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2004
A YEAR AT CNRS

2004 A YEAR AT CNRS

CENTRE NATIONAL
DE LA RECHERCHE
SCIENTIFIQUE

"During his journey, man must look beyond the world of dreams and the imaginary, and consider his role as a citizen of the world."

Gérard Mégie

The second edition of *A Year at CNRS* provides a look back at the progress made in 2004 in the various scientific fields where CNRS is active.

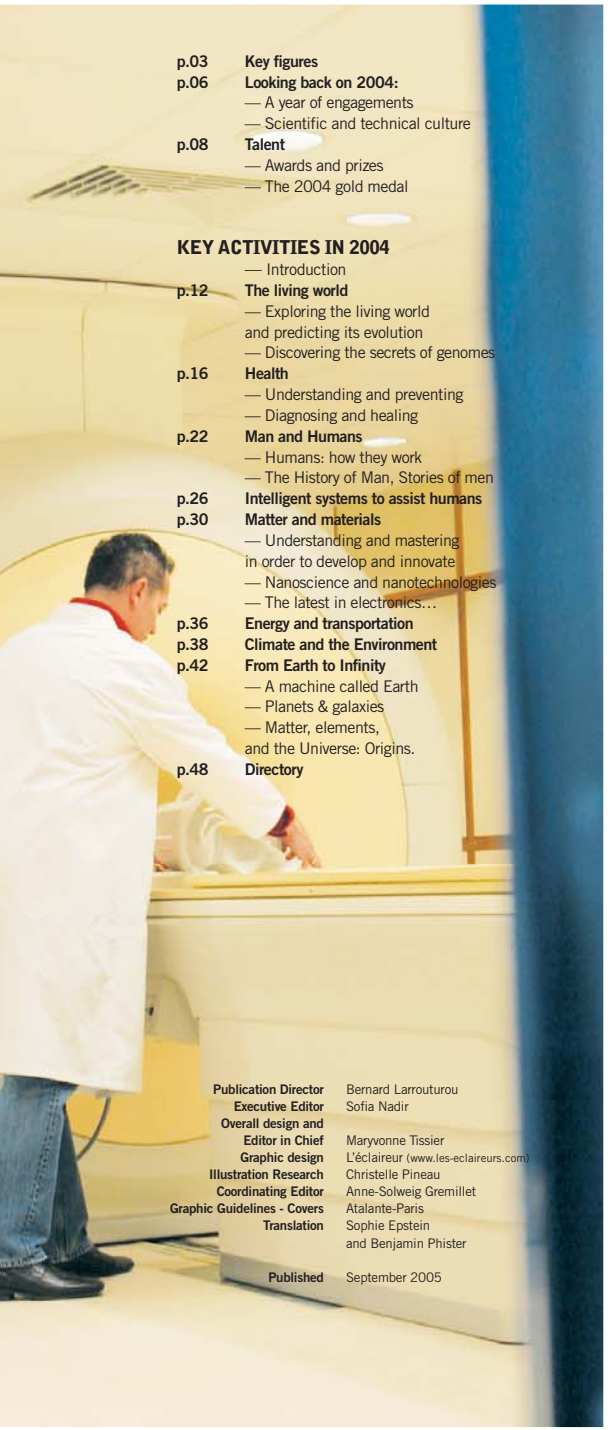
We have always enjoyed discussing advances in science. Without pretending to be exhaustive*, this brochure provides a glimpse into the past year's results, the fruits of the work carried out by our teams and, in many cases, alongside European and international partners. Research is rarely carried out alone, or within a single team, or even within a single discipline or country.

A Year at CNRS 2004 is intended for a general audience: it does not go into details of the scientific processes behind the results presented here. There is not enough room to cite every partner in all these scientific adventures. That is why I want to emphasize in this introduction that among the great treasures of CNRS are our partnerships with colleges and universities, with whom we share most of our laboratories, and therefore most of the results of our research.

This brochure is dedicated to the memory of Gérard Mégie. A world-renowned scientist, Gérard passed away in June 2004, just after we had finished the reform plan which is to be a blueprint for the future evolution of our organization. He was respected and appreciated by all his colleagues and a friend to many of us. He also worked hard to make both science and CNRS more open towards society, and I would like end by quoting him: "During his journey, man must look beyond the world of dreams and the imaginary, and consider his role as a citizen of the world."

BERNARD LARROUTUROU / CNRS DIRECTOR GENERAL

* For further information, press releases and media kits, see the *Journal du CNRS* (www.cnrs.fr, Press section) and the 2004 annual report (http://www2.cnrs.fr/sites/band/fichier/ca_ra2004.pdf).



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Published September 2005

KEY FIGURES

EUROPE AND INTERNATIONAL

A thousand and one ways to expand research in Europe!

Along with the construction of both an economic and a political Europe, another major project is underway: the building of the European scientific research area, in order to work together to generate new knowledge and know-how. It represents both the present and the future of French research.
— CNRS, already fully dedicated to this concept, is reaching out all over Europe and all the way to Russia, in order to increase the proportion of non-French European scientists in our teams, form tighter bonds with comparable organizations in other countries, and further increase our participation in the programs of the European Commission. Already more than one third of the articles published by CNRS laboratories are co-signed with partners from continental Europe.
— CNRS also intends to expand European initiatives for scientific communication, training, and the processing of both scientific and technical information.

CNRS LABORATORIES EMPLOY OVER **35,600 PERMANENT RESEARCH SCIENTISTS AND PROFESSORS, AND 17,600 ENGINEERS, TECHNICIANS, AND ADMINISTRATIVE STAFF** THROUGHOUT FRANCE (BOTH CNRS EMPLOYEES AND NON-CNRS STAFF).

17,500 PH.D. STUDENTS ARE PREPARING THEIR DOCTORAL THESES IN OUR LABORATORIES. WE ALSO ACCOMMODATE OVER **2,000 POST-DOCTORAL RESEARCHERS.**

67% OF FRENCH PUBLICATIONS COME OUT OF OUR LABORATORIES.

CNRS IS AMONG THE **TOP 5 FOR PATENT APPLICATIONS** IN FRANCE.

RESOURCES: **€2.29 BILLION EX-VAT** INCLUDING **€1.965 BILLION** IN GOVERNMENT SUBSIDIES, OVER **€280 MILLION** FROM GOVERNMENT, INDUSTRIAL, AND EUROPEAN PARTNERS, AND NEARLY **€45 MILLION** FROM ROYALTIES ON PATENTS AND LICENSES.

RESEARCH ABROAD

- **10 CNRS LABORATORIES LOCATED ABROAD**
- **50 VIRTUAL LABORATORIES** IN PARTNERSHIP WITH THE WORLD'S TOP RESEARCH INSTITUTES
- **200 INTERNATIONAL RESEARCH PROGRAMS**
- CNRS COORDINATES **100 EUROPEAN UNION ACTIONS** (NETWORKS OF EXCELLENCE, INTEGRATED PROGRAMS, ETC.)
- **5,000 HIGH-LEVEL FOREIGN RESEARCH SCIENTISTS** ARE WORKING IN OUR LABORATORIES THANKS TO **85 COOPERATION AGREEMENTS WITH 55 COUNTRIES.**
- **CNRS HOSTS 1,500 EUROPEAN POST-DOCTORAL RESEARCHERS EACH YEAR.**
- **10 PERMANENT OFFICES ABROAD** (IN BONN, BRUSSELS, HANOI, JOHANNESBURG, MOSCOW, BEIJING, SANTIAGO (CHILE), TOKYO, TUNIS, AND WASHINGTON)

IN JUST TWO YEARS, CNRS HAS RISEN FROM 10TH TO 5TH IN THE LIST OF PATENT APPLICANTS IN FRANCE.

Developing new ways to treat cancer, screening tools to discover new therapeutic molecules, drugs, communication and information science and technology, acoustics (noise reduction in aircraft), storing energy in fuel cells… In 2002 CNRS applied for 252 patents, according to the 2003 statistics of the *Institut National de la Propriété Industrielle* (French Industrial Property Institute or INPI). That makes CNRS fifth out of the top 100 organizations making national patent applications, behind L'Oréal, Renault, Peugeot Citroën Automobiles SA and the *Commissariat à l'énergie atomique* (Atomic Energy Commission or CEA). In 2001, CNRS was only 10th on the list. The CNRS patent portfolio included 7,450 patents in 2004, mainly in life sciences and chemical sciences. Ninety percent of the 200 companies founded since 1999 are still in business.

2004, A YEAR OF **EXTENSIVE ENGAGEMENTS**

June 8, 2004 > For the passage of Venus in front of the Sun, CNRS opened its doors to the general public. A rare observation for a European and international educational project

May 26, 2005 > Signing an agreement between IBM, the *Association française contre les myopathies* (French Muscular Dystrophy Association or AFM), and CNRS

December 15, 2004 > François d'Aubert presents the CNRS gold medal to Alain Connes, mathematician, in the presence of Bernard Meunier (CNRS chairman, left) and Bernard Larrouturou (CNRS Director General, right).

February 2, 2004 > Inauguration of the Robots exhibition at CNRS headquarters.

March 3, 2004 > A scientific collaboration agreement for archaeology and seismic risk is concluded between CNRS and the Iranian Ministry of Science, Research and Technology (MSRT).

June 25, 2004 > Signing an agreement to create an International Joint Unit in micro- and nanosciences between CNRS, the Japanese Laboratory of Integrated Micro-Mechatronic Systems (LIMMS), and the Institute of Industrial Science (IIS) at the University of Tokyo.

November 26, 2004 > Open house for linguistics at CNRS.

July 8 and 9, 2004 > *Objectif 2010:* defining the priorities for integrating CNRS in the European research community.

September 2004 > In India, the creation of an institute of mathematics, the conclusion of an agreement on biotechnologies, and the creation of a climate research laboratory

March 16, 2004 > Renewal of the agreement between CNRS and the National Research Foundation of South Africa (NRF), for research on natural plant-based substances, biodiversity, and water.

A YEAR OF SCIENTIFIC CULTURE

SCHOOLCHILDREN, HIGH SCHOOL STUDENTS, AND UNIVERSITY STUDENTS FROM FRANCE AND EUROPE, WITH OR WITHOUT THEIR TEACHERS, BENEFIT FROM SEVERAL TYPES OF ASSISTANCE OR OPERATIONS FROM CNRS: CNRS YOUTH CLUBS, MEETINGS AND DEBATES, ASSISTANCE FOR SUPERVISED PERSONAL RESEARCH, ONLINE MULTIMEDIA FILES, EXHIBITIONS, SCIENCE FAIRS, ETC. **THE FOLLOWING PICTURES ARE FROM SOME OF THESE EXCHANGES THAT ARE AS ENRICHING FOR THE YOUNG PARTICIPANTS AS THEY ARE FOR THE SCIENTISTS LEADING THE SESSIONS.**

BRINGING SCIENCE AND CHILDREN TOGETHER

At-home help

— Discover scientific images, CNRS films, or submit your questions to scientists over the Internet.

http://www2.cnrs.fr/jeunes/

Sessions in elementary, middle, and high schools

— CNRS Youth Projects, Science classes, Direct Science programs, Nepal conferences…

http://www2.cnrs.fr/jeunes/

Encounters

— Exhibitions (solar oven in Odeillo, Biospace in Toulouse, Traveling Cancer Train), open house (Science Fairs throughout France both in research laboratories and public places), Careers in Science forum, scientific cafés throughout France, film festivals (Paris, Lyons, Deauville, Oullins, Chamonix, etc.) and the famous Annual CNRS Youth Meetings (Citizens & Science) in Poitiers in October, with workshops and debates attended by over 500 young adults from 18 to 25 and 200 research scientists.

http://www2.cnrs.fr/jeunes/

October 14-17, 2004 > Antarctic Exhibition at the *Cité des sciences* (the Paris science museum), where research scientists answer questions from all.

October 22-24, 2004 > 14th annual CNRS Youth Meeting (Citizens & Science) at the Futuroscope in Poitiers.

October 14-17, 2004 > Exhibition on biodiversity during the Science Fair at the French Senate.

ONLINE DOCUMENTS FOR THE GENERAL PUBLIC

Discover or rediscover

— The *Journal du CNRS*, a monthly publication providing news about CNRS laboratories as well as a full report on a major scientific theme.

http://www2.cnrs.fr/presse/journal/

— *Thema* media kits provide in-depth background material for the media on themes that have stirred the interest of the public and the press, such as the American elections.

http://www2.cnrs.fr/presse/thema/

— *Sagascience* multimedia presentations on major scientific questions for the general public: evolution, the climate, water, handicaps, art, etc.

http://www2.cnrs.fr/multimedia/

— *Science & Décision* reports provide information to analyze subjects with a major social impact. They are genuine decision support tools for issues such as energy, stem cells, and mad cow disease.

http://www2.cnrs.fr/multimedia/

BESIDES THE IMPORTANT SCIENTIFIC RESULTS ACHIEVED IN 2004, RESEARCH ACTIVITIES IN CNRS LABORATORIES HAVE RECEIVED NUMEROUS PRIZES AND AWARDS.

A FEW SCIENTIFIC PRIZES FROM 2004

Three winners of EURYI (European Young Investigators) awards, a program coordinated by the European Science Foundation, were presented by CNRS. Each winner will receive 1.25 million over 5 years to create their research group in France.
— **Mihail Dumitru Barboiu,** 35, Romanian, CNRS Junior Researcher at the *Institut européen des membranes* (European Membrane Institute) in Montpellier.
— **Raffaele Colombelli,** 33, Italian, CNRS Junior Researcher at the *Institut d'électronique fondamentale d'Orsay* (Fundamental Electronics Institute in Orsay).
— **Jakob Reichel,** 39, born in Germany, will carry out his project at the Kastler-Brossel Laboratory (CNRS - *École normale supérieure - Université Paris 6*) in Paris.

The G. Edward Pendray Award of the American Institute of Aeronautics and Astronautics was attributed to:
— **Sébastien Candel,** Professor at the *École Centrale* and at the *Institut Universitaire de France*, member of the CNRS *Laboratoire d'énergétique moléculaire et macroscopique, combustion* (EM2C) (Molecular and Macroscopic Energy, Combustion Laboratory). In May 2004 he also received the Aeroacoustics Award from the Confederation of European Aerospace Societies.

— **Patrick Couvreur** received the **Pharmaceutical World Congress Scientific Award** given every four years to the three Europeans, three Americans, and three Asians with the most remarkable achievements in the pharmaceutical and therapeutic sciences.

The Joliot-Curie Prize of the *Société française de physique* (French Physics Society) was awarded to
— **Sylvain David** (*Institut de physique nucléaire d'Orsay* (Nuclear Physics Institute, CNRS - *Université Paris 11*) for his exceptional contribution to research on nuclear waste management and new means for producing energy.

In Earth Sciences and Astronomy, the annual European Geosciences Union meeting awarded three dignitaries from CNRS laboratories for their work and responsibilities in international scientific bodies.
— **Gérard Mégie,** CNRS Chairman at the time, who chaired and co-chaired several international bodies, including the International Ozone Committee of the International Council of Scientific Unions.
— **Michel Blanc,** CNRS Senior Researcher, Director of the *Observatoire de Marseille* (Marseilles Observatory).
— **Olivier Boucher,** CNRS Junior Researcher at the *Laboratoire d'optique atmosphérique* (Atmospheric Optics Laboratory) in Lille.

The American Geophysical Union honored three other CNRS laboratory research scientists in Earth Sciences and Astronomy:
— **Jean-Paul Montagner,** Professor at the *Université Paris 7*, who chaired the International Federation of Broadband Seismological Networks
— **Jean-Pierre Valet,** CNRS Senior Researcher and Director of the *Laboratoire de magnétisme et géomagnétisme* (Magnetism and Geomagnetism Laboratory) of the IPGP (Paris Geophysical Institute).
— **Adolphe Nicolas,** professor emeritus at the *Université de Montpellier*, former Director of the *Laboratoire de Tectonophysique* (Tectonophysics Laboratory) (CNRS-*Université Montpellier 2*).

— **Raul Madariaga,** was awarded **the American Seismological Society's 2004 medal.**

COVER PAGES!

CNRS research is regularly featured on the cover of prestigious scientific journals.
— ***Astronomy & Astrophysics***
— ***Cell***
— ***Nature***

All these scientific awards are summarized in the 2004 Annual Report, available online at the CNRS Web site.
http://www2.cnrs.fr/sites/band/fichier/ca_ra2004.pdf

BREAKING NEW GROUND IN MATHEMATICS

ALAIN CONNES

INDOMITABLE EXPLORER

IT IS WIDELY AGREED THAT ALAIN CONNES IS ONE OF THE GREATEST LIVING MATHEMATICIANS. THE CNRS GOLD MEDAL FOR 2004 WAS RECENTLY AWARDED TO THIS RESEARCH SCIENTIST, THE MAN BEHIND SEVERAL IMPRESSIVE DISCOVERIES AND WHO HAS SOME VERY SUBVERSIVE IDEAS.

> MILESTONES

1947 BORN IN DRAGUIGNAN, FRANCE.
1970 JOINS CNRS (HE LEFT IN 1974 ONLY TO RETURN AS SENIOR RESEARCHER FROM 1981 TO 1984)
1977 CNRS SILVER MEDAL
1979 PROFESSOR AT THE INSTITUT DES HAUTES ÉTUDES SCIENTIFIQUES (ADVANCED SCIENTIFIC STUDY INSTITUTE)
1982 FIELDS MEDAL
1984 ENTERS THE COLLÈGE DE FRANCE
2001 CRAFOORD PRIZE
2004 CNRS GOLD MEDAL

«**Mathematics are as broad and as deep as the ocean",** wrote Victor Hugo. Most certainly, Alain Connes, mathematician and winner of the CNRS gold medal for 2004, is a little like one of those explorers who discovered the new world by overcoming their fears and taboos. "One must not be afraid to rebel," says the research scientist. "The only authority in mathematics is oneself." This advice comes from a man who has chartered unknown territory, a mathematical world that may well reconcile two separate universes of the physical sciences: general relativity and quantum mechanics. This "bridge", called noncommutative geometry, is the result of previous work for which he was awarded the Fields medal in 1982, the equivalent of the Nobel Prize for mathematics.

Yet this professor at the *Collège de France* quickly puts you at ease with any shortcomings you might have: "To innovate in mathematics, you have to be somewhat naive. Otherwise you can come up with some clever tricks on a technical level, but you rarely make any real discoveries!"

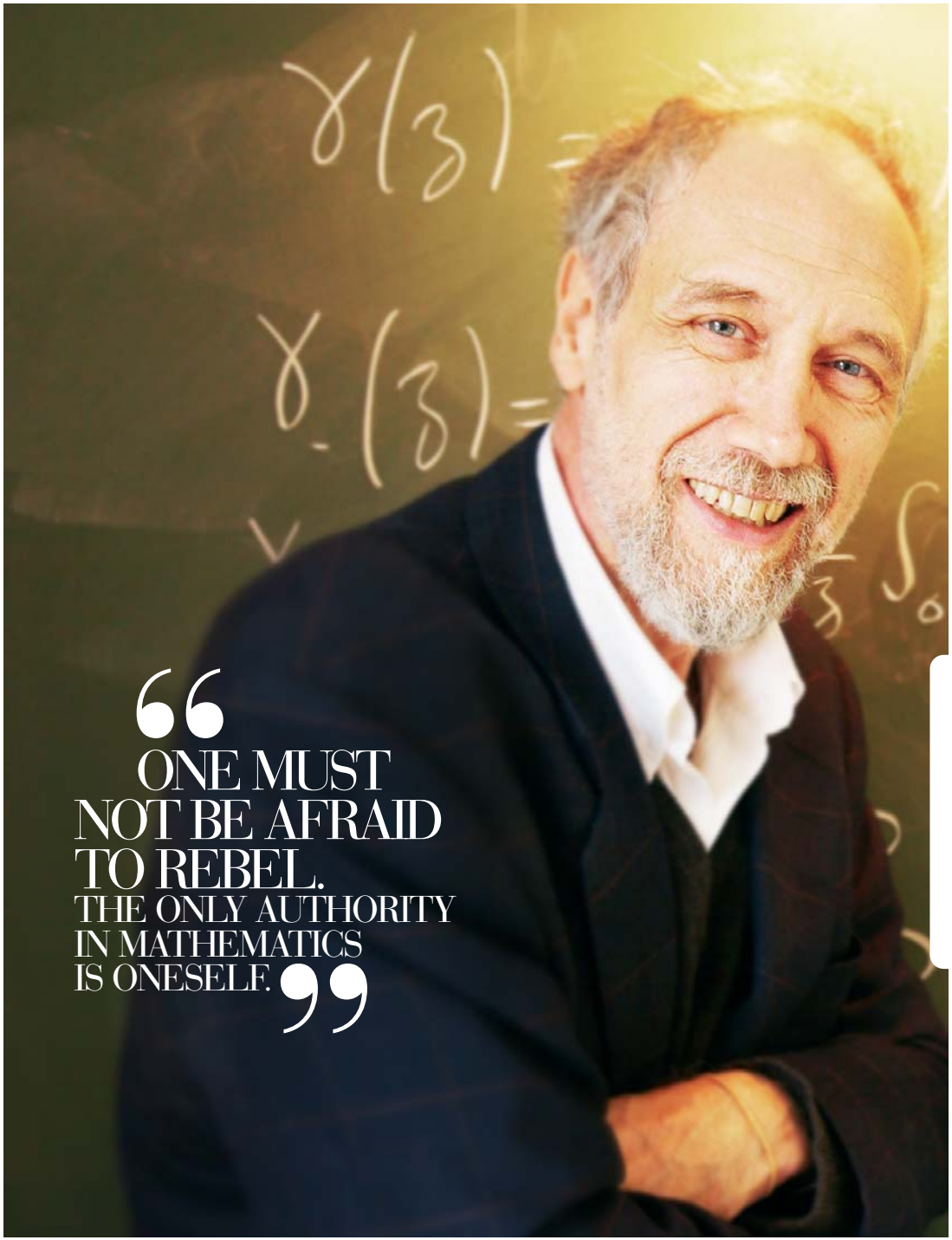
His brilliant studies led to the prestigious *École Normale Supérieure* in Paris. There, the winds of May 1968 blew him off course from a career as a professor in France's most prestigious universities, but did not prevent this rebel scholar from doing research. Nor from setting off to discover this mathematical reality which, in his opinion and as Plato suggested, "exists independently of human experience". He came up with the subject of his thesis while riding a train back from his first meeting with Professor Jacques Dixmier: "It was about the link between the research described during Dixmier's seminar and a fascinating book I had bought by chance on my way to a conference in Seattle, not knowing that in fact it was the central theme of the conference!". This coincidence would prove to be a lucky choice which soon led him to discover noncommutative geometry. His career took him from one continent to the next, from the *Université Paris 6* to Canada, from CNRS to the *Institut des hautes études scientifiques* (IHÉS) and finally to the *Collège de France*. In the end his work would cover several fields in mathematics, from analysis and algebra to algebraic topology via the analytical number theory… and mathematical physics.

Not satisfied with having created a new field of mathematics, the researcher wanted to free his discipline from the equation lovers' Tower of Babel. In 1987, at the *École polytechnique*, Alain Connes was the only permanent speaker at the "Mathematics of Tomorrow" colloquium, the conclusions of which remain an inspiration to CNRS policy: the field must open up to other sciences and to society. "Mathematics is the most sophisticated tool of thought we have at our disposal for 'understanding', and it is a great source of new concepts," says Alain Connes. This philosophy inspired him to write two essays. The first, co-authored with neurobiologist Jean-Pierre Changeux, is an analysis of mathematical objects and their ties to the human brain. The second is a subtle discussion of the major discoveries of the twentieth century with two eminent mathematicians, André Lichnerowicz and Marcel Paul Schützenberger.

The worthy successor to French mathematician Henri Poincaré (1854-1912), the 2004 gold medal-winner returned physics to its role as a muse for mathematics. And like any good mathematician, Alain Connes remembers reciprocals: "There are other paths besides the doctrine that currently dominates theoretical physics, i.e. string theory. Noncommutative geometry offers some interesting leads. On that score, our research scientist is irreproachable: his geometry has twice played a key role in string theory…

1. *Matière à penser*, with Jean-Pierre Changeux, Éditions Odile Jacob, 1989.
2. *Triangle de pensée*, with André Lichnerowicz and Marcel Paul Schützenberger, Éditions Odile Jacob, 2000.

FOR MORE INFORMATION ON THE GOLD MEDAL: JOURNAL DU CNRS DECEMBER 2004
ON THE 2004 SILVER, BRONZE, AND CRYSTAL MEDAL RECIPIENTS: CNRS WEB SITE
FOR ALL THE SCIENTIFIC PRIZES RECEIVED BY SCIENTISTS WORKING IN CNRS RESEARCH CENTERS: 2004 ANNUAL REPORT
http://www2.cnrs.fr/sites/band/fichier/ca_ra2004.pdf



KEY ACTIVITIES 2004

An important moment in a research scientist's life: publishing an article in a specialized scientific journal. On the international research scene, one way to measure a country's importance is by the number and quality of its publications, and how often they are cited by other researchers. How do CNRS laboratories and their partners fare in this competition by numbers?

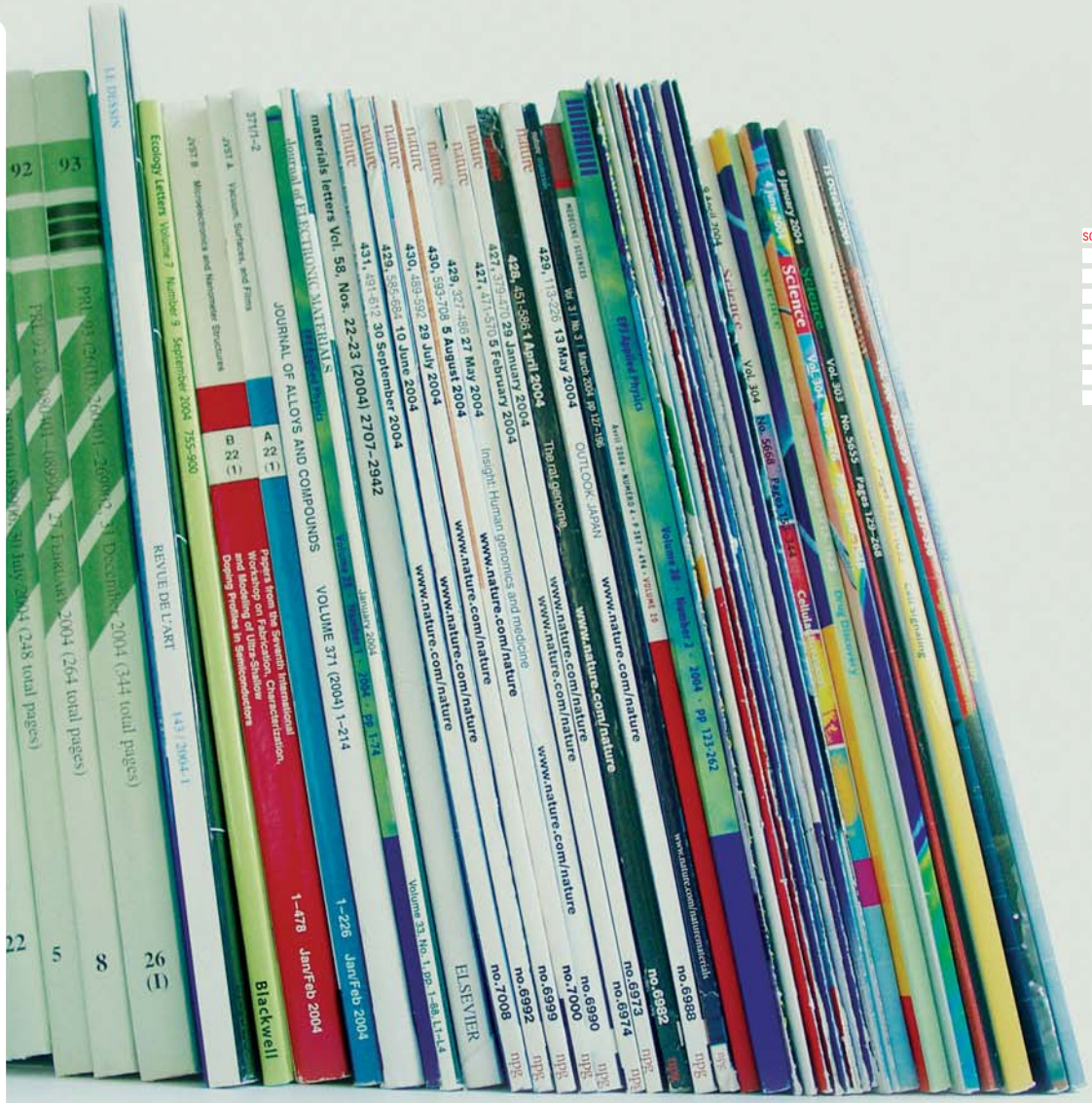
In materials and life sciences, excluding medical research, CNRS researchers co-author two-thirds of French publications. Articles from our laboratories represent the great majority of citations* for French publications: 82% in physics and Earth Sciences and Astronomy, 84% in chemistry.

International collaborative projects are increasingly important: half of the publications in 2001-2002 included at least one foreign partner laboratory, versus one third in 1991-1992. But the most important international opening concerns nuclear and particle physics, Earth Sciences and Astronomy, and the physical sciences and mathematics. The relative weight of the United States is decreasing in favor of the European Union.

Among publications from CNRS laboratories written in collaboration with French partners, between 4% and 22% (according to the scientific field) were written with a partner from the private sector in 2001-2002.

The following pages catalog a series of publications and significant events, technological innovations, and major new partnerships.

*Results are published annually and can be viewed at the CNRS Web site: www.cnrs.fr/DEP. These kinds of results are not yet available in human and social sciences.



SOURCE
NATURE /
SCIENCE /
CELL /
INTERNATIONAL JOURNAL OF ASTROBIOLOGY /
NATURE NEUROSCIENCE /
NEUROIMAGE /
PHYSICAL REVIEW LETTERS /
ASTRONOMY & ASTROPHYSICS /

FOR FURTHER INFORMATION, SEE THE FULL TEXT OF PRESS RELEASES, ARTICLES FROM THE JOURNAL DU CNRS, AND THE CNRS 2004 ANNUAL REPORT AT OUR WEB SITE: www.cnrs.fr.

> Studying the fruit fly to understand the mechanisms of memory and certain human neurodegenerative diseases in man.
SOURCE *NATURE* / PRESS RELEASE
DATE JULY 22, 2004

> A crystalline structure sheds light on the dynamics of an intracellular skeleton.
SOURCE *NATURE* / PRESS RELEASE
DATE MARCH 11, 2004

> A universal scheme of plant operations based on resource management by leaves.
SOURCE *NATURE* / PRESS RELEASE
DATE APRIL 22, 2004

> Animal spies: a cultural or a biological evolution?
SOURCE *SCIENCE*
DATE JULY 23
SOURCE PRESS RELEASE
DATE JULY 26, 2004

> The European **MitoCheck** program combines the efforts of teams from five different countries working to identify all the proteins involved in controlling the cell cycle, a fundamental life process which can cause cancer (among other things) when disturbed
SOURCE PRESS RELEASE
DATE JULY 20, 2004

> The impressive cognitive capabilities of bees.
SOURCE *NATURE* / PRESS RELEASE
DATE JUNE 17, 2004

CNRS expands its operations in Guiana
to encourage close collaboration with local universities. A new CNRS interdisciplinary program called *Amazonie* is overseeing this research. A team of chemists arrived in 2004 to share their know-how in extracting, purifying, and distinguishing molecules collected from the Amazonian terrestrial and marine environments, as well as in the chemical synthesis of derivative organic molecules.

> Both morning and evening biological clocks in flies are controlled by two distinct groups of neurons.
SOURCE *NATURE* / PRESS RELEASE
DATE OCTOBER 14, 2004

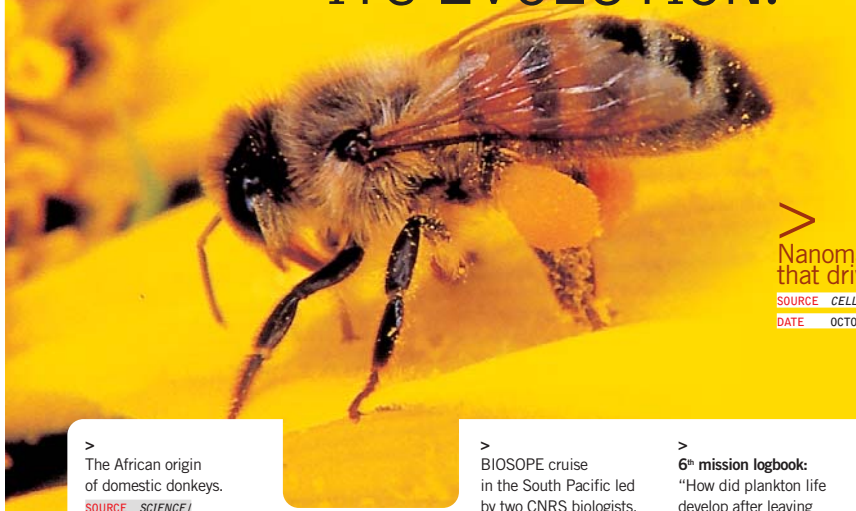
EXPLORING THE LIVING WORLD,

> Myosin-II, a protein that works like a cellular engine for sculpting organs.
SOURCE *NATURE*
DATE JUNE 10
SOURCE PRESS RELEASE
DATE JUNE 11, 2004

FROM MOLECULES TO ECOSYSTEMS: AN INTERDISCIPLINARY APPROACH TO THE LIVING WORLD. THE MECHANISMS ASSOCIATED WITH LIFE NEED TO BE STUDIED ON BOTH A LARGE SCALE AND AT THE LOWEST LEVEL. COOPERATION BETWEEN ALL THE DISCIPLINES OF LIFE SCIENCE AND INTERACTIONS WITH OTHER SCIENTIFIC FIELDS ARE MORE IMPORTANT THAN EVER. DUE TO THE DIVERSITY OF ITS AREAS OF RESEARCH, CNRS IS ESPECIALLY WELL SUITED TO MEET THIS CHALLENGE.

> Identifying the meeting points of **leatherback turtles** and fisheries.
SOURCE *NATURE* / PRESS RELEASE
DATE JUNE 3, 2004

PREDICTING ITS EVOLUTION.



> Nanomachines that drive cells.
SOURCE *CELL* / PRESS RELEASE
DATE OCTOBER 29, 2004

> The African origin of domestic donkeys.
SOURCE *SCIENCE* / PRESS RELEASE
DATE JUNE 18, 2004

> CNRS research scientists working with Russian scientists have identified DNA traces of hot spring bacteria in the ice sheet that has imprisoned Lake Vostok, the largest underground lake in the Antarctic.
SOURCE *INTERNATIONAL JOURNAL OF ASTROBIOLOGY*
DATE AUGUST 5
SOURCE PRESS RELEASE
DATE SEPTEMBER 15, 2004

> BIOSOPE cruise in the South Pacific led by two CNRS biologists.
SOURCE PRESS RELEASE
DATE OCTOBER 13, 2004

> **6th mission logbook:** "How did plankton life develop after leaving the ocean-desert?"
www.cnrs.fr
SOURCE PRESS RELEASE
DATE DECEMBER 7, 2004

> **7th mission logbook:** the exuberance of marine life in the chilly waters of Chile.
www.cnrs.fr
SOURCE PRESS RELEASE
DATE DECEMBER 14, 2004

> Analyzing the genome sequence of the **Mimivirus** (a giant DNA virus) changes our view of the evolution of life.

SOURCE *SCIENCE* ONLINE
DATE OCTOBER 14
SOURCE PRESS RELEASE
DATE OCTOBER 15, 2004

DISCOVERING THE SECRETS OF GENOMES

HOW ARE GENOMES ORGANIZED? WHAT IS THE PURPOSE OF ENTIRE REGIONS OF DNA? HOW DO GENES INTERACT WITH AND OTHER LIFE FORM COMPONENTS? WHAT IS THE EXACT FUNCTION OF EACH OF THE THOUSANDS OF PROTEINS? **COMPLEX QUESTIONS WITH VERY HIGH STAKES.**

> Thanks to the genome sequencing of ***Tetraodon nigroviridis*** (the green spotted pufferfish), an international consortium coordinated by Jean Weissenbach's group (CNRS Genoscope) reveals the structure of the genome that is a common ancestor to both man and fish.

SOURCE *NATURE* / PRESS RELEASE
DATE OCTOBER 21, 2004

> A French-American team discovers that "junk" DNA-sequences with no apparent use-is in fact involved in regulating the expression of genes.

SOURCE *NATURE* / PRESS RELEASE
DATE JULY 22, 2004

> Adaptive capabilities of tiger snakes: acquired knowledge may also be genetically determined.

SOURCE *NATURE* / PRESS RELEASE
DATE SEPTEMBER 16, 2004

> Over 20,000 human genes described by an international consortium involving CNRS research scientists.

SOURCE PUBLIC LIBRARY OF SCIENCE BIOLOGY
DATE JUNE
SOURCE PRESS RELEASE
DATE APRIL 21, 2004

> Deciphering the secrets of evolution: the example of yeasts. The "evolutionary distance" covered by the four yeasts studied is as vast as that which exists between marine invertebrates and man, including fish...

SOURCE *NATURE* / PRESS RELEASE
DATE JULY 1, 2004

> Human genome: a new mutagenic phenomenon is revealed.

SOURCE *PUBLIC LIBRARY OF SCIENCES*
DATE SEPTEMBER 7
SOURCE PRESS RELEASE
DATE SEPTEMBER 9, 2004

> Genomic imprinting: why and how do some of our genes "shut up"?

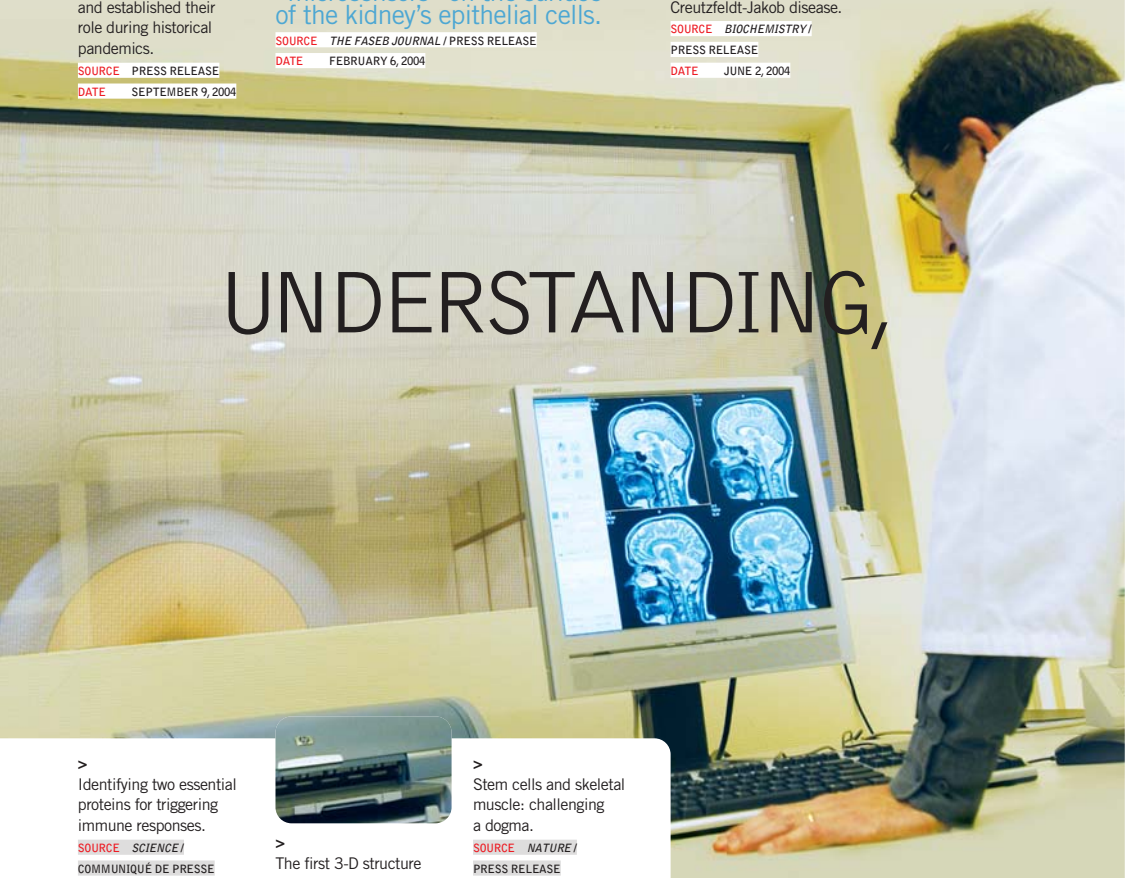
SOURCE *NATURE GENETICS ONLINE*
DATE OCTOBER 31
SOURCE PRESS RELEASE
DATE NOVEMBER 10, 2004

> Identifying two legume genes which control symbioses of interest to agronomists.

SOURCE *SCIENCE*
DATE FEBRUARY 12
SOURCE PRESS RELEASE
DATE FEBRUARY 13, 2004

UNDERSTANDING, PREVENTING

MEDICINE AWAITING RESULTS: EXPLORING NEW PATHS REQUIRES THE ALLIANCE OF SEVERAL DISCIPLINES.



> The black plague, the bubonic plague, the pneumonic plague… an interdisciplinary study has tracked the plague over the centuries, differentiated these three "varieties" and established their role during historical pandemics.
SOURCE PRESS RELEASE
DATE SEPTEMBER 9, 2004

> **Renal polycustosis, a genetic disease affecting 60,000 to 80,000 people in France, could be due to the failure of natural pressure "microsensors" on the surface of the kidney's epithelial cells.**
SOURCE *THE FASEB JOURNAL* / PRESS RELEASE
DATE FEBRUARY 6, 2004

> High pressure, a new experimental method for deciphering the enigma of prion proteins: a preliminary step to any therapeutic development for neurodegenerative pathologies such as Creutzfeldt-Jakob disease.
SOURCE *BIOCHEMISTRY* / PRESS RELEASE
DATE JUNE 2, 2004

> A new step towards the use of neuronal stem cells to repair the brain.
SOURCE *NATURE NEUROSCIENCE* / PRESS RELEASE
DATE MARCH 16, 2004

> Molecules for guiding nerve fibers: molecules that can do (almost) anything for neurons.
SOURCE *NATURE* / *CELL* / *BIOLOGY* / *NEURON* / PRESS RELEASE
DATE AUGUST 6, 2004

> At the *Institut Curie*, research scientists from CNRS and INSERM shed new light on the role of huntingtin, the protein whose mutation is the cause of Huntington's disease.
SOURCE *CELL* / PRESS RELEASE
DATE JULY 9, 2004

Obesity, a growing epidemic… How should we react? What are the important questions to ask? Sociologists, anthropologists, biologists, geneticists, and clinical researchers are analyzing the behavioral and biological processes that lead to obesity, and providing a few leads for trying to fight back.
SOURCE REPORT IN THE *JOURNAL DU CNRS*
DATE OCTOBER 2004

> The foreman of the Golgi complex, at the cell's center, has been discovered!
SOURCE *CELL* / PRESS RELEASE
DATE AUGUST 6, 2004

> Identifying two essential proteins for triggering immune responses.
SOURCE *SCIENCE* / COMMUNIQUÉ DE PRESSE
DATE AUGUST 20, 2004

> The first 3-D structure for a replicative protein of the severe acute respiratory syndrome (SARS) virus, a newcomer to the coronavirus family. It is a recent example of an emerging human pathogenic virus.
SOURCE *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES* (UNITED STATES)
DATE MARCH 16, 2004
SOURCE PRESS RELEASE
DATE MARCH 11, 2004

> Stem cells and skeletal muscle: challenging a dogma.
SOURCE *NATURE* / PRESS RELEASE
DATE SEPTEMBER 23, 2004

> Flies as models for studying the neurotoxic effects of glutamate in man.
SOURCE *CURRENT BIOLOGY* / PRESS RELEASE
DATE APRIL 6, 2004

> Towards a new view of heredity: launching a European Epigenome Network of Excellence comprising 25 laboratories in six European countries, including two French groups (CNRS - *Institut Curie* and CNRS - *Institut Pasteur*).
SOURCE PRESS RELEASE
DATE SEPTEMBER 6, 2004

> The molecular mechanism for protecting against certain neurological diseases through polyunsaturated fatty acids, which include omega-3.
SOURCE *THE EMBO JOURNAL* / PRESS RELEASE
DATE JUNE 3, 2004

> **The fruit fly,** a model for understanding the evolution of the immune system in vertebrates.
SOURCE *PLOS BIOLOGY* / PRESS RELEASE
DATE AUGUST 18, 2004

> Detailed dissection of molecular protein production factories: this fundamental work is offering major therapeutic prospects, especially for developing new classes of antibiotics.
SOURCE *NATURE* / PRESS RELEASE
DATE FEBRUARY 26, 2004

> Stem cells for repairing the liver: progress with animals.
SOURCE *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES* (UNITED STATES)
DATE JUNE 1st, 2004
SOURCE PRESS RELEASE
DATE MAY 25, 2004

DIAGNOSING,

ULTRA-FAST DETECTION OF LEGIONNAIRES' DISEASE

Research scientists at the Banyuls *Observatoire Océanologique et Laboratoire d'Océanographie Biologique* (Oceanological Observatory and Biological Oceanological Laboratory) (CNRS - *Université de Paris 6*), in collaboration with INSERM and the EDF Research and Development department, have developed a new method for detecting Legionnaires' Disease in under four hours, without requiring a bacterial culture. The *Legionella pneumophilaqui* bacteria proliferates quickly, especially in hot water installations, towers cooled with hot aerosol waste, air conditioners, and hot water systems in hospitals. Until now it took three to ten days to detect this bacteria.

When testing water for bacteria using this method, the bacteria are first concentrated in a filtering membrane, and then made fluorescent using a specific antibody combined with a fluorescent dye. Solid-phase cytometry, based on the sensitive and fast (a few minutes) detection of microorganisms which have been made fluorescent, scans the membrane surface and quickly detects and counts the number of Legionnaires' Disease bacteria. This method, which was validated on clean water in various hospitals in and around Lyon in partnership with CNRS, allows researchers to quantify Legionnaires' Disease bacteria in less than four hours. It does not determine whether the detected bacteria are dead or alive, however. Therefore a new research program has been launched to develop specific markers in order to differentiate dead bacteria from live ones.

SOURCE *APPLIED ENVIRONMENTAL MICROBIOLOGY*
DATE MARCH 2004
SOURCE PRESS RELEASE
DATE APRIL 2, 2004

> AIDS: new prospects for developing a vaccine.
SOURCE *IMMUNITY*
DATE NOVEMBER 16
SOURCE PRESS RELEASE
DATE NOVEMBER 17, 2004

> Parkinson's disease is linked to a deficit of dopamine, a neurotransmitter that acts on movement control.
SOURCE *NATURE NEUROSCIENCE*
DATE JULY
SOURCE PRESS RELEASE
DATE JUNE 16, 2004

> A new therapeutic path for pigmentary retinopathy
SOURCE *NATURE GENETICS*
DATE JULY 2004
SOURCE PRESS RELEASE
DATE JUNE 28, 2004

> Tricks used by dendritic cells to inform the immune system of infection by the AIDS virus.
SOURCE *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES* (UNITED STATES)
DATE APRIL 12, 2004
SOURCE PRESS RELEASE
DATE APRIL 20, 2004

> Legionnaires' Disease: sequencing the genome of the *Paris* and *Lens* strains.
SOURCE *NATURE GENETICS*
DATE NOVEMBER
SOURCE PRESS RELEASE
DATE OCTOBER 4, 2004

INTEGRAGEN : This company, founded in 2000 by research scientists from CNRS, INSERM, and the *Centre National de Génotypage* (National Genotyping Institute)-among others- is trying to provide a faster, less expensive solution for an even earlier genetic diagnosis of diabetic or autistic patients.
SOURCE *JOURNAL DU CNRS*
DATE OCTOBER 2004

> A new potential target for inducing insulin synthesis and treating diabetes.
SOURCE *JOURNAL OF CLINICAL INVESTIGATION*
DATE MAY 2004
SOURCE PRESS RELEASE
DATE MAY 4, 2004

A CHEMICAL FORMULA FOR RETINA REATTACHMENT OPERATIONS

A severely detached retina can lead to blindness, and the retina must be flattened against the eye wall before taking the steps to reattach it. This can be achieved by an internal tamponage using a substitute for the vitreous body. This substitute, which is heavier than water, must also be transparent, have high density, and be innocuous. Thus a fluorocarbon-fluorodecalin-was developed by Isabelle Rico Lattes and her team at the *Laboratoire interactions moléculaires et réactivité chimique et photochimique* (Laboratory for Molecular Interactions and Chemical and Photochemical Reactivity, or IMRCP). This product, marketed in 1990 by the Chauvin-Opsia company in Toulouse under the DK-Line brand, was used during surgical operations for reattaching the retina. As the product was toxic in the long term, it could not be used beyond the intraoperative period.

In order to overcome the toxicity problems and encourage healing by keeping the liquid in the eye for several weeks, the IMRCP laboratory developed Oxane HD, an original chemical formula which has received several patents. The American firm Bausch and Lomb, the world's largest consortium in vitreoretinal surgery and of which Chauvin-Opsia is now a subsidiary, has marketed the product since 2003. Some 15,000 retina reattachment cases have already been treated worldwide during the twelve months the product has been on the market (6,000 in Europe including 700 in France).

> Fatty tissue: a new source for cellular therapy.
SOURCE *CIRCULATION RESEARCH* / PRESS RELEASE
DATE FEBRUARY 6, 2004

HEALING

HELPING IMPROVE THE DIAGNOSIS, TREATMENT,
OR PREPARATION OF VACCINES, DEVELOPING A NEW APPROACH...
CUTTING-EDGE RESEARCH IS VITAL TO HEALTH.

> New hope for treating obsessive-compulsive disorder (OCD).
SOURCE *JOURNAL OF NEUROSURGERY* OCTOBER
SOURCE PRESS RELEASE
DATE OCTOBER 26, 2004

ELECTRONIC DNA DETECTION USING TRANSISTOR NETWORKS

A team of physicists from the *Laboratoire Pierre Aigrain* (*École Normale Supérieure* - CNRS - *Universités Paris 6* and *7*) recently demonstrated that it was possible to detect DNA using electronics only via silicon transistor networks. This detection method uses the intrinsic charge of the biological molecule and therefore does not require any marking, such as radioactive tracers. Researchers were able to run a detection test on one of the most frequent pathogenic mutations in the human genome: hereditary deafness in children.

SOURCE *APPLIED PHYSICS LETTERS*
DATE MARCH 1, 2004
SOURCE PRESS RELEASE
DATE MARCH 4, 2004

> Significant progress in understanding the molecular mechanism of the Coffin-Lowry syndrome, a rare genetic disease characterized by mental retardation and skeletal deformation.
SOURCE *CELL* / PRESS RELEASE
DATE APRIL 30, 2004

> New resources for fighting tuberculosis.
SOURCE *CELL* / PRESS RELEASE
DATE OCTOBER 22, 2004

>
Can we do arithmetic if we don't have words to designate numbers? This is what we learn from the Mundurucus Indians…

SOURCE *SCIENCE* / PRESS RELEASE
DATE DATE 15 OCTOBER 2004

>
The brain's motor areas work via anticipation: the human brain prefers to predict rather than react to movements by others.

SOURCE *NATURE NEUROSCIENCE* / PRESS RELEASE
DATE NOVEMBER 25

MATHEMATICS: Men and women are equal. A study clearly demonstrates that the fear of confirming the negative stereotype whereby women are less capable than men in mathematics… is enough to diminish their performance!

SOURCE *JOURNAL DU CNRS*, REPORT: HOW DO WE LEARN?
DATE JULY-AUGUST 2004

>
The estimation of time -essential to life-as seen from the cerebral cortex

SOURCE *SCIENCE*
DATE MARCH 5
SOURCE PRESS RELEASE
DATE MARCH 8, 2004

HUMANS: HOW THEY WORK

PEOPLE, THEIR EMOTIONS, THEIR BEHAVIOR… AND THEIR BRAINS: INTEGRATIVE NEUROBIOLOGY, THE STUDY OF COGNITIVE FUNCTIONS, BEHAVIORAL SCIENCES, THE NEURONAL BASES OF MENTAL PROCESSES. SEVERAL DISCIPLINES ARE CURRENTLY WORKING TOGETHER TO SOLVE THE MYSTERIES OF THE BRAIN, USING NONINVASIVE CEREBRAL IMAGING TECHNIQUES, ANALYZING COMPLEX COGNITIVE MALFUNCTIONS IN PATHOLOGIES, OR DURING NORMAL OR PATHOLOGICAL CEREBRAL AGING…

17 / 05 / 04
First scientific meetings of the national cognitive and neurocognitive studies network for autism: multidisciplinary scientific research is required to understand and treat the most serious developmental psychopathlogies.

SOURCE PRESS RELEASE
DATE MAY 14, 2004

02 / 07 / 04
Meeting with the scientific press on the theme "How do we learn?"
www.cnrs.fr
SEE THE ONLINE MEDIA KIT

26 / 11 / 04
The media, students, and companies meet with CNRS linguistics experts: conferences, debates and exhibitions presented by 40 laboratories.

>
The brain remembers our faults and our qualities differently.

SOURCE *NEUROIMAGE* / PRESS RELEASE
DATE JULY 8, 2004

>
Where do memories hide in the brain?

SOURCE *SCIENCE* / PRESS RELEASE
DATE JULY 2, 2004

HOW THE FEELING OF REGRET INFLUENCES OUR DECISIONS.

Regret is a key factor in decision-making. Angela Sirigu, neurobiologist at the *Institut des Sciences Cognitives* (Cognitive Sciences Institute) in Lyons (CNRS - *Université Lyon 1*), working with economist G. Goricelli, tested the capacity for feeling regret in situations where subjects choose between two games of chance with a financial reward.

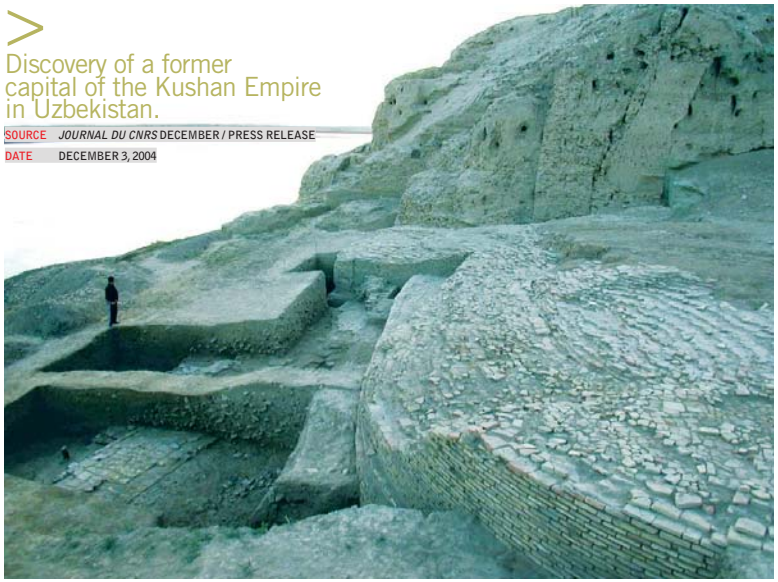
The key finding of this work is not the subjects' simple emotional reaction at winning or losing (joy/disappointment), but how the subjects feel when they compare what they have obtained with what they could have obtained had they made a different choice. It is this so-called "counter-factual" comparison that causes regret. Thus it appears that regret is an emotion resulting from a cognitive treatment of the situation. Neuropsychological analysis of patients with lesions of the ventromedial prefrontal cortex (part of the orbitofrontal region) shows that those patients did not experience this feeling of regret when faced with the consequences inherent in a choice.

These results also modify the traditional economic theory that considers the decision-maker as a rational individual who makes choices based on the calculation of probabilities.

SOURCE *SCIENCE*
DATE MAY 21
SOURCE PRESS RELEASE
DATE MAY 24, 2004

THE HISTORY OF MAN: STORIES OF MEN

SEARCHING, OBSERVING, **DESCRIBING,** INTERPRETING, **EXPLAINING MAN AND HIS HISTORY...**
A FASCINATING EXPLORATION THROUGH THE TORRENTS OF TIME.



> Discovery of a former capital of the Kushan Empire in Uzbekistan.

SOURCE *JOURNAL DU CNRS* DECEMBER / PRESS RELEASE
DATE DECEMBER 3, 2004

> The mummified sacred lion at the tomb of Maïa, the royal wet nurse of the pharaoh Tutankhamun, is revealed in Saqqara.

SOURCE NATURE / PRESS RELEASE
DATE JANUARY 15, 2004

A TAMED CAT IN CYPRUS... MORE THAN 7,000 YEARS BC

It was previously thought that the first domesticated cats appeared in Egypt during the second millennium BC. But the excavation at the Cypriot site of Shillourokambos recently revealed a sepulture dating between 7,500 and 7,000 years BC which associated man and cat. This discovery suggests that cats were tamed much earlier than previously assumed, when man first began to settle and farm; it also implies that domesticated cats originated in the Orient rather than in Egypt.

SOURCE *SCIENCE* / PRESS RELEASE
DATE APRIL 9, 2004

> What causes a book to become a bestseller? Analyzing literary success through statistical physics.

SOURCE *PHYSICAL REVIEW LETTERS*
DATE NOVEMBER 19, 2004
SOURCE PRESS RELEASE
DATE NOVEMBER 23, 2004

> Cerebral growth in *Homo erectus*: closer to chimpanzees than to modern man.

SOURCE *NATURE* / PRESS RELEASE
DATE SEPTEMBER 16, 2004

> **75,000 YEAR-OLD JEWELS!** CNRS prehistorians and South African research scientists have analyzed 41 small shells used as jewelry dating back 75,000 years, proving that jewels were invented much earlier than was previously believed. This discovery has major ramifications for studies of the origin of symbolic thinking and language.

SOURCE *SCIENCE* / PRESS RELEASE
DATE APRIL 16, 2004

> Pottery and bones complete the final excavations of the funeral mound at Prissé-la-Charrière.

SOURCE *JOURNAL DU CNRS* SEPTEMBER / PRESS RELEASE
DATE SEPTEMBER 17, 2004

MATHEMATICS IN ANCIENT CHINA

Karine Chemla, in collaboration with Guo Shunchun (Chinese Academy of Sciences) has published *Les Neuf Chapitres* (Éditions Dunod). Classical mathematics in ancient China and its commentaries represent a genuine scientific event.

Les Neuf Chapitres, a work about mathematical procedures, presents 250 problems written during the first century of our era. They have long been considered a true classic, so much so that mathematical activity in China often consisted of comments on that work.

Les Neuf Chapitres is the first known text to present the three fundamental operations for writing algorithms: iterations, conditionals, and the assignment of variables. The commentaries attempt to demonstrate that the algorithms are correct and express a desire to generalize the mathematical problems raised, such as performing fractional arithmetic or extracting square or cube roots. This work contradicts the preconceived notion whereby the ancient Greek texts are the sole historical source of mathematical demonstration.

SOURCE PRESS RELEASE
DATE SEPTEMBER 23, 2004

> **Artémis:** a new accelerator for carbon-14 dating was inaugurated on April 8, 2004 at the Atomic Energy Commission (CEA) Center in Saclay, France by CNRS, CEA, the Ministry of Culture and Communication, the *Institut de Radioprotection et de Sûreté Nucléaire* (Radioprotection and Safety Institute, or IRSN), and the *Institut de Recherche pour le Développement* (Development Research Institute, or IRD). Applications for this accelerator are found in fields such as archaeology, museography, environmental and climate studies.

SOURCE PRESS RELEASE
DATE APRIL 8, 2004

> Traditional societies: mythical ancestor or biological ancestor? Shedding light with an ethno-genetic approach.

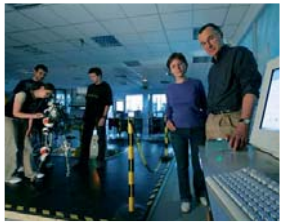
SOURCE *AMERICAN JOURNAL OF HUMAN GENETICS* / PRESS RELEASE
DATE NOVEMBER 5, 2004

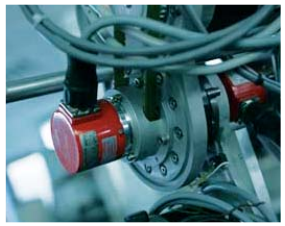
> What we learn from Neanderthal man's teeth...

SOURCE *NATURE* / PRESS RELEASE
DATE APRIL 29, 2004

INTELLIGENT SYSTEMS TO ASSIST HUMANS

COMPUTERS... INFORMATION SYSTEMS... VIRTUAL REALITY... ROBOTICS... SIGNAL, SPEECH, AND IMAGE PROCESSING... COMMUNICATION NETWORKS... CONTENT AND USAGE... TO ASSIST HUMANS.





RABBIT ROBOT: HE USED TO JUST WALK BUT NOW HE CAN RUN!

This robot was developed as part of the national Robea project associating seven French laboratories and two universities*. The goals: to develop methods and theoretical tools for enabling a two-legged robot to both walk and run, and to validate them through experiments.

Rabbit moves on a plane and only has four motors (hips and knees): he has no feet, so his ankles are not motorized. Rabbit took his first steps in 2002. In September 2004, he tried running and the first results (a few strides) were very encouraging. The strategy used for running is an extension of the work developed for walking. Movements during the phase with both feet off the ground prepare for the next phase, where one foot touches down.

http://robot-rabbit.lag.ensieg.inpg.fr/

SOURCE VIDEOS AND ADDITIONAL INFORMATION ARE AVAILABLE ON THE SITE OF THE RABBIT PROJECT.

* *Institut de Recherche en Communications et Cybernétique de Nantes* (Nantes Institute of Communications and Cybernetic Research); *Laboratoire d'Automatique* (Automatics Laboratory) in Grenoble; *Laboratoire d'Informatique, de Robotique et de Microélectronique* (Computing, Robotics, and Microelectronics Laboratory) in Montpellier; *Laboratoire de Mécanique des Solides* (Solid Mechanics Laboratory); *Laboratoire de Robotique* (Robotics Laboratory) in Versailles; *Laboratoire des Signaux et Systèmes* (Signal and Systems Laboratory); *Laboratoire de Vision et Robotique* (Vision and Robotics and Laboratory); University of Michigan, Ohio State University.

> New technologies serving education: the launch of *Kaleidoscope*, a European network of excellence coordinated by CNRS and involving research scientists, industrialists, and users in 23 countries.
SOURCE PRESS RELEASE
DATE MARCH 4, 2004

TOO MUCH SECRECY?

The verification of cryptographic protocols is vital as they are used in a wide range of applications such as secure payment over the Internet or cellular telephony. These protocols can be broken by an intruder capable of intercepting messages. But they are very difficult to verify: for example, Gavin Lowe discovered an error in the Needham-Schroeder protocol 18 years after it was published…

Véronique Cortier of the *Laboratoire Spécification et Vérification* (Specification and Verification Laboratory, CNRS - ENS Cachan) introduced a new protocol model and developed a program proving that the protocol being studied keeps the requested secrets. This program found the error, detected manually, in the Needham-Schroeder protocol and enabled the verification of the secrecy of several other cryptographic protocols.

> Journalists, CNRS research scientists and... robots met on January 23, 2004 for a "Robotics Special".
SOURCE PRESS RELEASE
DATE FEBRUARY 10, 2004

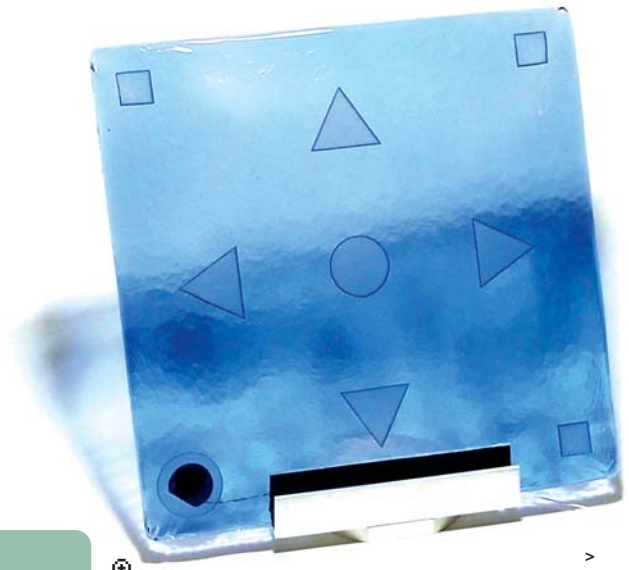
> CNRS multiplies the computing capabilities of European research by acquiring a new IBM Power4+ supercomputer.
SOURCE PRESS RELEASE
DATE FEBRUARY 19, 2004

> Inauguration in Evry on May 6 and press demonstration of EVR@, the first virtual reality platform, and of @ugmentée in France, financed by the Ministry of Education and Research, CNRS, and the Essonne General Council.
SOURCE PRESS RELEASE
DATE MAY 3, 2004

> Electronic version of the *Académie Française* dictionary, developed in collaboration with the *Laboratoire Atilf* (*Analyse et Traitement Informatique de la Langue Française* - Computer Analysis and Processing of the French Language, CNRS - *Université Nancy 2*).
SOURCE PRESS RELEASE
DATE JUNE 24, 2004

> Inspired by the flight control mechanisms of flies, research scientists* have shown that an airborne creature can navigate alone without measuring either its altitude or its ground speed. Octave, the miniature (100 g) airborne robot, managed to fly over a hilly terrain at 3 meters/second, and even to take off and land automatically, while having sensible reactions to contrary and favorable winds. The basis of this surprising performance is an automatic pilot inspired by a fly's eye. Installed on a drone or aircraft, this automatic pilot does away with the need for multiple traditional sensors which are both heavy and expensive; the robot can also operate in the infrared or millimetric spectrum, for flying on automatic pilot with zero visibility.

*Biorobotics team of Nicolas Franceschini, *Laboratoire Mouvement et Perception* (Movement and Perception Laboratory, CNRS - *Université de la Méditerranée*)



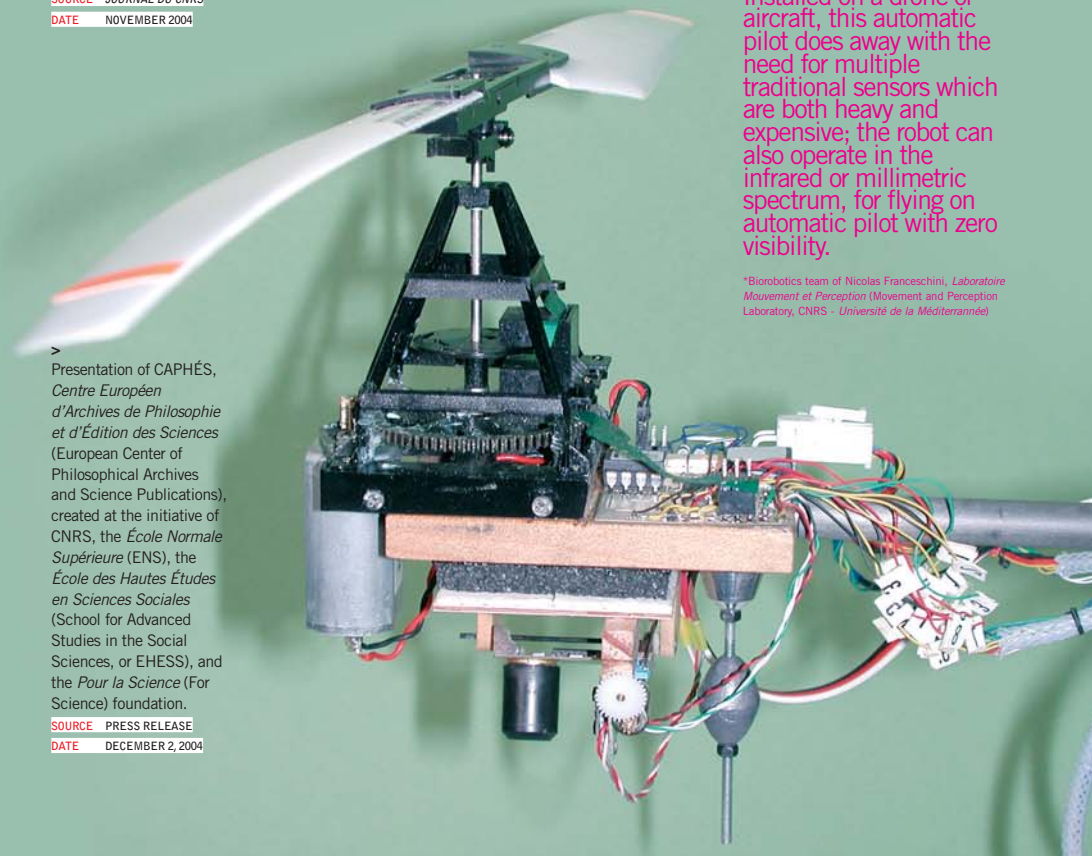
The computing of the future is arriving in our homes to transform everyday objects into tactile, interactive devices. The startup company Sensitive Object uses a patent from CNRS - *Université Paris 7*.
SOURCE *JOURNAL DU CNRS*
DATE JANUARY 2004

> Provide information technology resources and share data throughout Europe, 24 hours a day? Due to the efforts of 21 scientific and industrial partners, including 3 from France (CNRS, CEA, and Communication & Systèmes), the European computing grid is shifting into high gear!
SOURCE PRESS RELEASE
DATE MARCH 31, 2004

> How can we obtain the enormous computing capacity required to discover the secrets of matter? The solution may reside in the creation of apeNEXT, a supercomputer developed by Italian, French, and German physicists and computer scientists.
SOURCE PRESS RELEASE
DATE JULY 1, 2004

Sounds from outer space for music lovers by Haliaetus: loudspeakers whose shape is directly inspired by the profile of rocket engines help reduce noise distortion. Based on a score by CNRS - *Université Paris 6*.
SOURCE *JOURNAL DU CNRS*
DATE NOVEMBER 2004

> Presentation of CAPHÉS, *Centre Européen d'Archives de Philosophie et d'Édition des Sciences* (European Center of Philosophical Archives and Science Publications), created at the initiative of CNRS, the *École Normale Supérieure* (ENS), the *École des Hautes Études en Sciences Sociales* (School for Advanced Studies in the Social Sciences, or EHESS), and the *Pour la Science* (For Science) foundation.
SOURCE PRESS RELEASE
DATE DECEMBER 2, 2004



UNDERSTANDING AND MASTERING IN ORDER TO DEVELOP AND INNOVATE

DEVELOPING NEW COMPOUNDS, UNDERSTANDING CHEMICAL REACTIVITY, UNCOVERING IN MORE AND MORE DETAIL-TO THE POINT OF PREDICTING-THE RELATIONS BETWEEN THE STRUCTURE OF ATOMIC-LEVEL COMPOUNDS AND THEIR PROPERTIES... THE CHEMICAL SCIENCES ARE CARRYING OUT RESEARCH INTERFACED WITH SEVERAL OTHER DISCIPLINES AND ARE DISCOVERING ALL KINDS OF APPLICATIONS, FROM THE ENVIRONMENT AND MATERIALS TO BIOLOGY AND PHARMACOLOGY.

CATALYSIS SPECIALISTS TAKE UP A CHALLENGE FROM DAILY LIFE!

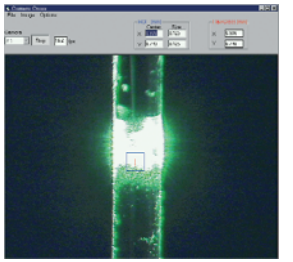
How to prevent the enameled aluminum base of household irons from becoming clogged, especially with synthetic fibers? This is the subject of a joint project by the CNRS *Institut de Recherche sur la Catalyse* (Catalysis Research Center) in Villeurbanne and the Calor-SEB company which has led to the development of a palladium-based catalytic coating.
Although only a few nanometers thick, the coating offers very high catalytic oxidation at low temperatures (250-300°C), is perfectly homogeneous and extremely smooth, and ensures optimal glide. It also adheres very well to the underlying enamel, is only a few dozen nanometers thick, and represents a minimal additional cost. The industrial partner plans to market the iron.

> GIGA, the world's only machine for testing the resistance of concrete under extreme stress.
SOURCE PRESS RELEASE
DATE MAY 12, 2004

> Zeolite IM-12, a synthetic precious stone for petrochemistry.
SOURCE *SCIENCE* / PRESS RELEASE
DATE MAY 14, 2004

> Water-resistant coatings, adhesives, and... the physical phenomena of wet dog hair.
SOURCE *NATURE* / PRESS RELEASE
DATE DECEMBER 9, 2004

> **Developing powders via supercritical fluids:** their use on a commercial scale is a source of major technological change in several fields and more especially in the agri-food and pharmaceutical industries.



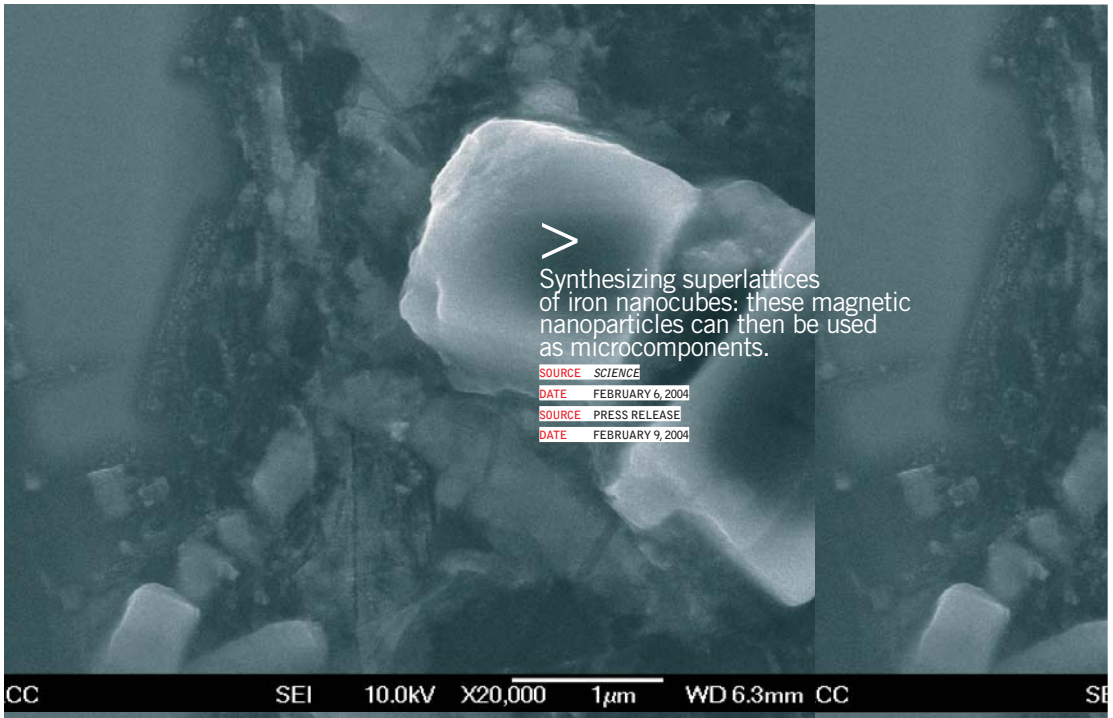
FILMING THE MOVEMENTS OF ATOMS WITH X-RAYS

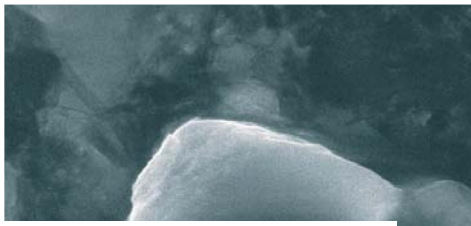
Two teams of research scientists managed by Michael Wulff of the European Synchrotron Radiation Facility (ESRF, Grenoble) and by Savo Bratos of the *Laboratoire de Physique Théorique des Liquides* (Laboratory of Theoretical Fluid Physics, CNRS - *Université Paris 6*) have managed to monitor the real-time formation of diatomic molecules in a solvent. The reaction is triggered by a laser pulse and is followed by brief X-ray pulses. The local and global changes to the solvent structure during the reaction were also monitored. This is the first time that such atomic movements are viewed in real time.

SOURCE *PHYSICAL REVIEW LETTERS / NATURE*
DATE MAY 20, 2004
SOURCE PRESS RELEASE
DATE MAY 28, 2004

NANOSCIENCE AND NANOTECHNOLOGIES: FAST GROWTH, AN INTER-DISCIPLINARY CALLING

WE ARE BEGINNING TO BETTER UNDERSTAND THE WORLD AT THE NANOMETER LEVEL - ONE MILLIONTH OF A MILLIMETER- A FIELD OF RESEARCH WHERE MAJOR DISCOVERIES ARE EXPECTED IN PHYSICS, CHEMISTRY, MATERIAL SCIENCES, AND BIOLOGY. THIS "NANOWORLD" CONCEALS CONSIDERABLE TECHNOLOGICAL TREASURES.





> Synthesizing superlattices of iron nanocubes: these magnetic nanoparticles can then be used as microcomponents.

SOURCE *SCIENCE*
DATE FEBRUARY 6, 2004
SOURCE PRESS RELEASE
DATE FEBRUARY 9, 2004

MICROCAVITY NANOLASERS

Information and communication sciences and technologies are clamoring for components that emit or detect on very large and very robust wavelengths.

Quantum cascade lasers are a new category of components whose emission of light results from "falling" electrons (or a tunnel effect) following "stages" (or quantum wells) with the emission of photons at each "stage". This offers enormous flexibility for component architectures by stacking thin layers of various thicknesses. For some applications, it is preferable to obtain an emission via the surface. This can be achieved by creating a resonant microcavity using the photonic crystal concept.

There are numerous applications for quantum cascade lasers in fields such as spectroscopy, gas detection, and even telecommunications with wireless connections that are insensitive to atmospheric conditions. Combining these two concepts makes it possible to develop vertical emission lasers with optical microcavities.

In the strategically important fields of nanosciences and nanotechnologies, this innovation enables scientists to imagine new features for quantum cascade lasers, in particular concerning size.

The first prototype was developed at Bell Labs (United States) by Raffaele Colombelli and his associates in the team of Dr. Federico Capasso. Colombelli -now a research scientist at the *Institut d'Électronique Fondamentale d'Orsay* (Fundamental Electronics Institute) (CNRS - *Université Paris-Sud*)- was awarded the 2004 European Young Investigator (EURYI) prize from the European Science Foundation to start an activity in this field.

> The European Nanomempro network of excellence, coordinated by CNRS, is at the crossroads of nanosciences and membrane technologies. After starting with 13 scientific partners, this "interest club"-a gateway for transferring knowledge between public and private research-already numbers 40 private companies.

SOURCE PRESS RELEASE
DATE SEPTEMBER 27, 2004

> Modeling nano-objects in crystal molds: a Franco-German cooperative program

SOURCE *PHYSICAL REVIEW LETTERS 2004 I*
PRESS RELEASE
DATE NOVEMBER 9, 2004

> Nanotechnologies: Cooperative agreement between CNRS and the Japanese National Institute for Materials Science.

SOURCE PRESS RELEASE
DATE MARCH 25, 2004

> A Franco-British team demonstrates that double-walled carbon nanotubes have original properties for resisting high pressure.

SOURCE *PHYSICAL REVIEW LETTERS 2004 I*
PRESS RELEASE
DATE OCTOBER 4, 2004

> Optical nanoscopy, a new technique for observing isolated metallic nanoparticles

SOURCE *PHYSICAL REVIEW LETTERS 2004 I*
PRESS RELEASE
DATE OCTOBER 22, 2004

BIOCHIPS: HIGHLY APPLIED MICROARRAYS

Biochips are microarrays (such as glass strips) covered with an ordered series of small deposits of biological liquids (DNA, proteins) that are made to react with another biological product. The latter usually has a fluorescent label. The chips allow the analysis of thousands of DNA, RNA, or protein sequences in just a few hours, in order to immediately determine which genes respond to the action of a given molecule, which are involved in a disease, or to determine the expression of the genes of an organism being studied under particular conditions.

The work initiated by Pascal Belaubre of the CNRS *Laboratoire d'Analyse et d'Architecture des Systèmes* (System Analysis and Architecture Laboratory, or LAAS) in Toulouse is based on the use of micro- and nanotechnologies to develop new biochip architectures for very small volumes of products at low cost (a 1 to 100 ratio), using conventional collective microproduction techniques developed in microelectronics.

Thus it will be possible to perform investigations more quickly and on larger quantities of products. This concept of nanosystem-based biochips has very important applications for future research in genopoles.

This research has been awarded an international patent and is part of in an integrated European project.

>
Creation of an international CNRS - University of Tokyo laboratory in Japan for microsystems and nanotechnologies.
SOURCE PRESS RELEASE
DATE JUNE 28, 2004

THE LATEST IN ELECTRONICS...

WITH THE ONGOING MINIATURIZATION OF ELECTRONICS, THERE IS AN INCREASED DEMAND FOR FURTHER RESEARCH ON NEW PROCESSES AND MATERIALS TO DETERMINE THE EVOLUTION OF THE TECHNOLOGIES OF THE FUTURE.

Lumilog, a recent startup, is already launching new products, including a semiconductor for the laser diodes in next generation DVDs. Its young founders previously worked in a CNRS laboratory.
SOURCE *JOURNAL DU CNRS*
DATE NOVEMBER 2004

>
The electronic components of the future: launching the SINAO European network of excellence, coordinated by CNRS, with 41 partners in 16 countries representing the main players in research and industry in this field.
SOURCE PRESS RELEASE
DATE FEBRUARY 2, 2004

>
Microelectronics of the future: CNRS and the CEA inaugurate the SPINTEC laboratory in Grenoble dedicated to developing innovative mass storage components and random-access memory for computers and telecommunications.
SOURCE PRESS RELEASE
DATE MARCH 11, 2004

GROWTH OF EXTREMELY PURE SINGLE-CRYSTAL DIAMONDS

The materials and plasma team, managed by Alix Gicquel in the Laboratoire d'Ingénierie des Matériaux et des Hautes Pressions (Materials and High Pressure Engineering Laboratory) (CNRS - *Université Paris 13*), has managed to obtain very pure diamonds and very high crystal quality. This work has applications in a wide range of fields, specifically in power electronics (switches), radiation or particle detectors, and sensors.
SOURCE *NATURE*
DATE SEPTEMBER 30, 2004

> ONERA and CNRS launch their first joint aerospace projects: hollow-sphere foam for the fields of mechanics, acoustics, and thermal studies, as well as studies of evaporation phenomena in multicomponent fuels for aeronautics.
SOURCE PRESS RELEASE
DATE SEPTEMBER 15, 2004

> CNRS presents its work "for a clean and economical engine" to the press.
SOURCE PRESS RELEASE
DATE JUNE 18, 2004

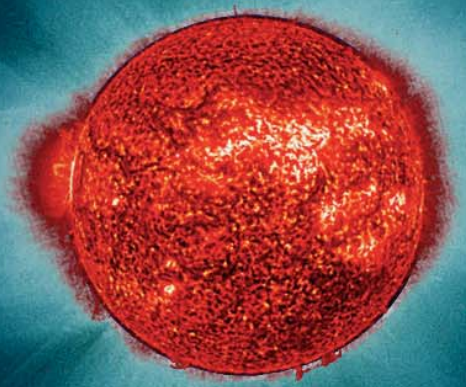
> CNRS and the SNCF (the national railways company) put research on the right track by signing their first four-year agreement for scientific cooperation in mechanics, aerodynamics, robotics, and electronics.
SOURCE PRESS RELEASE
DATE DECEMBER 15, 2004

DECREASING CONSUMPTION, RENEWING ENERGY SOURCES... AND

REDUCING POLLUTION

IMPROVEMENTS IN TODAY'S ENERGY SYSTEMS, THE DEVELOPMENT OF NEW ONES, THE RATIONAL USE OF ENERGY, THE LIMITATION OF POLLUTION, AND THE CONTROL OF OPERATIONAL SAFETY ARE **KEY RESEARCH FIELDS FOR CNRS,** ON BOTH SCIENTIFIC AND TECHNOLOGICAL LEVELS. THIS RESEARCH IS MOST OFTEN CARRIED OUT WITH OTHER ORGANIZATIONS OR COMPANIES.

> CNRS, in association with Spanish, German, and Swiss teams, recently created SolLab, an alliance of European laboratories for research and technologies of concentration solar systems, a means for obtaining the high temperatures required to produce energy. It will coordinate the research efforts of the main European centers involved in this field. This project is strategically important at both the European and international levels as it concerns sustainable development.
SOURCE PRESS RELEASE
DATE OCTOBER 20, 2004



CNRS initiates numerous projects with the CEA: projects include ITER, the International Thermonuclear Experimental Reactor; a technological platform for hydrogen and fuel cells in Belfort, in partnership with INRETS and the *Université de Besançon*, the *Université de Nancy*, and UTBM; and the INES project on the building in Chambéry; programs on photovoltaics.

INAUGURATION OF AN INNOVATIVE, ECONOMICAL URBAN LIGHTING SYSTEM IN ALBI

Since December 2, 2004 in Albi, a new urban lighting system, based on new metallic halogen lamps with a ceramic covering, uses about 50% less energy to produce the same luminous intensity and to provide lighting better suited to the human eye.

This is the result of the European NumeLite project started three years previously. Coordinated by Georges Zissis of the *Centre de Physique des Plasmas et de Leurs Applications* (Physics Center for Plasmas and their Applications, CNRS - *Université Toulouse 3*), this project involved eleven public and private partners representing six European countries.

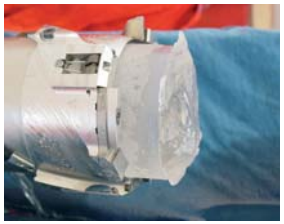
By allowing a significant conservation of energy, it contributes to sustainable development and land-use planning.
SOURCE PRESS RELEASE
DATE DECEMBER 2, 2004

> 55 million years ago, the North Pole had a subtropical climate: this is the first result of the Arctic drilling mission of the international IODP program, financed by a European consortium and administered by CNRS - INSU (*Institut National des Sciences de l'Univers* - National Institute of Earth Sciences and Astronomy).
SOURCE PRESS RELEASE
DATE SEPTEMBER 9, 2004

> Earth as a "snowball", totally covered by ice: severe cold warning 750 million years ago!
SOURCE *NATURE*
DATE MARCH 18, 2004
SOURCE PRESS RELEASE
DATE MARCH 17, 2004

CLIMATE CHANGE, AIR QUALITY, WATER POLLUTION, AND UNFORESEEABLE WEATHER PATTERNS: **MAJOR AREAS FOR RESEARCH**

THE IMPACT OF CLIMATE CHANGE: RESEARCH SCIENTISTS, ENGINEERS, AND TECHNICIANS ARE CARRYING OUT THE BASIC RESEARCH REQUIRED TO BETTER UNDERSTAND THE OPERATION OF EARTH'S FLUID SYSTEMS (ATMOSPHERE AND OCEANS) AND CLIMATE VARIATIONS. THEY ARE ALSO INVOLVED IN MORE APPLIED RESEARCH. **CNRS PLAYS AN IMPORTANT ROLE IN SEVERAL EUROPEAN PROJECTS FOCUSING ON THIS RESEARCH.**



THE SECRETS OF THE CLIMATE OVER THE LAST 740,000 YEARS.

Once again in 2004, core samples from polar ice in the Antarctic furthered our knowledge of the climates of the past, over a time period never previously matched: 740,000 years. Teams from the European EPICA project, including CNRS, the CEA, and the *Institut Polaire Français Paul-Émile Victor* (French Polar Institute) analyzed three kilometers of ice collected over an eight-year period at the French-Italian base of Concordia, located more than 1,000 kilometers inland on the Antarctic continent. The profiles of temperature, carbon dioxide, methane, and dust developed by the teams from the CEA, CNRS, and the *Université Joseph-Fourier* in Grenoble revealed that the Earth has been through eight climate cycles, with a brutal change in the rhythm of those cycles 420,000 years ago. Before then, the highest temperatures were colder. The warmest period lasted 28,000 years.

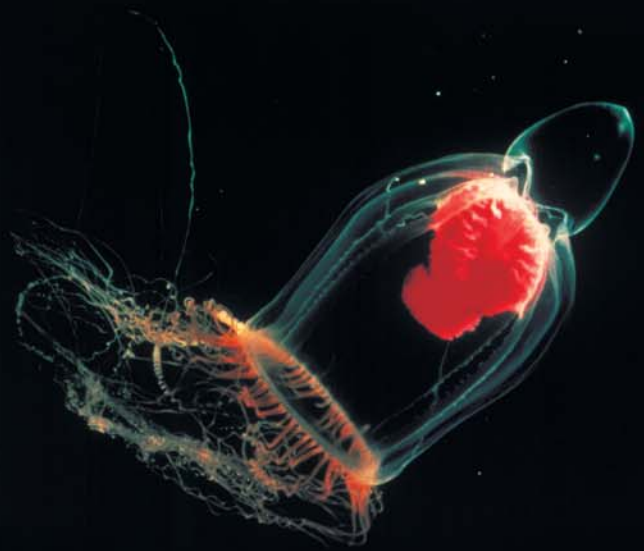
On December 21, 2004, the EPICA drilling project was completed five meters above the rock platform.

SOURCE *NATURE* / PRESS RELEASE
DATE JUNE 10, 2004
SOURCE *JOURNAL DU CNRS*
DATE MAY 2004

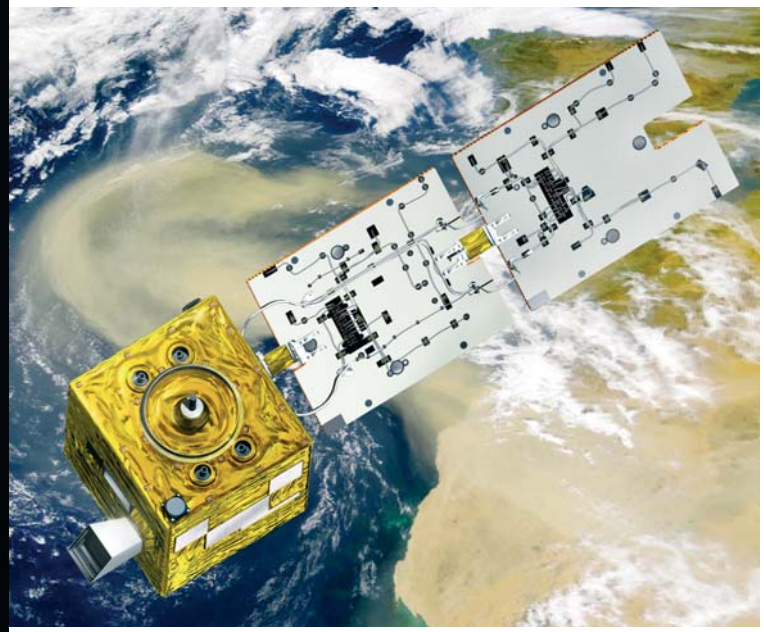
> The "forest fires" experiment in southern Corsica to better understand the phenomena involved and to define firefighting and fire prevention strategies.
SOURCE PRESS RELEASE
DATE JULY 5, 2004

> An international network of 26 laboratories determined the complete sequencing of a single-cell algae. This is of interest to nanotechnologists and the fight against the greenhouse effect: this diatom performs 20% of the photosynthesis on the planet.
SOURCE *SCIENCE* / PRESS RELEASE
DATE OCTOBER 1, 2004

> How to better predict flooding? NOVIMET, created in 2003, has an exclusive license for two CNRS patents...
SOURCE *JOURNAL DU CNRS*
DATE JUNE 2004



> Plankton and bacteria: a vital link in the carbon cycle.
SOURCE PRESS RELEASE
DATE NOVEMBER 30, 2004



> PARASOL, the second microsatellite developed by CNES, was launched into orbit on December 18, 2004, and is designed to study the properties of clouds and aerosols. This space mission was developed by CNRS laboratories, mainly the *Laboratoire d'Optique Atmosphérique* (Atmospheric Optics Laboratory, CNRS - *Université Lille 1*).

> Following the Comparative history of man and climates prepared by Emmanuel Le Roy Ladurie, Honorary Professor at the *Collège de France*, research scientists at CNRS, CEA, and INRA have pieced together the climate of Burgundy since 1370, based on the harvest dates of Pinot Noir, the region's leading grape.
SOURCE *NATURE* / PRESS RELEASE
DATE NOVEMBER 18, 2004

> The rocky summit of Mont Blanc, 40 meters west of the ice summit: preliminary results of the French-Swiss drilling project that will determine the evolution of the composition of both our atmosphere and the summit's temperatures over at least the past 100 years
SOURCE PRESS RELEASE
DATE AUGUST 2, 2004

> Four-year accreditation of a CNRS-IN2P3 laboratory (*Institut National de Physique Nucléaire et de Physique des Particules*, National Institute for Nuclear and Particle Physics) by the *Comité Français d'Accréditation* (French Accreditation Committee, or COFRAC) for the analysis of radionuclides present in all types of environmental samples.
SOURCE PRESS RELEASE
DATE APRIL 13, 2004

WATER, A PRECIOUS RESOURCE

Water is the subject of numerous CNRS studies* that bring together research scientists with various types of expertise: geologists, chemists, biologists, historians, sociologists, economists, geographers… For example, the study of polar ice has allowed paleoclimatologists to reconstruct the history of the Earth's climates on a geological scale, helping to refine forecasts for future climate changes. By studying water cycles and quantifying the exchanges between the biosphere and the atmosphere, climatologists are also trying to better understand the factors that control the climate, as water vapor impacts the greenhouse effect.

The quality of water-both a resource and a life environment- is essential to agriculture, industry, and household consumption. It must be preserved and its use must be controlled: CNRS chemists and physicists are working to develop the most effective methods for analyzing pollutants, to design wastewater treatment systems, or to develop advanced filtration systems. The biological diversity of streams, rivers, and lakes depends on the quality of water and its management. By searching for biological indicators, we can better evaluate the health of these hydrosystems.

Where do we stand on achieving a more political or economic administration of water, in areas where it can become a source of conflict? Research projects offer more appropriate management methods.

CNRS has set up international cooperation programs to address these fundamental issues and provide expert advice at the request of foreign partners when the quantitative and qualitative management of water presents public health problems.

SOURCE SAGASCIENCE ONLINE MULTIMEDIA PRESENTATION: www.cnrs.fr/saga.htm

* These programs involve other research organizations such as INRA, IRD, Météo France, CÉMAGREF, BRGM, CNES, IFREMER, and the *Laboratoire Central des Ponts et Chaussée* (Central Bridges and Roadways Laboratory).

>
In the Egyptian desert, a French-Egyptian team discovers the Earth's largest field of meteor craters using radar satellite images to visualize the subsurface of arid regions, and several meters underground.
SOURCE *JOURNAL DU CNRS*
DATE OCTOBER 2004
SOURCE PRESS RELEASE
DATE OCTOBER 4, 2004

A MACHINE CALLED EARTH

DESCRIPTION AND DETAILED IMAGES OF THE STRUCTURE OF THE VARIOUS LAYERS AROUND OUR PLANET, THEIR INTERACTIONS AND LINKAGE... ANALYSIS OF HOW THE EARTH WORKS CAN NO LONGER BE "COMPARTMENTALIZED" BECAUSE WE NEED TO UNDERSTAND ALL THE INTRICATE MECHANISMS IN CHANGES TO ITS MANTEL AND CORE, THE EROSION OF CONTINENTS, FORMER OCEANIC CURRENTS, CHANGES TO MAGNETIC FIELDS, ETC.

>
For the first time, research scientists have been able to reproduce in a laboratory the deformations occurring in the rock of the Earth's mantel under extreme pressure and temperature conditions.
SOURCE *NATURE* AND PRESS RELEASE
DATE APRIL 22, 2004

> Why do the ripples on the ocean floor have scars?

SOURCE *NATURE* / PRESS RELEASE
DATE NOVEMBER 11, 2004

>
While plate tectonics offers a satisfactory overall plan for the operation of Earth's dynamics, questions remained about how long that plan has been in operation... Scientists now have reason to believe that oceanic subduction works the same today as it did 1.8 billion years ago
SOURCE *SCIENCE* AND PRESS RELEASE
DATE MAY 7, 2004

>
Are silent earthquakes precursors to giant earthquakes in subduction zones?
SOURCE *SCIENCE* AND PRESS RELEASE
DATE SEPTEMBER 24

>
Was there rain on Mars 3 billion years ago? Scientists have been intensely debating the origin of Mars' valleys for over thirty years. Now we know that they bear witness to a time when water was present on the planet's surface in a liquid state and for a stable period.
SOURCE *SCIENCE* / PRESS RELEASE
DATE JULY 2, 2004

> Why are there magnetic contrasts on Mars?

SOURCE *EOS*
DATE DECEMBER 16
SOURCE PRESS RELEASE
DATE JANUARY 14, 2004

>
Since the arrival on Mars of the Mars Global Surveyor probes, and more recently of Mars Odyssey, a number of converging signs indicate the presence of ice in the first few meters of the subsurface at high latitudes.
SOURCE *NATURE*
DATE OCTOBER 28, 2004
SOURCE CPRESS RELEASE
DATE OCTOBER 27, 2004

PLANETS & GALAXIES

SEARCHING TO THE FAR REACHES OF THE UNIVERSE... THE VERY LARGE TELESCOPE, SATELLITES, AND SPACE PROBES: EXTENSIVE RESOURCES ARE BEING DEPLOYED ON A PLANETARY SCALE TO UNDERSTAND BOTH THE ORIGIN AND THE EVOLUTION OF THE UNIVERSE, THE FORMATION AND EVOLUTION OF GALAXIES AND THEIR CLUSTERS, AND THE PHYSICS OF COMPACT OBJECTS. BUT ASTRONOMERS AND ASTROPHYSICISTS ARE ALSO CURIOUS ABOUT THE INTERSTELLAR MEDIUM AND STARS, INCLUDING OUR SUN, AND THEIR IMPACT ON EARTH AND PLANETS IN BOTH THE SOLAR SYSTEM AND EXTRASOLAR SYSTEMS.

> Flames/Giraffe: a unique tool for understanding how galaxies evolve.
SOURCE *ASTRONOMY AND ASTROPHYSICS 2004* / PRESS RELEASE
DATE JUNE 10, 2004

> Extrasolar planets: models for understanding their evolution.
SOURCE *ASTRONOMY AND ASTROPHYSICS LETTERS 2004* / PRESS RELEASE
DATE APRIL 21, 2004

> Both the spinning of Mercury around its axis and its revolution around the sun are explained by the chaotic movements of its orbit.
SOURCE *NATURE* / PRESS RELEASE
DATE JUNE 24, 2004

> The SNIFS spectrograph sees its first supernova, in Hawaii.
SOURCE PRESS RELEASE
DATE JUNE 4, 2004

> The AMBER interferometer, a giant telephoto lens installed in Chile on the European Very Large Telescope (VLT), will enable research scientists to zoom in on the universe to see planets develop, probe the area around black holes, and dive into the heart of galaxies.
SOURCE PRESS RELEASE
DATE APRIL 5, 2004

> The smallest extrasolar planet is detected.
SOURCE PRESS RELEASE
DATE AUGUST 25, 2004

> MUSE, a 3-D spectrograph selected for the VLT in order to observe the universe both in volume and in depth. It should revolutionize the study of the formation and the evolution of galaxies.
SOURCE PRESS RELEASE
DATE JULY 8, 2004

FIRST RESULTS FROM MARS EXPRESS: A SHOWER OF DISCOVERIES

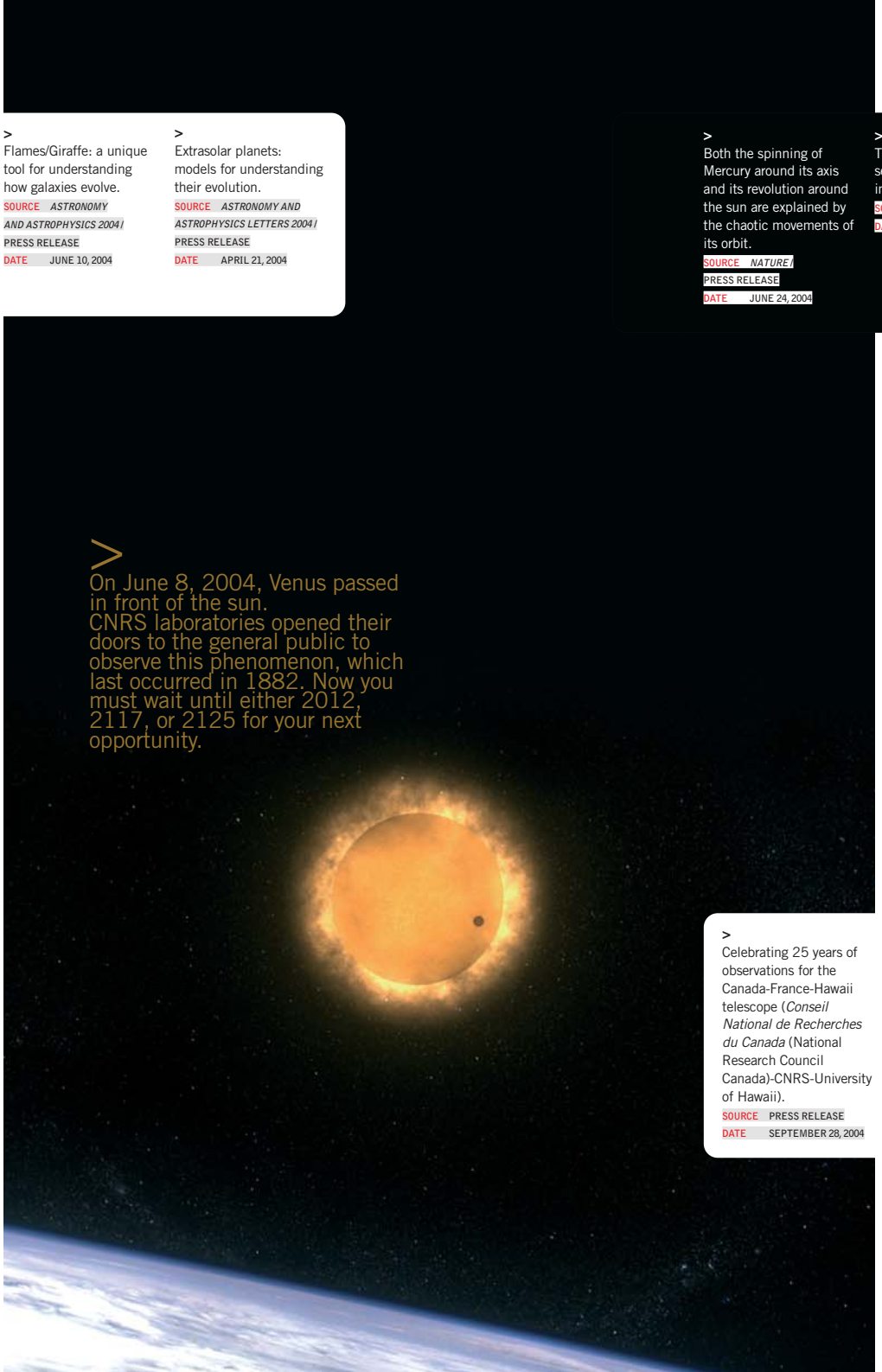
The Mars Express probe of the European Space Agency was successfully launched into orbit around the red planet on December 25, 2003. The instruments on board the probe have been operational since the start of 2004. Two instruments in particular, whose principal investigators are French, have achieved major breakthroughs.

Omega[1] is an infrared imaging spectrometer. For the first time, it has produced spectacular images of enormous permanent stretches of pack ice, mostly consisting of dry ice. Omega also detected the presence of water ice (H_2O), also found on the edges of these "dry ice icebergs". By directly detecting ice, water vapor, and water trapped in the rock, Omega should make it possible to evaluate the total amount of water available on the surface of Mars. Furthermore, the probe has revealed expanses of sulfates, salts, and clay that may be due to alteration caused by water and related to the climate change on Mars.

The SPICAM[2] spectrometer, working in the ultraviolet and infrared range, is helping determine the composition of Mars' atmosphere by analyzing ozone, water vapor, and carbon dioxide (CO_2). It demonstrated for the first time an inverse correlation between ozone and water vapor, as the latter destroys the former. It also performed the first complete vertical sounding of the atmospheric density on Mars (mainly CO_2) by applying the star occultation technique used on Earth to monitor the ozone layer.

[1] The prime contract for the Omega project is the *Institut d'Astrophysique Spatiale* (Space and Astrophysics Institute), in cooperation with the *Laboratoire d'Études Spatiales et d'Instrumentation en Astrophysique* (Laboratory for Space Studies And Astronomical Instrumentation), the Institute for Cosmic Research (IKI) in Moscow, and the Space Physics Institute (IFI) in Rome.
[2] The CNRS *Service d'Aéronomie* (Aeronomy Department) was the prime contractor for the development of Spicam, with the participation of IKI (Moscow) and the Belgisch Instituut voor Ruimte-Aeronomie (BIRA, or Belgian Institute for Space Aeronomy) in Brussels.

> On June 8, 2004, Venus passed in front of the sun. CNRS laboratories opened their doors to the general public to observe this phenomenon, which last occurred in 1882. Now you must wait until either 2012, 2117, or 2125 for your next opportunity.



A real fireworks display for astronomy and astrophysics in 2004, with the commissioning of instruments and new European and international observation resources, both on Earth and in space. The French community, which helped develop the instruments, is now benefiting from their operations, and as a result has made several major scientific breakthroughs.

> Launch of the ESA Mars Express in early 2004. CNRS laboratories were involved in the development of the spacecraft's onboard instruments (the *Institut d'Astrophysique Spatiale* (Space and Astrophysics Institute) in Orsay and the *Service d'Aéronomie* (Aeronomy Department)).

> The NASA-ESA Cassini-Huygens probe, in orbit around Saturn since May 2004: French laboratories helped develop the instruments, mainly the Huygens final approach lander for Titan.

> Successful launch of the Rosetta probe which will reach the Churyumov Gerasimenko comet in 2014: French laboratories participated in over a dozen onboard experiments, including two experiments where the principal investigators are French (the *Institut d'Astrophysique Spatiale d'Orsay* (Space and Astrophysics Institute) and the *Laboratoire de Planétologie de Grenoble* (Planetology Laboratory)).

> Back on Earth, the spectrometers of the *Laboratoire Galaxies, Étoiles, Physique, Instrumentation* (Galaxies, Stars, Physics, and Instruments Laboratory) of the *Observatoire de Paris* (Paris Observatory) and the spectrometer of the *Laboratoire d'Astrophysique* (Astrophysics Laboratory) in Marseille, the *Observatoire Astronomique de Marseille-Provence* (Astronomical Observatory) installed in the focus of the Very Large Telescope (VLT) of the ESO delivered their first results in studying galaxies and their evolution. As for the Very Large Telescope interferometer of the ESO, the instrument AMBER (from the *Laboratoire Universitaire d'Astrophysique* (University Astrophysics Laboratory) in Nice and the *Laboratoire d'Astrophysique* in Grenoble) captured its first photons.

> Celebrating 25 years of observations for the Canada-France-Hawaii telescope (*Conseil National de Recherches du Canada* (National Research Council Canada)-CNRS-University of Hawaii).
SOURCE PRESS RELEASE
DATE SEPTEMBER 28, 2004

> Located in Chile, the Very Large Telescope or VLT pulverizes the record for detecting the most remote galaxy in the universe!
SOURCE PUBLICATION ON THE *ASTRONOMY AND ASTROPHYSICS* SITE / PRESS RELEASE
DATE MARCH 1, 2004

> Antifreeze in the Hale-Bopp comet: this ethylene glycol is the most complex organic molecule ever identified in a comet
SOURCE *ASTRONOMY AND ASTROPHYSICS LETTERS 2004* / PRESS RELEASE
DATE MARCH 24, 2004

> The first image of an extrasolar planet?
SOURCE *ASTRONOMY AND ASTROPHYSICS LETTERS 2004* / PRESS RELEASE
DATE SEPTEMBER 10, 2004

> Incredible performance by the EPIC X-ray sensor, which enabled the observation of a miniscule hot spot on a star called Geminga.
SOURCE *SCIENCE*
DATE JULY 16, 2004
SOURCE PRESS RELEASE
DATE JULY 15, 2004

MATTER, ELEMENTS, AND THE UNIVERSE: ORIGINS

— The elementary particles of matter, their fundamental interactions, their assembly into atomic nuclei, and the properties of those nuclei... This exploration uses particle detectors located near huge high-energy accelerators such as the CERN in Geneva or the GANIL in Caen. But there are also instruments on Earth or onboard probes and satellites to observe high energy cosmic rays (astroparticles) emanating from the violent phenomena observed in the universe, or the cosmological manifestations of particle physics.
These activities in particle physics, in combination with cosmology (the science of the origin of the universe), provide a new way to look at the origin of matter.
Observing the universe with new messengers (such as neutrinos, high-energy cosmic rays, very massive particles in the universe, gravitational waves), the emerging domain of astroparticles, is today becoming a research priority for CNRS.
Particle physics, nuclear physics, cosmology, and astroparticles are helping to improve our understanding of the physics of the origin of matter, the elements, and the universe, all themes which fascinate a very wide audience. They require developments in intensive data processing (large grids of computers), instruments to explore the infinitely small and the extremely fast, and acceleration techniques. This development is often carried out in close cooperation with high technology companies.

— The CNRS *Institut National de Physique Nucléaire et de Physique des Particules* (National Institute for Nuclear and Particle Physics) coordinates nuclear physics and high energy programs on behalf of CNRS and universities, in partnership with the CEA.

>
Determining the mass of the top quark in order to approach the Higgs boson, the "cornerstone" of the standard model of particle physics.
SOURCE *NATURE* / PRESS RELEASE
DATE JUNE 10, 2004

>
To better understand both the basic elements of matter and how they interact, physicians are building particle accelerators that are not only increasingly powerful but also bigger and bigger. To avoid both the increasing size and costs, CNRS and CEA research scientists have developed an innovative laser-plasma accelerator, a total technological break with traditional accelerators. The scientific community has already dubbed it the Dream Beam!
SOURCE *NATURE*
DATE SEPTEMBER 30, 2004
SOURCE PRESS RELEASE
DATE OCTOBER 15, 2004

WHERE DO COSMIC RAYS COME FROM?

Earth is bombarded by cosmic rays, a shower of particles (protons, electron, and gamma rays), which can have very high energy levels. Where do they come from? The mystery has remained unsolved since they were first discovered in 1913. We have long known that any violent phenomenon producing shock waves can accelerate protons or electrons to very high energy levels, which makes them interact and in turn produce very high energy gamma photons. But what are these cosmic accelerators and what accelerates the protons? That is the key question. We need to identify the sites which accelerate protons in order to explain why they represent the majority of cosmic rays. Today the most likely candidates appear to be the remains of supernovas (stars which explode at the end of their lives).

In Namibia in 2004, the HESS international experiment, which involves several CNRS teams, developed the first high energy gamma ray cartography of the remains of supernovas. The experiment determined for the first time worldwide that the remains of supernovas are indeed accelerators of charged cosmic rays (electrons or protons), providing a major clue to the origin of cosmic rays.
SOURCE *NATURE* / PRESS RELEASE
DATE NOVEMBER 4, 2004

>
Morocco and France work together to research the ultimate components of matter.
SOURCE PRESS RELEASE
DATE JANUARY 7, 2004

>
Muons: exoticism in particle chemistry.
SOURCE *PHYSICAL REVIEW LETTERS*
DATE JULY 20, 2004
SOURCE PRESS RELEASE
DATE JULY 22, 2004

>
International Neutrino Conference 2004: An enigmatic particle is finally about to reveal its secrets.
SOURCE PRESS RELEASE
DATE MAY 27, 2004

WHERE IS THE ANTIMATTER?

While the universe contained as much antimatter as matter at the time of the Big Bang, antimatter appears to have completely disappeared since, a phenomenon that our present level of knowledge cannot explain. Scientists are actively searching for subtle differences in behavior between matter and antimatter (a violation of CP-symmetry).

In 2004, the BaBar experiment at the Stanford Linear Accelerator Center in California demonstrated a new, spectacular difference in behavior between B mesons and anti-B mesons (very heavy mesons). If there were no difference, the B- and anti-B mesons would disintegrate in exactly the same way. But BaBar measured very different disintegration rates in a specific channel, which indicates a phenomenon that directly violates symmetry. Moreover, this effect is 100,000 times stronger than the one previously observed with K mesons (very light mesons).

The result, which tests a key mechanism in the structure and behavior of matter, is a significant advance in the identification of elements able to explain the problem of the "disappearance" of antimatter.
SOURCE ONLINE PUBLICATION ON THE *PHYSICAL REVIEW LETTERS* SITE / PRESS RELEASE
DATE AUGUST 2, 2004

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National Committee for Scientific Research
This committee, established within CNRS, groups the bodies for consulting and research evaluation
http://www.cnrs.fr/sgcn/accueil.html

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