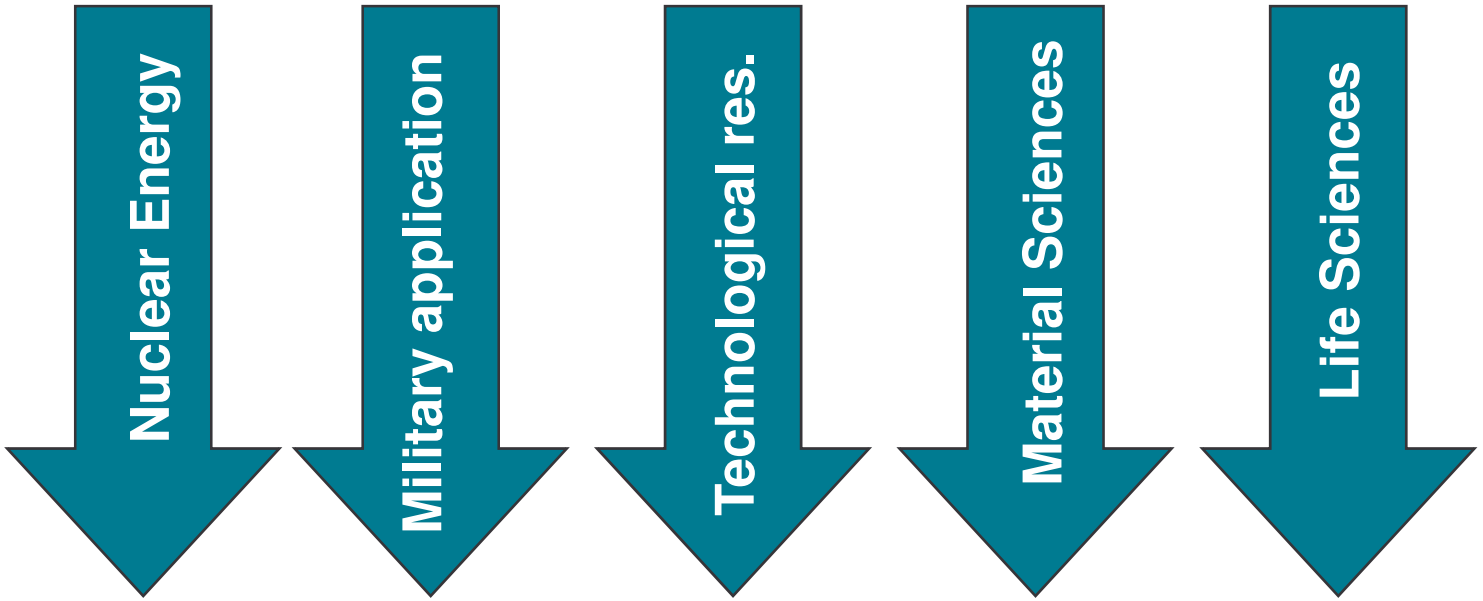
CEA - A research body mainly devoted to technology

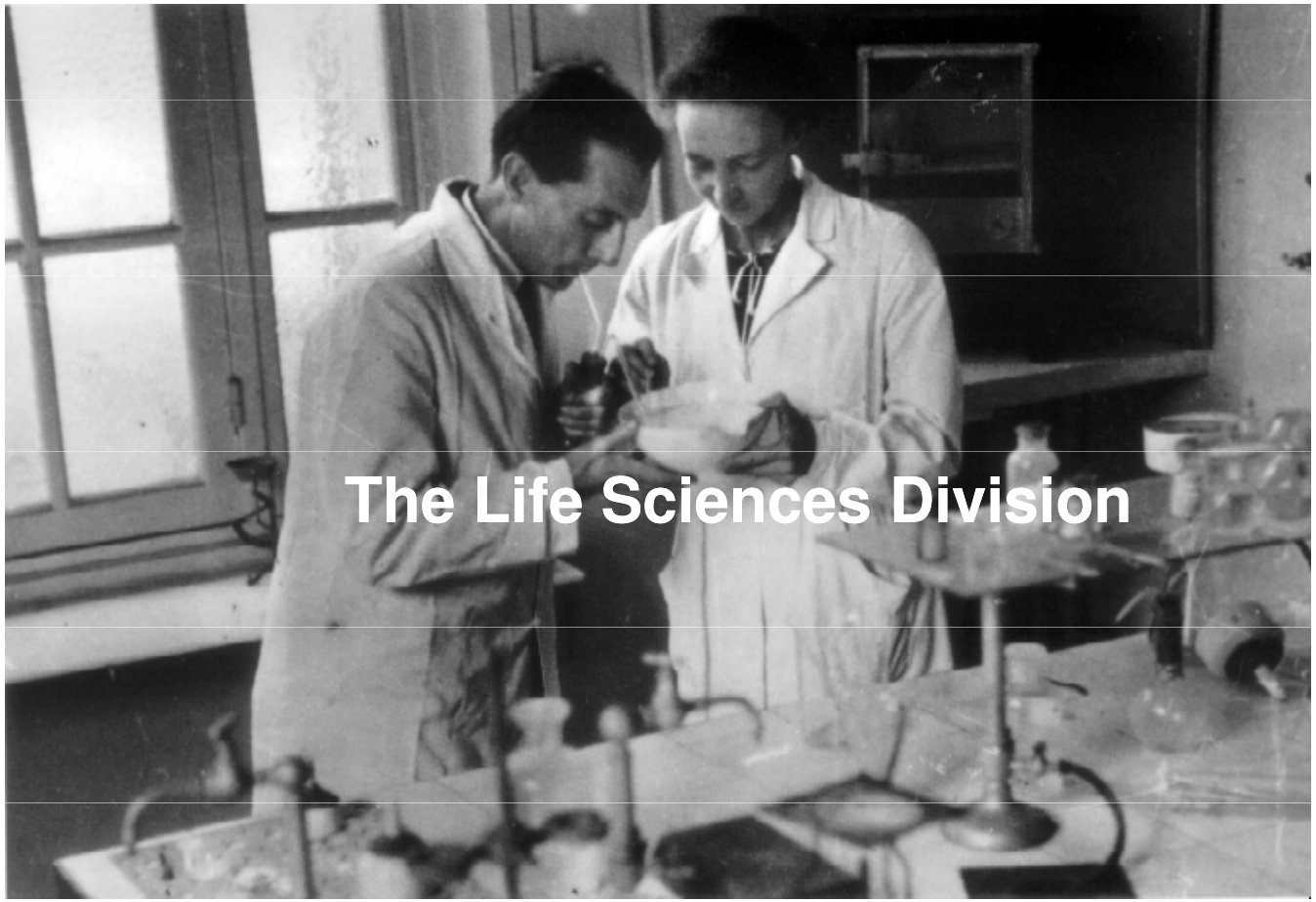
Technologies for Information and Health

Five operational divisions

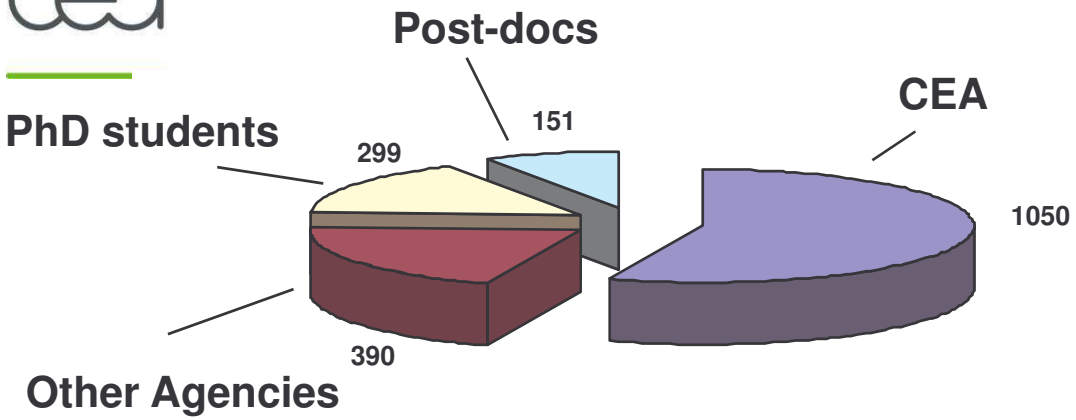


Five transverse programs

General presentation



Resources for Research (2006):



Total: 1890 researchers and technical staff in 2006

+ 230 people in 2007 (Genoscope and CNG)

Budget *for* Life Sciences: 180 M€ (including 50 M€ external resource)

Organization and programs:

8 institutes

Research programs

- **Radiobiology**
- **Environmental nuclear Toxicology**
- **Nuclear medicine**
- **Labelling, structure and engineering of Biomolecules**
- **Genomics and large scale biology**
- **Biotechnologies**
- **Security : nuclear, radiological, biological and chemical risks**

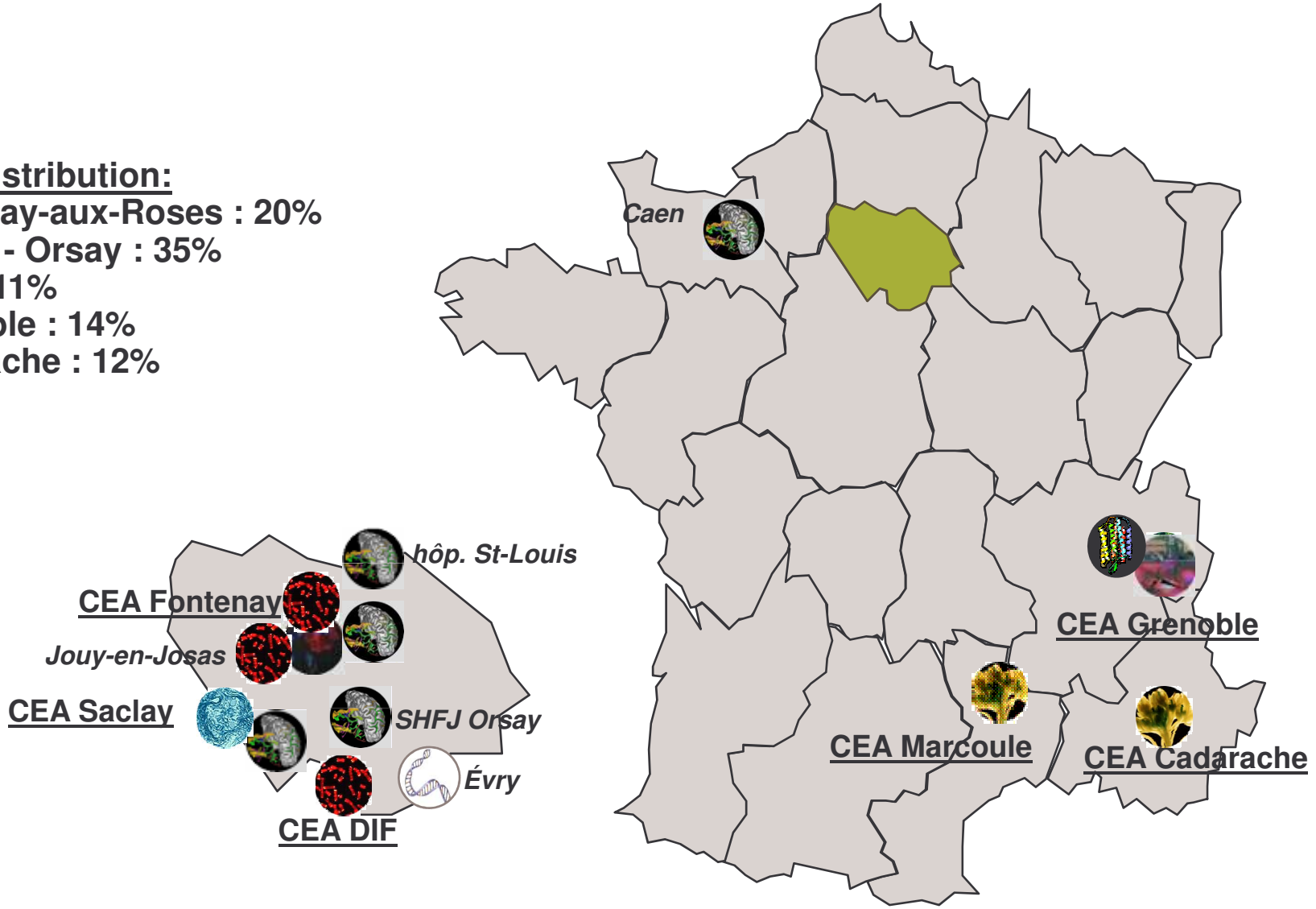
The Life Sciences Division (DSV)

National organization

Division of Life Sciences
Director : Gilles Bloch

- Institute of biology technologies Saclay (IBITEC-S)
  Michel Riva
- Institute of life sciences research and technologies (IRTSV)
  Jérome Garin
- Jean-Pierre Ebel Institute of structural biology (IBS)
  Eva Pebay-Peyroula
- Institute of environmental biology and biotechnology (IBEB)
  Thierry Heulin
- Fontenay-aux-Roses centre
  Malgorzata Tkatchenko
- Institute of molecular and cellular radiation biology (IRCM)
  Paul-Henri Roméo
- Institute of emerging diseases and innovative therapy (IMETI)
  Philippe Leboulch
- Institute of biological imaging (I²BM)
  Malgorzata Tkatchenko
- Institute of genomic (IG)
  Jean Weissenbach

Staff distribution:
Fontenay-aux-Roses : 20%
Saclay - Orsay : 35%
Evry : 11%
Grenoble : 14%
Cadarache : 12%



The Life Sciences Division (DSV)

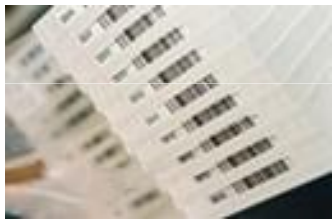
Technological facilities (in addition to genomics facilities)

Biochemistry for post-genomics

Infrastructures for research on Prion disease

***In vivo* imaging platforms**

Structural Biology Platforms



Screening facilities for bioactive molecules

Platforms for biochips

Proteomics Technological Platform

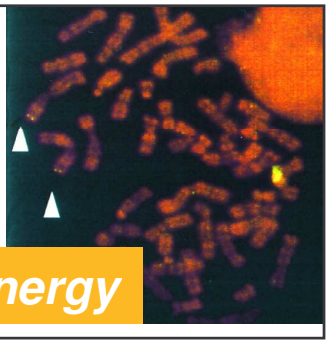
Platform for Phytotechnology

Infrastructures for research in radiobiology and nuclear toxicology

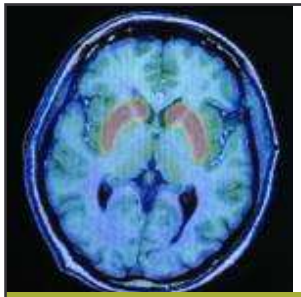
3 missions in line with the general strategy of CEA

❖ *Biological bases of a sustainable nuclear option*

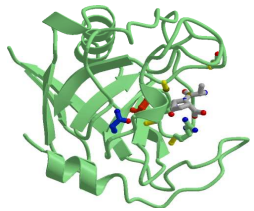
- The scientific nature of medical and environmental risks (radiobiology, environmental toxicology)
- Answer to public and political issues (e.g. low doses)
- Select and prepare experts for international agencies



Energy



❖ *Provide the health sector with technologies*



Technologies for health

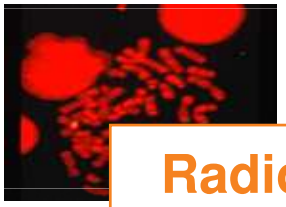
An original set of competences and facilities

- In vivo imaging and innovative labelling
- Biotechnologies
- Structural biology and protein engineering
- Computing, bioinformatics

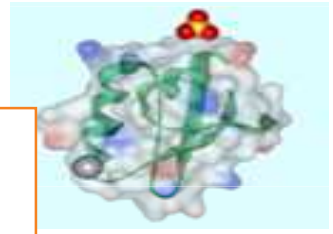
❖ *Knowledge and tools for biosecurity & biodefense*

- Emerging diseases (prion, virology)
- Bioterrorism (toxins, infectious agents)

Global security



Bio for safe nuclear energy



Radiobiology ⟷ **Nuclear toxicology**

Effects of ionizing radiations

- **Characterization of biological responses (molecular damages, cell and tissue response, cancerogenesis)**
- **Specific markers of exposure and response**
- **Markers of individual susceptibility**
- **Effects on germinal cells**

- **Entry routes in the biosphere and human** (from micro-organisms to plants and humans)
- **Mechanisms of toxicity** (radiological and/or chemical)

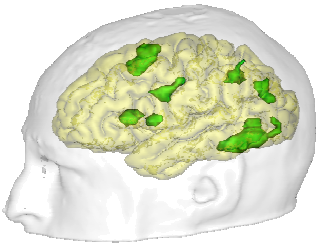
Radioprotection

- ➔ **Quantification of impact to human health**
- ➔ **Novel protection measures**

Medical imaging

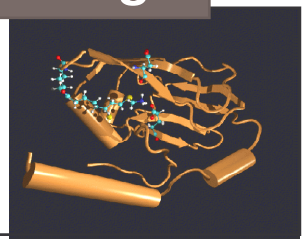
- **Methodologies:** TEP, MRI, multimodal animal imaging
- **Imaging of cognitive processes** (language, memory, calculation, …)
- **Nuclear medicine:** neurodegenerative diseases, psychiatry, oncology, cardiology
- **Imaging gene expression** (gene and cell therapy)
- **Drug discovery and development**
- **Image analysis**

SHFJ NeuroSpin MIRCen

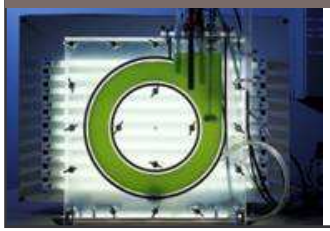


Biomolecules : Labelling, structure and engineering

- **Novel labelling concepts and methods**
- **Structure and function of biomolecules**
- **Protein engineering**



Biotechnologies

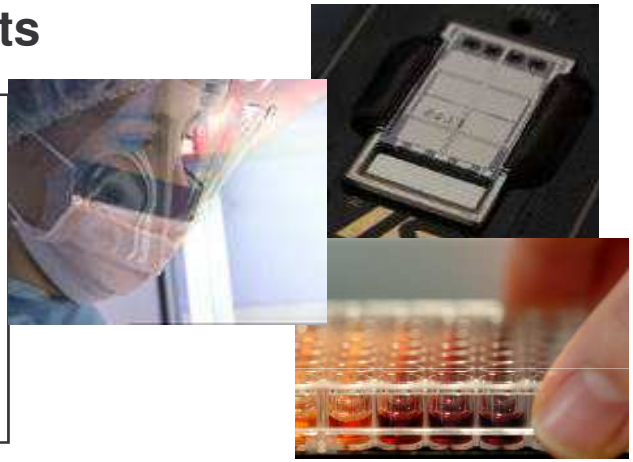


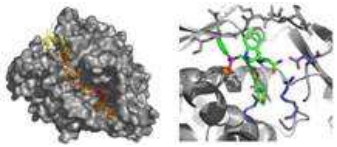
- **Diagnostics and medical monitoring**

  Methods for pharmacology and pharmacokinetics, biomarkers, assays for food and environmental safety
- **Biochips**
- **Bioenergy : bioinspired and biomass**

Mobilization against CRBN threats

- **Biomolecular technologies**
- **Knowledge of biological agents, dedicated facilities**
- **Microelectronics, sensors**





- **Characterization of current and potential threats** (toxins, virulence factors, genomes, antigens…)
- Novel **detection assays**
- **Medical protection** (vaccines)
- **Medical treatment** (HTS of drug leads, structure-based drug design)
- **Decontamination** (enzyme-based processes)

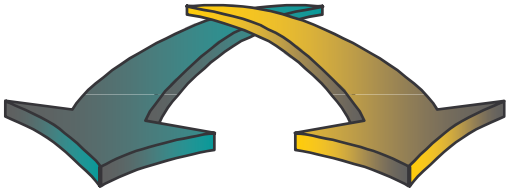
The Life Sciences Division (DSV)

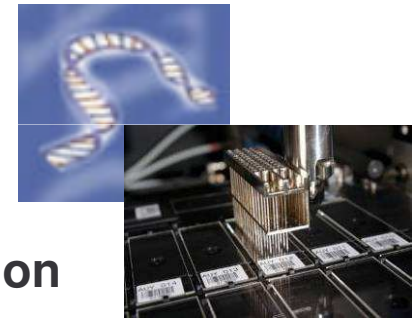
In 2007 integration to the Life Sciences Division of the CEA:

- **Genoscope - French National Sequencing Centre (CNS)**
- **French National Genotyping Centre (CNG)**

In association with an array of **post-genomic platforms** (manufacturing DNA chips, high speed screening, proteomic analysis, functional and structural studies, etc.)

Service to the scientific community
+ specific research projects





Complementary competences for innovation

- **High-throughput technologies development and bioinformatics applications**
- **Individual susceptibilities in radiobiology and toxicology**
- **Personalized medicine**

Web site:
http://www-dsv.cea.fr

Platforms

A unique research platform brain imaging with very high field NMR

- Development of **new concepts and designs for very high field MRI**

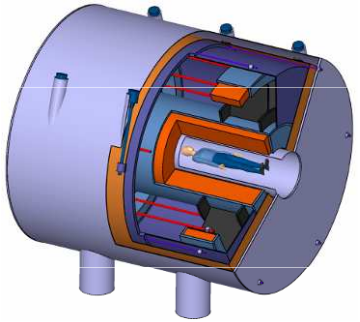
  design of a large bore, **11.7 T** magnet for **human** studies

4 very high fields magnets: 17T mouse, 3T human, 7T human, 11.7T human

- Development of new methods and concepts in data/image analysis and neuronal modeling for the cognitive sciences

- **High resolution anatomical and functional MRI** in humans, from newborns to adults

- Neurophysiology (electrophysiology) and neurochemistry in **non human primates** using very high field MR imaging and spectroscopy

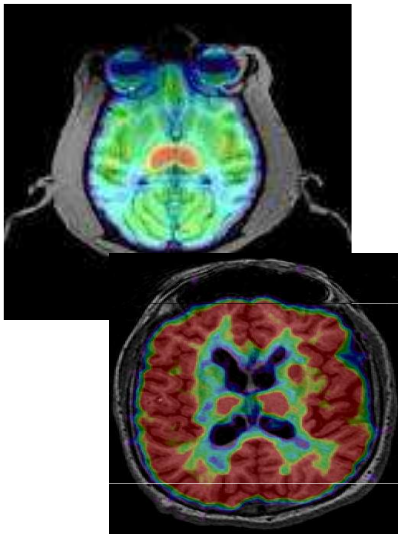


- Microscopic imaging of brain development and functional genomics of **transgenic mice**

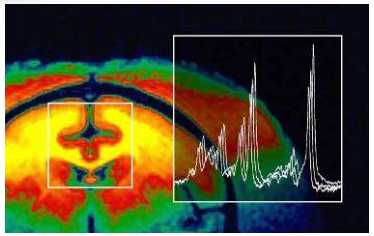
A pre-clinical imaging facility for gene and cell therapy

- **New facility under construction in Fontenay (CEA)** in collaboration with Inserm (primates, animal PET, MRI, MRS)

- Development of innovative therapies for **neurodegenerative diseases** including *ex vivo* and *in vivo* gene therapy
- Development of **primate models** for human diseases



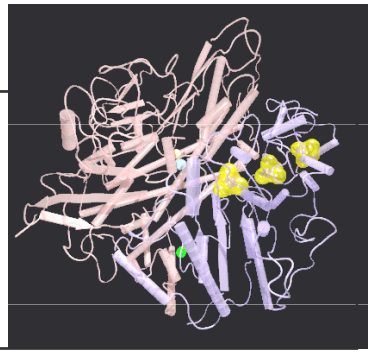
- **Pre-clinical trials in surgery**
- Development of technologies and assays for imaging molecular/cellular events in living animals (MRI, MRS, PET) especially for therapeutic monitoring and analyzing *in vivo* gene expression



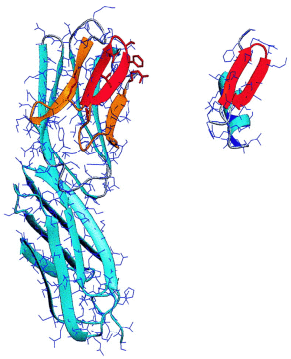
Isotopic labeling platform

Structure and Protein engineering

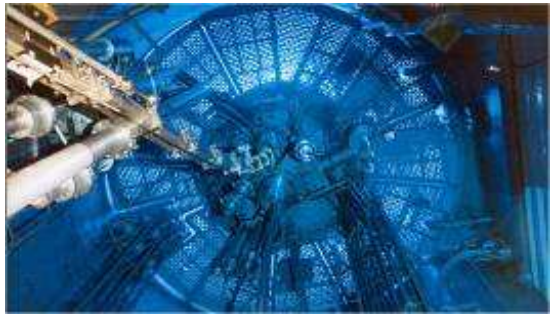
- **Isotopic labelling**
- **Radiation and detection**
- **Computer science**



- New methods of isotopic labeling and molecular labeling : chemical, enzymatic and/or genetic methods
- Structural and functional study of biomolecules :
  - - X-ray diffraction
  - - neutron scattering
  - - NMR
  - - Modelization, molecular dynamics
- Protein engineering: biotechnological applications

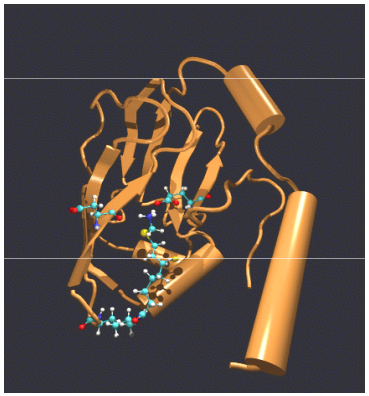


The tools for structural biology at the CEA



Neutron scattering :
Institut Laue Langevin

NMR Spectroscopy
(800 MHz) : CEA



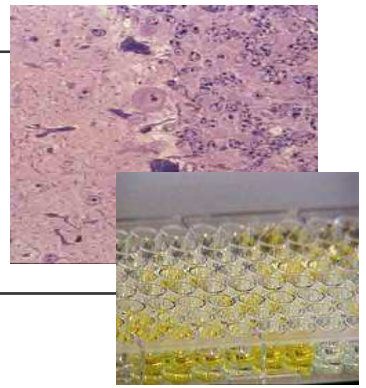
Grenoble CEA laboratories

X ray diffraction : ESRF

Modelization and
molecular dynamics

Emerging pathologies and innovative therapies platform

- **Isotopic labelling**
- **Diagnostic tests**
- **Ultrasensitive detection of biological molecules**



- **Prion diseases**
- **Chikungunya virus** (*la Réunion* island)
- **Avian flu**
- **…**
- Development detection and diagnostic tests
  - Antibodies
  - DNA (biochips)
- Evaluation of immune response (vaccines) and available treatments
- Techniques of decontamination

➢ ***A pre-clinical scientific research platform unique in Europe in terms of equipment (3600 m2) and scientific excellence***

➢ ***A space to accommodate industrial teams in biotechnological fields (1200 m2)***