Sciences, COPED embodies the determination of the Académie des Sciences to contribute through scientific development to solving major worldwide issues, by thoroughly:

- promoting scientific training and research projects;
- organizing forums on topical issues for DCs (Developing Countries);
- creating and maintaining bonds with national and international organisms dedicated to research for development;
- tightening ties with the appropriate Directorate-Generals of the European Commission;
- operating in steadfast cooperation with the Interacademic Group for Development (GID).

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COPED has continued channelling its efforts into the organization in Africa of major colloquia focused on topics of crucial interest for development. Since the cooperation initiatives in the field of chemistry in Francophone Africa is lagging behind, it has been decided to focus on chemistry and its role in the characterization and repurposing of natural resources - whether plant, animal or mineral. First, representatives from seven Francophone African countries have been invited at the Académie des Sciences at the end of 2013 to discuss on specific themes that could be considered on the colloquium. Cotonou has been selected as the venue, with direct support from the Académie nationale des sciences, des arts et des lettres du Bénin. First scheduled for October 2014, this colloquium had been postponed for April 2015 due to the Ebola epidemic that had stricken Western Africa. This colloquium involved about twenty European and sixty African speakers. A special issue of the *Comptes Rendus de l'Académie des sciences* shall be devoted to it.

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COPED was also involved in the 1st conference of the North-South Aemase (African-European-Mediterranean Academies for Science in Education) programme of ALLEA, organized on the initiative of the academies of Egypt, France, Italy, Morocco and Senegal, with support from the IAP (InterAcademy Partnership) and NASAC (Network of African Science Academies) interacademic networks. This colloquium, which was held in Roma from 18 to 20 May 2014, was devoted to the theme of science teaching in the service of society and development. Co-chaired by Académie Member Odile Macchi, the Vice-President of COPED, it greeted representatives from the 26 countries of the North-South area involved but also from the Americas and Australia. Thanks to the quality of the interactions shared between Northern and Southern countries, bilateral or multilateral cooperation projects will be launched on several themes: the professional development of science teachers, assessment of pilot projects on teaching, role of the industry, relations between the formal methodology of school teaching and the informal science education of the citizen (at the museum, exhibitions, fairs, etc.), using information technology in the classroom. The minutes of the conference have been published at the end of 2014[25].

When *La main à la pâte* goes international

In the aim to disseminate the experience of *La main à la pâte*® outside the borders of France, the Foundation for Science Cooperation [Fondation de coopération scientifique] *La main à la pâte - Pour l'Éducation à la science*[26]*:*

- holds an international seminar and greets foreign delegations: the seminar gathers every year a little more than forty participants from about thirty countries of Asia, Africa and the Americas. It enables foreign participants to discover the operation *La main à la pâte* in France, and is often an opportunity for establishing new collaborations;
- takes part in international events: the conference of IAP's *Science Education Programme* in Beijing (October 2014), a subregional ministerial forum on spurring the academies on to aim technological development and the creation of youth employment opportunities in Cairo (November 2014), an exploratory mission in Armenia (November 2014);
- advises partner countries in the local implementation of their strategy: ten training sessions to the operation La main à la pâte take place every year out of France (South Africa, Algeria, Saudi Arabia, Brazil, Indonesia, Italy, Mexico, Vietnam, etc.) and in 2014 the Foundation provided such new resources in English as the teaching module *Screens, the Brain and the Child* and the booklet *Setting up, Developing and Expanding a Centre for Science and/or Mathematics Education;*
- carries out a specific action at the European level: coordinates the Sustain *(Supporting Science Teaching Advancement Through Inquiry)* Project and is in charge of the national Contact Point of the *Scientix2* programme, coordinated by the European Schoolnet.

Putting knowledge to work for development: GID

Groupe interacadémique pour le développement

The Groupe interacadémique pour le développement [Interacademic Group for Development] was created in 2007 by ten academies of Southern Europe and the African continent. It is committed to boosting a true codevelopment Euro-African programme. In order to reach this goal, GID is backed up by two important networks of academies, whose creation it did bring about: GID-EMAN (the Euro-Mediterranean Academic Network) et GID-ESAN (the Euro-Sub-Saharan Academic Network). With André Capron as President until 2012, it is now chaired by François Guinot, the Honorary President of the Académie des Technologies.

With strongly support from the Académie des Sciences, GID assumes three key missions:

- acting through education - by means of one of its flagship programmes, the *Women Health Education Program*, which focuses on health education by and for women -, through training - by means of its *Sciences, Métiers et Sociétés* workshops, which are aimed at leaders involved in the formulation of public policy in their countries - and through information - by means of its publications, which are available on its website[27];
- being a think tank and driving forward: Euro-Mediterranean conventions (*Parmenides*) gather every year scientists, technologists and other stakeholders involved in development for a specific field under consideration, in the aim to reveal and bring to the fore the real development needs, reflect on the knowledge that is either available or requiring further exploration, identify the impediments to marshalling such knowledge, and, finally, draw up recommendations to overcome them. It is planned to build on this model and organize Euro-Sub-Saharan conventions *(FastDev, Forum africain des sciences et technologies pour le développement);*
- catalyzing initiatives for development: when it is necessary, GID acts as a catalyst for furthering the training and actions of groups who, in their operations, are best qualified to achieve the projects stemming from the recommendations.

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In November 2013 in Malta, was held the 6th Parmenides conference, which laid the foundations for the creation of an *Observatory for Development in the Mediterranean*, as recommended at the 2011 4th *Parmenides* conference in Rabat, Morocco, whose theme was: *Water and Sanitation: Risks and Issues in the Mediterranean*. The Mediterranean area indeed experiences a fast population growth, in particular on its Southern banks, together with an uneven spread of seasonal tourism inflow on its shores. The Mediterranean countries thus have to manage an expanding demand for infrastructures adapted to such evolutions while ensuring that natural, especially halieutic, resources are preserved. GID's academies deem it essential to create an observatory that, building on the steadfast cooperation of marine research institutes and on the sharing of skills and data gathered from scientific publications, shared experiences and observation systems, would become a genuine decision aid tool for political leaders and stakeholders involved in the sustainable development of the Mediterranean.

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In February 2014, Ahmadou Lamine Ndiaye, the President of the Académie nationale des sciences et techniques du Sénégal (National Academy of Sciences and Techniques of Senegal), and François Guinot, the President of GID, have invited the African Academies to meet in Dakar and put in place the tools for Euro-Sub-Saharan development - the GID-ESAN network and the 1st edition of the FastDev convention, which shall be organized in 2016 - replicating what works in the Euro-Mediterranean zone.

PERFORMING THE ROLE OF AN EXPERT AND ADVISOR

Deciding in matters of scientific and technological options is up to the political stakeholders, who must be able to make informed decisions. Since its creation, the Académie des Sciences performs the role of an advisor, as indicated in Article 3 of its statutes. Its members' scientific excellence, its multidisciplinary and global outlook now allow it to play a key role as an expert. In order to do so, the Académie sets up Committees and Working Parties, which are the cornerstones of its activity as they compose Reports, Advice Notes or Recommendations – as many decision aid tools available for public consultation.

Experts Committees: to reflect and propose

Thanks to its members, top-level scientists representing all disciplines and fields of research, the Académie des Sciences may look into any modern issue in which science plays a part. Standing or Ad-Hoc Thematic Committees, indeed, allow members of the Académie to analyse and review the most recent data and formulate recommendations for action.

Standing Committees most notably constitute the cornerstone of the Académie's advisory mission. Out of presentations & debates prepared by members of the Académie, and to which external experts are invited when useful, Reports, Advice Notes or Recommendations are drafted, proposed to decision makers and made available for consultation to all citizens browsing the website of the Académie des Sciences.

The missions of such Committees of the Académie des Sciences have been detailed in *One Year with the Académie des Sciences -2012*[28].

Environmental Sciences

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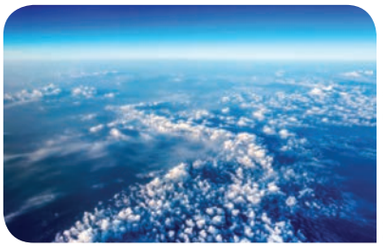
The organization of the *Comité des Sciences de l'Environnement [Standing Committee for Environmental Sciences]* has been revamped in 2013: its three-tier structure (Water-Food, Climate, Population-Health) has been abandoned in favour of a plenary organization, around keywords referring to diversified and more precise transversal themes.

The *Comité des Sciences de l'Environnement* has prepared the public session that the Académie held on the observation of the climate on 16 December 2014 in the prospect of the 2015 Paris Conference.



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Moreover, the *Comité des Sciences de l'Environnement,* which is behind many reports of the Académie, has reflected on the work achieved in the last two decades and its accuracy through time. It has thus undertaken a short study on ozone, in order to update the 1993 and 1998 reports (respectively *Ozone troposphérique* [Tropospheric Ozone] and *Ozone stratosphérique* [Stratospheric Ozone]), whose scientific contents remain solid but which need an update with the most recent data. Similarly, the *Ozone* sheet of the Livret de l'environnement [Booklet on the Environment], as all information sheets of this document intended for teachers, has been revised.

It has also been decided to adopt a renewed and standing reflection on biodiversity, in line with the 1995 report and the recent position of the Académie on the operating procedures of IPBES, the International Platform on Biodiversity and Ecosystem Services - recommending that the governance of such organisms be entrusted to scientists of international reputation. The study shall focus on the adaptation mechanisms of biodiversity to climate change, and on the limits of these mechanisms. The written document shall include explanatory sheets, each written by an expert in the relevant theme, and now follow an ecosystemic, rather than species-oriented, approach.

Space Research

The *Comité de la recherche spatiale (Standing Committee for Space Research)* has joined up with the *Comité des sciences de l'environnement* to address a recommendation to the Centre National d'Etudes Spatiales (French National Centre for Space Studies), in preparation of its *Séminaire quadriennal de prospective scientifique spatiale [Quadrennial Seminar of Prospective Studies on Space Science]* (March 2014). Following a synthetic review of the most pressing problems to solve in the various scientific fields that are linked to space - meteorology, climate, oceanography, Earth observation, stratosphere, etc. - this recommendation is based on the observation that allocated resources decrease and, in this context, outlines five proposals on instrumental R&D, micro- and nano-systems for the flotillas, the future of the sectors that give space research its structure, data-modelling coupling, and international coordination.

In parallel, the *Comité de la Recherche Spatiale* is in charge of conveying the French positions in the European framework of EASAC (the European Academies Science Advisory Council). It has indeed contributed to the European Space Exploration: Strategic Considerations of Human versus Robotic Exploration report. This report was presented to the public at the Embassy of Switzerland in Paris on 15 September 2014, with the support of the Académie des Sciences.
Having the ears of the public authorities, the *Comité de la Recherche Spatiale* of the Académie des Sciences forcefully stands a focal point for reflection and proposals to reach the French and European policy arenas.

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Energy prospects

The *Comité de Prospective en Energie (Standing Committee for Prospects in Energy Procurement)* has issued a detailed advice note on shale gas, which was made public on 15 November 2013. It has been interviewed as an expert on this topic by the Assemblée Nationale [French National Assembly] on 18 February 2014.

Moreover, the *Comité de Prospective en Energie* has:

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- sent representatives on 28 April 2014 on an information visit to the French electricity transmission system operator RTE (Réseau de Transport d'Electricité);
- hosted, on 29 April 2014 in Paris, the 9th meeting of the *Energy Steering Panel* of EASAC *(European Academies Science Advisory Council)*;
- Appointed a representative on 29 April to the Seminar of the French National Alliance for Energy Research Coordination (Alliance Nationale de Coordination de la Recherche pour l'Energie, Ancre);
- jointly organized on 26 June 2014 a meeting at the Embassy of Germany in Paris, with experts from the Académie des Sciences, the Académie des Technologies, Acatech *(Deutsche Akademie der Technikwissenschaften)* and *Leopoldina Nationale Akademie der Wissenschaften* on the theme of energy transition. This reflection continued on 5 and 6 March in Berlin;
- interviewed several personalities with an expertise in the field of energy.

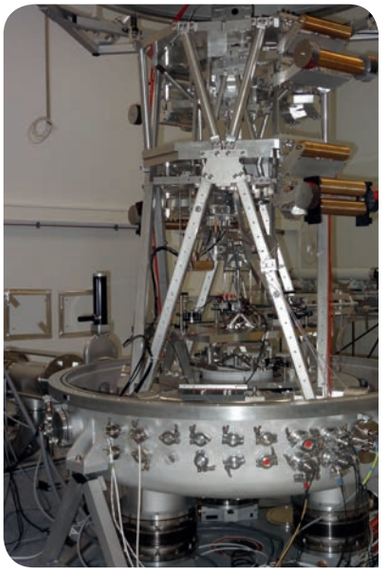
As part of its ongoing reflection on networks, storage, energy efficiency and saving, and different plausible scenarios, the *Comité de Prospective en Energie* has prepared an advice note on energy transition (*Avis sur la transition énergétique)*, adopted by the Academy on 6 January 2015.

Science and metrology

The Académie, concerning world metrology, bears a responsibility inscribed in an international treaty, the Metre Convention (1875). This treaty states that the President of the Académie des Sciences chairs the General Conference on Weights and Measures (CGPM). The 25th edition of this conference was held in Versailles from 18 to 20 November 2014: it gathered the delegates of the Member State governments as well as observers from the associates of the CGPM, under the presidency of Philippe Taquet. The CGPM adopted five resolutions addressing scientific and institutional issues[29], including the future redefinition of the International System of Units (SI) which had already been discussed at the 24th CPGM in 2011.

The *Comité Science et Métrologie (Standing Committee for Science and Metrology)* takes an active part in these redefinition efforts. It has thus met on this theme at the Bureau International des Poids et Mesures (International Bureau on Weights and Measures, BIPM) in Sèvres in April 2013. At this session, the Comité Science et Métrologie has interviewed Martin Milton, the director of BIPM, and Michael Stock, the Director of the Electricity Department and (Interim) Director of the Mass Department of BIPM. Both have provided an overview on the obstacles that remain to be addressed before any redefinition of the SI may take place, including the persistent divergence between the experimental values obtained for Planck's constant. Moreover, the Comité Science et Métrologie has looked into drafting the next presentation brochure of the SI, edited by BIPM.

In 2014, the *Comité Science et Métrologie* organized a colloquium to celebrate the centenary of the Sagnac effect discovery : *Sagnac Effect: 100 years later* - 10 October 2013[30]. In 1913, indeed, the French physicist Georges Sagnac observed a phase difference in the interference of two luminous signals circulating in two opposite directions on the circumference of a rotating disc with their source of emission is on this very disc. This discovery, known as the Sagnac effect, was published in the same year in the *Comptes Rendus de l'Académie des sciences*. It lead to the invention of ring laser gyroscopes, which for example allow for aircraft navigation (10 October 2013).



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Science and biosafety

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The *Comité Science et Biosécurité [Committee for Science and Biosafety Issues]* of the Académie des Sciences has replaced in 2014 the *Comité Science et Sécurité (Standing Committee for Science and Safety Issues)*. It gathers a group of about fifteen members of the Académie along with some external personalities, all experts from different fields pertaining to the life and medical sciences - cell biology, molecular biology and genetics, bacteriology, virology, risks associated with the use of toxins, immunology, chemistry, computer sciences, plant biology, the environment and synthetic biology.

The Académie has warned the political decision makers on how essential it was to promptly implement the appropriate goals for ensuring biosafety in France, which are recommended in the Académie's report *Les menaces biologiques. Biosécurité et responsabilité des scientifiques [Biological threats: Biosafety and the scientists' responsibilities],* published in 2008 under the supervision of Académie Member Henri Korn[31]. Some of the proposals expressed in this report have been considered and are being discussed with the public authorities. Such is particularly the case with the proposal to set up a National Advisory Council for Biosafety (Conseil National Consultatif pour la Biosécurité, CNCB), with two distinctive sides: a scientific side, with the *Comité Science et Biosécurité* of the Académie des Sciences, and an institutional side, under the supervision of the services of the Prime Minister and involving representatives from the different ministries and bodies concerned by biosafety issues. Decisions should be shortly taken with the relevant administration and soon made public but in the current context of threats, the *Comité Science et Biosécurité* felt it necessary to start exploring these issues by itself, and has committed itself to undertake the following missions:

- to discuss any relevant issue pertaining to biosafety;
- to contribute to the foresight studies that focus on the risks posed by the dual nature of research in life sciences;
- to contribute to raise the researcher's awareness and respect for agreements and conventions ratified by France in the field of biology;
- to express advice, for the best benefit of the public authorities, on research projects that might lead to the emergence of new biological threats, through a "risk/benefit" analysis enabling them to identify the critical point beyond which the risks presented by such research exceed the beneficial effects that are wished for;
- to express the principles with which the agencies in charge of allocating resources should comply, including the Agence Nationale pour la Recherche [French National Research Agency] and scientific and technological public institutions, in order to avoid funding research of potential dual nature, whose "benefit/risk" ratio would first appear negative;
- to contribute to updating, should the need occur, the list of protected sectors and sensitive specialities that are subject to the risks detailed in the policy arrangements for protecting the scientific and technical potential of the nation (Protection du Potentiel Scientifique et Technique, PPST)[32];
- to make recommendations to avoid the dissemination of any research result presenting biosafety risks.

In this framework, the Comité Science et Biosécurité is reflecting on the dialogue that should be set up between national and international scientific communities and public authorities on biosafety, and on how to raise the awareness of researchers in life sciences and stakeholders in charge of public health to all of these risks. Controlling some laboratories believed sensitive, while preserving the freedom of research, should considered. The Comité Science et Biosécurité is also considering how the experts' role may be better acknowledged as they contribute to decisions of a collective nature, and how best practices against potential emergency situations may be best defined.

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Moreover, the Comité Science et Biosécurité shall list and hear all the existing structures in the field of biosafety in France and may pay particular attention to specific research contract projects. It shall take the initiative to consider any topical issue requiring scientific advice or recommendations and, lastly, shall take stock of the threats facing the French territory.

Science, ethics and society

The *Comité Science, Ethique et Société (Standing Committee for Science, Ethics and Society)* has continued operating in 2013 and 2014, addressing issues of deontology within the Académie and general issues of ethics.

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Following the formulation of rules for the presentation of the Prizes of the Académie, which were adopted in January 2012, the Committee focused on the issue of member election, in the perspective of the 2013 and 2014 sessions of elections. The issue of gender parity has been extensively debated, and so has been the major concern to avoid conflicts of interest. These rules have been officially presented to the assembly of the Electoral Commission of 10 June 2014. They revolve around the four major steps of the election procedures: detecting candidates, filling an application file, submitting the file before the Commission, and discussing the file within the Commission.

Moreover, the *Comité Science, Ethique et Société* has started a long-haul exploration on research funding, once again with a focus on the issue of conflict of interest, but also aiming at answering any blames for lacking objectivity, which are often expressed against the scientists who agree on partnerships with the industry. In order to do so, the Comité has asked several members of the Académie enjoying, at the time or before then, such kind of relations to cover wide fields of activities and experiences. The minutes of these debates are available for all members of the Académie to consult.

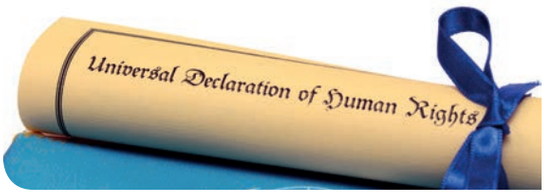
The *Comité Science, Ethique et Société*, through its President, Académie Member Anne Fagot-Largeault, has also taken an active part in the work of the ALLEA *(All European Academies)* Permanent Working Group on Science and Ethics, notably revising the *Statement on Ethics Education in Science and Research.* This document was followed by a brochure published by ALLEA, *Ethics Education in Science*[33], which has been sent to 300 doctoral schools from French universities, at a time when they are expected to teach young researchers the great principles of research ethics.

Finally, the *Comité Science, Ethique et Société* has taken part in the reflection engaged by the Académie on science publishing, regarding the current evolution of the publishing world (see the report of the Académie des Sciences *The challenges Facing Scientific Edition).*

The *Comité Science, éthique et société* is now considering different themes with an ethical dimension to them, and in particular: ethics in expertise, ethics with regard to the third world, ethics education at high school level, the role played by foundations in the functioning of research, the scientific quality of reviews and the issue of open access, science and obscurantism.

Defending the men of science

The *Comité de défense des hommes de sciences (Standing Committee for the Defence of Scientists' Rights*, CODHOS) of the Académie has been chaired since 2013 by Édouard Brézin et Jean Illiopoulos. It meets about once every six weeks to address the individual situations that would come to its knowledge and follow up the situations it would have already considered. It works in liaison with foreign academies, mainly the U.S. National Academy of Sciences (NAS), the French Ministry of Foreign Affairs and, sometimes, Amnesty International.



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Every year, 5 to 10 releases or penalty mitigations are observed concerning persons for whom CODHOS has taken action. In 2013 and 2014, CODHOS has thus been most pleased to hear that 8 scientists had been released (in Turkey, Bahrain, South Africa, Canada, Equatorial Guinea and Tajikistan) and that 20 Bahraini health professionals had been cleared of charges.

CODHOS has also supported the candidacy of the new Turkish academy of sciences *Bilim Akademisi* to join ALLEA (*All European Academies*). It is composed of scientists who have resigned from the Turkish Academy of Sciences TÜBA, as a reaction to a decree from the Turkish government changing the election procedures of the members of the academy. *Bilim Akademisi* joined ALLEA as a Corresponding Member in April 2014.

CODHOS takes part in the International Human Rights Network of Academies and Scholarly Societies, created on the initiative of NAS in 1993 and whose members meet every two years to improve the coordination of their actions: the last session was held in Halle (Saale), Germany, from 26 to 29 May 2014, and gathered 29 nationalities.

Finally, in 2014, CODHOS has interviewed Carol Corillon, the Executive Director of the International Human Rights Network of Academies and Scholarly Societies, and Faouzia Charfi, a physicist and professor emerita at the University of Tunis who is the author of *La science voilée* [Science behind a veil] (Odile Jacob Ed., May 2013, 224 p) and who campaigns for women's rights and promotion and for the separation of religion from the State.

Teaching sciences


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The whole set of concerns of *the Comité sur l'Enseignement des Sciences (Standing Committee for Science Education and Training)* which has been chaired by Étienne Ghys since April 2013, should be understood in the larger framework of the one-day seminar organized in September 2013, as one of its four sessions was devoted to the following theme: "l'Académie des Sciences et les Jeunes: Missions, Bilan, Actions" [the Académie des Sciences and the Youth: Mission, Assessment, Initiatives).

The *Comité sur l'enseignement des sciences* has first focused on the future of the Internats d'Excellence [Boarding Schools for Excellence], then in danger of disappearing. It has also questioned the relevance of on-line courses for the particular case of science teaching. More specifically, through discussions on the various publics and disciplines that should receive priority attention, it has carefully outlined and explained a cooperation project it shares with several partners from the university to implement distance education modules for the use of instructors in francophone Africa.

It has also continued, and has been doing so since its creation, to consider the science programmes of study in the curriculum, whether from a broad comprehensive perspective or, more specifically, concerning the programmes of study of the Classes Préparatoires aux Grandes Ecoles [classes where candidate students prepare for selective exams to higher education schools]. This reflection was also stimulated by interviews of science teachers from such Classes Préparatoires, or teaching at the end of high school or at elementary school.

History of science and epistemology

The *Comité histoire des sciences et épistémologie* (Standing Committee for the Science History and Epistemology) has also triggered off two colloquia in 2013-2014: *L'Enseignement Philosophique et les Sciences: Nouvelles Perspectives [Philosophy Teaching and Sciences: New Prospects]* on 13 November 2013, and *Les scientifiques et l'épistémologie: la rationalité scientifique aujourd'hui [Scientists and Epistemology: Scientific Rationality Today]* on 10 December 2014. Sciences are currently studied within various frameworks, both inside and outside science classes themselves. The scientists' contributions to reflection in their own fields of study in the last century have been most memorable. With relativism increasingly influencing the mindsets of the decision-making milieus, a bias towards short-term research projects is at risk of being favoured, to the detriment of less-targeted, yet promising, research. Where does scientific rationality currently stand? During this colloquium, academicians from various disciplines have contributed to this self-reflection of science.

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Advice Notes and Reports

The digital revolution: how does it impact the developing brain?

L'enfant et les écrans [Children and Screens], an Advice Note, January 2013. J.-F. Bach, O. Houdé, P. Léna, S. Tisseron, Le Pommier Ed, 2013, 272 p

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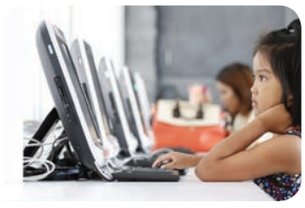
The construction of the brain functions depends upon the nature of the sensory, affective and cultural stimulations from the outside. Children's exposure to digital screens has thus a crucial impact. What are the risks for dependency or regressive phenomena of a child facing screens? What role may play interactive tablets and other new digital tools in knowledge learning and transmission? How does it impact the child-parent relationship? How is it possible to regulate the access to screens and not prohibit it? May video games and social networks be beneficial for teenagers? The Académie des Sciences has confronted the most recent evidence in neurobiology, psychology and cognitive sciences, psychiatry and medicine, to the fast-paced evolution of technologies and their uses. It takes stock of the issues, benefits and risks brought about by this disruption and underpins the necessity to adopt a differentiated pedagogy, depending on the age of each child, from babies to teenagers.

An appeal for true and proper computer science teaching

Teaching Computer Science in France: Tomorrow Can't Wait!, a Report, May 2013[34]



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The Académie des Sciences beforehand emphasizes the distinction that should be made between teaching "computer science" teaching and "digital education", between teaching the perennial basics of the computer science methodology and learning how to use tools and techniques which appear and go out of date very fast. Having expressed such a warning, the report mentions the conspicuously high potential of computer science for boosting the economic and cultural development of our modern societies, and observes that computer science is devoted too small a space in the education of students and French citizens. The Académie des Sciences issues recommendations that support the creation, in France, of a structured and adapted computer science teaching course, provided by professors that would be specifically trained for it. Computer science should become a unified, autonomous discipline, with its own ways of thinking and results.

Shale gas: wishing for more research

Elements to Clarify the Shale Gas Debat, an Advice Note, November 2013 [35]

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France, which imports 98% of the gas it uses, would be, with Poland, the greatest shale gas reservoir in Europe. The idea to reach energy autonomy through the exploitation of shale gas is thus a tempting one. It appears nevertheless necessary to first take an up-to-date stock of the risks induced by their extraction and provide a rational appraisal of the uncertainties. The Académie des Sciences has taken the initiative to study this complex issue it had already mentioned in its report La recherche scientifique face aux défis de l'énergie (December 2012).

It expounds in this Advice Note the main aspects that should be taken into account in matters of environmental risk control:

- water availability: admittedly, the necessary volume is high, yet it should be compared to other water consuming activities, including leisure, and other sectors that produce energy;
- preventing the contamination of ground water: such contamination, caused by methane or products used in fracturing, is possible but it can be avoided by respecting minimum vertical distances between the fracturing zones and the aquifers. The sealing of the casings, to prevent leakage into the aquifers involves, for its part, techniques that are well known and handled by the gas and fuel industry, but whether drillings will remain sealed in the long run is a question that should be thoroughly investigated;
- recovering water used for drilling and fracturing: it is advisable to initiate research aimed at developing agents that improve fracturing efficiency and mitigate the impacts on the environment. Water used for drilling is a potential contaminant and, before any exploration or exploitation should occur, relevant wastewater treatment processes should be defined and implemented;
- greenhouse impacts: for the same quantity of energy produced, using gas implies a two-fold decrease of CO_2 emissions, compared to using coal. Moreover, using gas avoids emitting pollutants that are proper to coal (heavy metals and natural radioactive elements). The balance of replacing coal by natural gas is thus a positive one, provided, though, that the level of methane leakage remains low;
- induced seismicity: it appear lower than natural seismicity or seismicity linked to mining activities. Nevertheless, the risk should be assessed depending on the local conditions and requires implementing strict and efficient seismicity monitoring procedures.

To progress on all these aspects, the Académie des Sciences recommends that *"an independent multidisciplinary scientific authority be created to monitor any action taken to objectively evaluate shale gas resources and exploitation methods"*.

Scientific publishing: time to change the model?

The challenges Facing Scientific Edition, a Report, July 2014[36].

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The Académie des Sciences considers that the current models of scientific publishing to not ensure the whole international scientific community equal access to high-quality, immediately available information. It recommends a restructuration along two major lines of work: open archives and an Open Access institutional framework based on the ratification of national, or even international, agreements, between the States and publishers. In this report, the Académie des Sciences also mentions the primordial role played by scientific publishing in the assessment of researchers and the negative drifts that may be expected from this.

Freedom to conduct research: the GMP case

French Academies Call for Freedom of Research on Genetically Modified Plants (GMPs) to be Restored. Interacademic Advice Note (Agriculture, Sciences, Technologies), March 2014[37].

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Public research should maintain and develop its expertise skills for the benefit of all, including through experimentation. The three academies have set a reflection on the issue of genetically modified plants, with in particular a colloquium in November 2013. This reflection has lead the academies to express the following observations and recommendations:

- GMPs are not the only promising solution for agriculture. Yet they constitute a tool to be used alongside others for a sustainable, productive and environmentally friendly agriculture, designed to serve a globally fast-growing population;
- the spread of some currently available GMPs should be backed up by close attention to environmental effects and especially resistance against biotic factors (living organisms such as insects, weeds). This notably implies that Best Management Practice training should be provided to farmers;
- the use of GMPs should be assessed on a case-by-case basis before it be authorised, from a Cost-Benefit-Risk analysis viewpoint that takes into account the different social, ecological and economic situations;
- the very strict EU regulation on marketing authorisation allows their long-term efficacy and safety to be tested.

Scientific research: warning on a critical situation in France

Cri d'alarme de l'Académie des sciences sur le financement de la recherche [A Clarion Call on Research Funding from the Académie des Sciences]. A communiqué, December 2013

The Académie publishes arguments to support its uneasiness about the reduction of research funding in France. Well aware of the financial crisis that affects this country, it considers that an answer to this crisis would be to secure research funding, given its promising impacts on the education and economy of the country.

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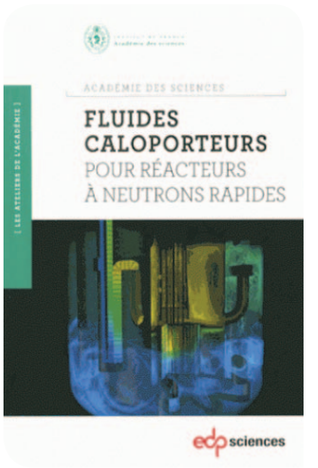
Inquiétudes dans les laboratoires de recherche: l'Académie des sciences tire de nouveau la sonnette d'alarme. [Worries at the Research Laboratories: Another Clarion Call from the Académie des Sciences]. A Communiqué, October 2014

The Académie des Sciences once more expresses its concern, as the situation of research in France deteriorates, and wishes to make known its proposals on bringing the required changes. On 7 October 2014, this statement was addressed to the President of the Republic, the Prime Minister and the members of the Government who are concerned by the issue, and to the President and Vice-President of the Office Parlementaire d'Evaluation des Choix Scientifiques et Technologiques (the Parliamentary Office for Scientific and Technological Assessment, OPECST).

These statements follow the publication of the September 2012 report *Remarques et propositions sur les structures de la recherche publique en France [Remarks and Proposals on the structures of public research in France],* which was the contribution of the Académie des Sciences to the November 2012 French Symposium on Research (Assises de la Recherche).

Fluides caloporteurs pour réacteurs à neutrons rapides [Coolants for Fast-Neutron Reactors] (March 2014)

EDP Sciences, « Académie des sciences » Collection, March 2014.



This condensed publication provides an outline of the essential elements of a two-day meeting held in February 2013 by the Académie des Sciences on the use of coolants in generation IV fast-neutron reactors. Coolants, once extracted, convey heat from their energy sources (nuclear fission here) to colder sources, where it is transformed into electric energy via turbines. Fast-neutron reactors (so-called Generation IV) are currently the only reactors able to produce, through the fission of uranium, significant flows of energy at the scale of the century and far beyond, and for all important cities of the world. Following a presentation on the general scope of the problem from the scientific and technical perspectives, as well as from the viewpoint of industrial development, this book analyzes four types of solutions, which concern liquid metals, gas and molten salts. It finally highlights their common difficulties, as well as the different characteristics resulting from these solutions, including the size and thermal regimes of these reactors. The publication is accompanied by a CD-ROM including all the scientific presentations that were held.

Notes

1,2/ See (in French) at www.academie-sciences.fr/fr/Ceremonies/ceremonie-de-reception-des-academiciens-elus-en-2013.html and www.academie-sciences.fr/fr/Ceremonies/ceremonie-de-reception-des-academiciens-elus-en-2014.html (page 4)
3 / Video recordings of the sessions (in French) available at www.academie-sciences.fr/fr/Videos/les-videos.html (page 6)
4 / See also the interacademic advice note on GMP research published in March 2014. (page 8)
5 / Video recording of this session (in English) available at www.academie-sciences.fr/fr/Colloques-conferences-et-debats-par-et-pour-la-communaute-scientifique/genetics-epigenetics-and-psychiatric-diseases.html (page 10)
6 / The list of awards is available (in French) at www.academie-sciences.fr/fr/Laureats/plaquettes-des-prix.html (page 10)
7 / Now the Airbus Group corporate Foundation (page 13)
8 / www.fondation-lamap.org (page 18)
9 / The list of awards is available at www.fondation-lamap.org/fr/prix-lamap (page 18)
10 / Vidéo recordings since 2014 are available at www.academie-sciences.fr/fr/Table/Transmettre-les-connaissances/Seances-publiques/ (page 19)
11 / « Faciliter la mise en œuvre des actions de la Délégation à l'éducation et à la formation [de l'Académie des sciences] et celles de la Fondation pour l'éducation à la science [La main à la pâte] » Circulaire du ministre de l'Éducation nationale aux recteurs d'académie, 6 mars 2012 - extrait (page 20)
12 / The minutes of the 2012 and 2013 colloquia are available (in French) at www.academie-sciences.fr/fr/Table/Methode-scientifique/Colloques/ (page 21)
13 / Video recordings of the sessions (in french) are available at www.academie-sciences.fr/fr/Videos/les-videos.html (page 26)
14 / Available for consultation (in French) at www.csa.eu/multimedia/data/sondages/data2014/opi20140916-les-jeunes-et-la-science.pdf (page 31)
15 / See a copie of the envelope at www.academie-sciences.fr/fr/Transmettre-les-connaissances/les-plis-cachetes.html (page 33)
16 / The InterAcademy Partnership now includes the InterAcademy Panel, InterAcademy Council and InterAcademy Medical Panel (by decision of November 2014) (page 38)
17 / ALLEA also includes non scientific academies (page 38)
18 / www.easac.eu/fileadmin/PDF_s/reports_statements/Easac_25_ESP_complete.pdf (page 39)
19 / WCRP (World Climate Research Programme), IGBP (International Geosphere Biosphere Programme), Diversitas et IHDP (International Human Dimensions Programme on Global Environmental Change). (page 39)
20 / Gathering ICSU, ISSC (International Social Science Council), Unesco (United Nations Educational, Scientific and Cultural Organization), Unep (United Nations Environment Programme), Unu (United Nation University), WMO (World Meteorological Organization) et, on the financial side, IGFA (International Group of Funding Agencies for Global Change Research)/Belmont Forum. (page 39)
21 / With ISCC and UNIDSR (United Nations International Strategy for Disaster Reduction) (page 39)
22 / Texts are available (in French and in English) at www.academie-sciences.fr/fr/Rapports-ouvrages-avis-et-recommandations-de-l-Academie/g-science-2013.html (page 40)
23 / See the Joint statement on energy transition published by the four academies on 10th July 2015 at www.academie-sciences.fr/en/Advice-Notes-and-Reports/joint-statement-on-the-energy-transition-in-france-and-germany.html (page 42)
24 / Video recordings (in English) of the session are available at www.academie-sciences.fr/en/Colloquia-Conferences-and-Debates/celebrating-cern-s-60-years-of-existence-at-the-academie.html (page 42)
25 / www.allea.org/Content/ALLEA/pdf/AEMASE%20conference%20report_Digital.pdf (page 49)
26 / www.fondation-lamap.org/ (page 49)
27 / See the website g-i-d.org/en (page 50)
28 / Downloadable at www.academie-sciences.fr/pdf/documentation/RAgb_sources/projet/un_an_2012_gb.pdf (page 52)
29 / Available for consultation at www.bipm.org/en/cgpm-2014/ (page 53)
30 / The minutes of this colloquium have been the focus of a special issue of the Comptes Rendus de l'Académie des Sciences 2014, 15 (10): 787-916 (page 54)
31 / H. Korn, P. Berche, P. Binder. PUF, 2008 (page 54)
32 / See the Arrêté [Decree] of 3 July 2012 relative to PPST at www.legifrance.gouv.fr (page 54)
33 / www.allea.org/Pages/ALL/33/522.bGFuZz1FTkc.html (page 55)
34-37/ See (in English) www.academie-sciences.fr/en/Table/Performing-the-role-of-an-expert-and-advisor/Advice-Notes-and-Reports/ (pages 57-59)

Head of Publications: Catherine Bréchignac, Secrétaire perpétuel of the Académie des Sciences
Delegate for Scientific Information and Communications: Alain-Jacques Valleron
Head of Communications: Emmanuelle Chollet
Head of Art: Natacha Oliveira
Translation: Nicolas Rigaud
Graphic design and printing: CLUMIC Arts Graphiques
Paris, September 2015

Académie des sciences
23, quai de Conti - 75006 Paris - France
www.academie-sciences.fr

ISBN 978-2-909344-29-0