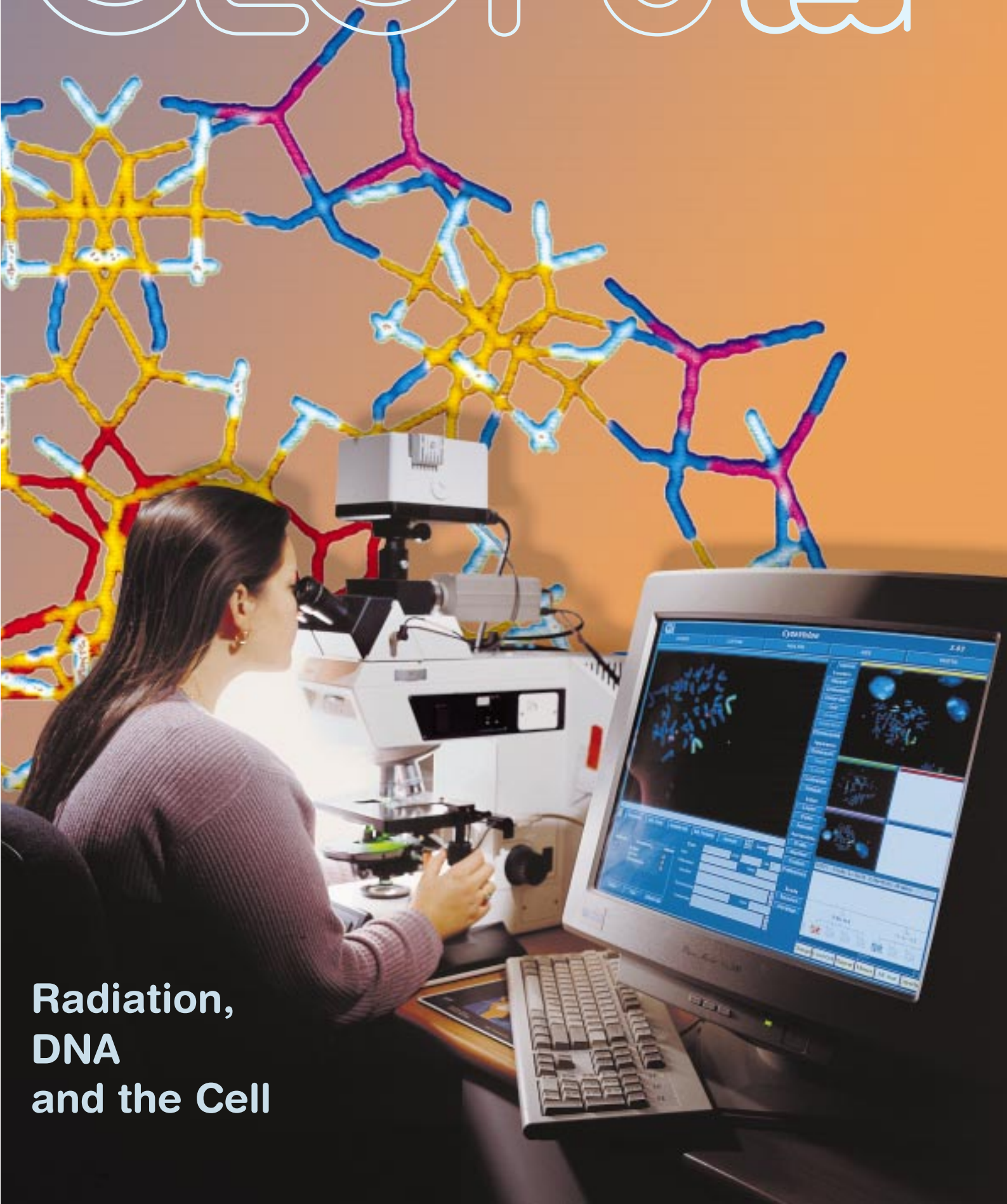


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**Radiation,
DNA
and the Cell**

Editorial

The fresh impetus enjoyed by research in the field of radiobiology over the last few years, especially in France, is reason enough to review the state of knowledge concerning the action of ionizing radiation on living matter. Such a review is the purpose of this issue of *Clefs CEA*, in which we present a sum of sound scientific information on this topic. It shows how researchers at CEA (which has been assigned a pilot mission by the public authorities), in close collaboration with those of other research bodies and academia, are making an active contribution to achieving a fuller and deeper understanding of how radiation acts on DNA, the cell and tissues.

The basis on which this issue is organized is the timescale that characterizes the biological action of radiation and the reactions of the organism. The first part thus deals with the initial events at the DNA and cell levels, which take place in a tiny fraction of a second. The second part focuses on the response of the organism in the seconds, minutes and hours that follow. The third part looks at the events that, on a scale of years or even generations, can ensue from faults in the mechanisms that in the vast majority of cases allow damage to be repaired, or at least elimination of cells that are too badly impaired.

A last more general contribution describes how an international body like the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), whose job it is to evaluate the health impact of ionizing radiation, has organized the integration of progress in scientific research. Though all may not yet be known in fine detail, experts are able to provide authorities with the best available scientific basis on which to draw up standards with wide safety margins to ensure the protection of workers and the general public.

The concepts used in biology are highly specific and often unfamiliar. This issue therefore includes material intended to make the reading easier, including boxes in which basic notions are explained, and a glossary. Some readers will not need them; we hope others will find them helpful.

In both its form and content this issue of *Clefs CEA* is the first of a series, each one of which will present the work and results of CEA on a strategic scientific or technological topic, and the context in which the work is conducted and the results achieved. The next issue will present a panorama of the contributions made by our organization to new energy technologies.

Anne-Marie Birac

Chief Editor

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Radiation, DNA and the Cell

FOREWORD by *Ethel Moustacchi*

IONIZING RADIATION AND LIVING MATTER

(different types of radiation, definitions, units, experimental means)

I. DNA LESIONS

INTRODUCTION by *Christine Jimonet*

RADIATION-INDUCED DAMAGE TO NUCLEIC ACIDS by *Jean Cadet*

BOX A: DNA molecule, heredity vector

STRUCTURAL ANALYSIS OF RADIO-INDUCED LESIONS OF DNA

by *Yves Boulard and Georges Victor Fazakerley*

BOX B: Replication of DNA: near-perfect fidelity

RADIOLYSIS OF WATER by *Bernard Hickel*

PHYSICAL TOOLS FOR STUDYING RADIO-INDUCED LESIONS by *Pascal Pihet*

II. EARLY RESPONSES AND REPAIR PROCESSES

INTRODUCTION by *Marie-Claude Gaillard*

THE CARETAKERS OF THE GENOME. Repair of DNA Lesions Induced

by Ultraviolet-light and Ionizing Radiation by *Serge Boiteux, Juan Pablo Radicella and Sylvie Chevillard*

BOX C: Chromosomes, material supports for genes

Ionizing Radiation-RESISTANT BACTERIA by *Marie Libert*

EFFECTS OF RADIATION ON THE CELL DIVISION CYCLE. Using Yeasts as Models

by *Carl Mann and Marie-Claude Marsolier*

BOX D: The cell, the essential link

BOX E: The cell division cycle: under control duplication

RADIATION-INDUCED GENES by *Odile Rigaud and Michael Kazmaier*

BOX F: Amino acids, the chemical alphabet of proteins

CELL SUICIDE by *Évelyne May and Hervé Coffigny*

Effects of Ionizing Radiation. THE MEASURABLE CONSEQUENCES AT THE LEVEL

OF THE CELL by *Philippe Voisin*

III. LATE RESPONSES

INTRODUCTION by *Christine Jimonet*

CHROMOSOMIC INSTABILITY by *Françoise Hoffschir and Laure Sabatier*

RADIO-INDUCED CANCERS. Study on Cell Cultures by *Catherine Luccioni*

RADIO-INDUCED GENETIC RISK ESTIMATED by *Bernard Dutrillaux*

FROM THE CELL TO MAN

FROM RESEARCH TO REGULATIONS by *Anne Flüry-Hérard*

CORRESPONDENCE SCALE OF LEVELS OF EXPOSURE TO IONIZING
RADIATION AND EFFECTS ON HEALTH

GLOSSARY

(words appearing in **boxes** and in **the glossary** are respectively printed in **red** or in **blue**
in corresponding texts at their first occurrence)

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The fundamental and technical progress of recent years in human genetics and molecular biology have made major advances possible in radiobiological research. Here: a cytoviewing apparatus processing images of genetic material obtained by fluorescence, on a background of a transverse section of a DNA.

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■ NEW ENERGY
TECHNOLOGIES

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