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## 1946

**AT THE END OF THE WAR, THE CEA CENTRE OF FONTENAY-AUX-ROSES OPENED ITS DOORS WITH A MISSION: TO DEVELOP FRENCH NUCLEAR RESEARCH.**

Researchers, engineers and technicians have thus worked primarily in the fields of physics, nuclear energy and its applications, before embarking upon nuclear robotics. Since its creation, the centre has used radioactive tracers to study biological mechanisms and to conduct research on the effects of radiation on living organisms, particularly with radioprotection as an objective. The centre now dedicates its research to the life and health sciences.

**Discover the results of this work in 10 key achievements.**

### Zoé, a discovery gallery

The hall of the Zoé reactor, transformed into a discovery gallery, displays these 10 key research projects conducted at the CEA of Fontenay-aux-Roses. This space is open to the public every year during the European heritage days (*Journées européennes du patrimoine*) or the national French event Science Fair (*Fête de la science*). Group visits can also be organised on request.

**Contact**  
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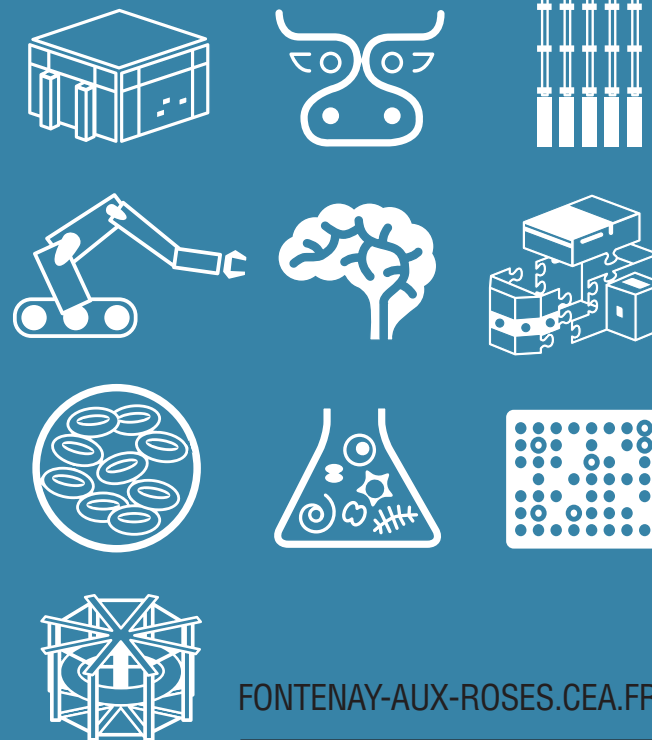


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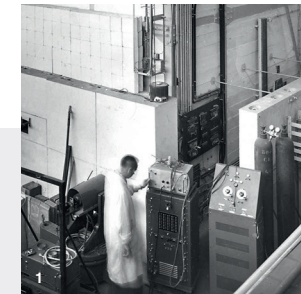
## CEA CENTRE OF FONTENAY-AUX-ROSES

# 10 KEY ACHIEVEMENTS

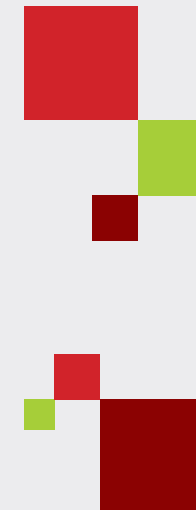
FROM 1946 TO TODAY...



FONTENAY-AUX-ROSES.CEA.FR



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**French Alternative Energies and Atomic Energy Commission (CEA)**  
Centre de Fontenay-aux-Roses  
18, route du Panorama – B.P. 6  
92 265 Fontenay-aux-Roses Cedex  
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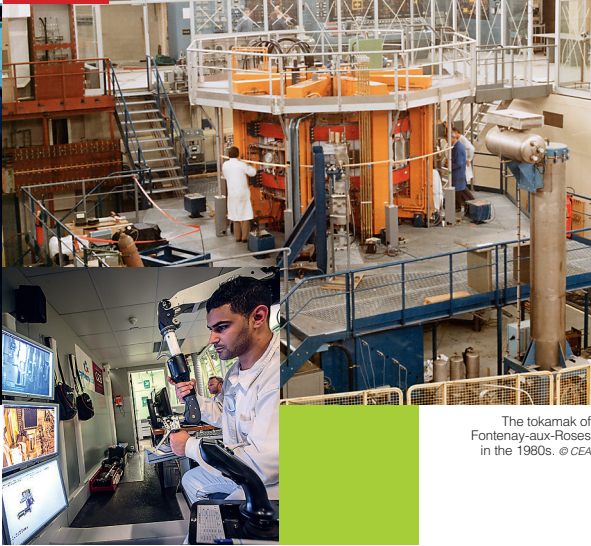
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1/ The Zoé reactor © Archives CEA 2/ Maurice Surdin, Frédéric Joliot-Curie and Lew Kowarski next to the Zoé control room © Archives CEA 3/ Removing radioelements from the Zoé reactor © Archives CEA 4/ Prion diagnostic test © CEA/L.Godart 5/ The Triton reactor core © CEA/Pierre Jahan



Tracking gene therapy targets against Parkinson's disease by teleradiography. © AP/HP



The tokamak of Fontenay-aux-Roses in the 1980s. © CEA

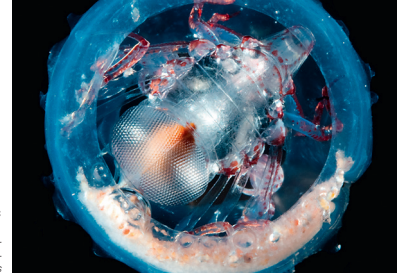
Telemanipulation of the Maestro arm. © CEA



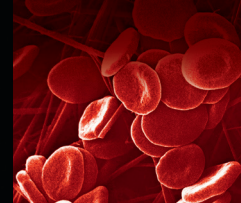
### TFR (TOKAMAK FONTENAY-AUX-ROSES), THE FIRST FRENCH TOKAMAK

A tokamak is a machine that can heat gases to millions of degrees. The objective is to study the possibility of producing energy by nuclear fusion, taking its inspiration from the reactions at the sun's core. The TFR was in service from 1973 to 1986, and obtained a world record temperature of 20 million degrees in 1976. The CEA now pursues its fusion research at Cadarache with the Tore Supra tokamak, and the international project ITER.

Planktonic organism. © M. Ormestad-Kahikui-Tara-Oceans



Red blood cells. © Inserm



### 40 MILLION NEW PLANKTONIC GENES

The Genoscope of Evry, attached to the CEA of Fontenay-aux-Roses, is sequencing all of the plankton populations that were sampled during the worldwide Tara Oceans expedition. More than 40 million planktonic genes were thus discovered in 2015. These genes could be a source for new therapeutic molecules or for industrial interest.



### A WORLD PREMIERE IN THE FIGHT AGAINST A GENETIC BLOOD DISEASE

In 2010 a patient with the most severe form of beta-thalassemia (a blood disease that affects 40,000 new-born babies in the world each year) was treated with a gene therapy developed at the CEA of Fontenay-aux-Roses, in collaboration with Saint-Louis hospital, Necker hospital and the company Bluebird Bio. Clinical trials are continuing with success.



### ZOÉ, THE FIRST FRENCH NUCLEAR REACTOR

The first French "atomic pile" was activated on December 15, 1948 at 12:12 pm. Named Zoé (*Zéro énergie, zero energy – Oxyde d'uranium, uranium oxide – Eau lourde, heavy water*), this reactor was operated until 1976 for the study of physics and nuclear materials, to calibrate detectors and measuring instruments, to supply radioelements for medicine and science, to train personnel in piloting reactors, and to help lay the foundations of radioprotection.



### THE WORLD'S BEST-SELLING "MAD COW DISEASE" TEST

In the midst of the mad cow disease crisis, researchers at the CEA of Fontenay-aux-Roses and Saclay developed in several months a diagnostic test for prions, the agent of this disease. This test has been used in slaughterhouses since 2001 to remove sick animals from the food industry. The aim of this is to avoid transmission of prions to humans, in whom it induces a variant of the neurodegenerative Creutzfeldt-Jakob disease. This was the most widely adopted test in the world, with more than 60% of the global market.



### TRITON, THE FIRST FRENCH DISMANTLED NUCLEAR REACTOR

The complete dismantlement of Triton, an experimental nuclear reactor that was in service at Fontenay-aux-Roses from 1959 to 1982, was completed in 2004. This event was the first of its kind in France. The decommissioning technical operations that were performed have made it possible today to accommodate research facilities for infectious diseases and innovative therapies on this site.



### DISTINGUISHING THE ORIGIN OF CANCERS

As the result of a collaboration between the CEA of Fontenay-aux-Roses, the Gustave Roussy Cancer Center and the Pasteur hospital in Nice, genetic markers that were identified in 2011 and 2013 have made it possible to recognise the origin of certain cancers, such as thyroid cancer. These "signatures" allow to distinguish between spontaneous tumours and those caused by radiotherapy or a nuclear accident (*i.e. radio-induced*).



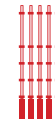
### MAESTRO, THE FIRST ROBOT ARM THAT IS RESISTANT TO RADIOACTIVITY

Maestro is an articulated "arm" ending in a multifunction "hand" that has been designed to resist extremely strong radioactivity. Developed in large part at Fontenay-aux-Roses in collaboration with IFREMER and the company Cybernetix, Maestro was put into service in 2015. This arm makes it possible to intervene wherever the level of radioactivity prevents access by workers, and can be used to disassemble, cut, measure, decontaminate, etc.



### A WORLD PREMIERE IN THE FIGHT AGAINST PARKINSON'S DISEASE

In 2014, fifteen people with Parkinson's disease were able to recover a large part of the control over their movements, thanks to an innovative therapy developed in collaboration between the CEA centre of Fontenay-aux-Roses, the Henri Mondor hospital of Créteil, the University Paris-Est Créteil and the company Oxford Biomedica. Research is ongoing in order to further improve the process.



### PUREX, A PROCESS FOR RECYCLING NUCLEAR FUEL

PUREX (Plutonium Uranium Refining by Extraction) is a chemical process devised in the United States, which makes it possible to extract uranium and plutonium from spent nuclear fuel. The uranium and plutonium are then reused to produce energy, by being recycled into new fuels. The CEA of Fontenay-aux-Roses has worked on this process since 1954 in order to industrialize it. PUREX has thus been used in the reprocessing plant of La Hague since 1967.



Microscopy section of a thyroid gland invaded by a malignant tumour. © CEA

Pulsed column in the PUREX process. © P. Stroppa/CEA