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# OBITUARY

**EUGÈNE ROUX, 1924–1985**

Eugène Roux was 61 years old when he died from cancer on August 21, 1985. His name will remain associated with the initiation, in France, of isotopic and spectroscopic approaches of photosynthesis.

He was born in 1924 in Bourg de Péage (Drôme), where both his father and mother taught at the local gymnasia. The family however soon moved to central France, where Eugène spent his childhood and youth. He lived there through the events of world war II, which deeply affected him throughout his life.

Despite these troubled times, he successfully passed the competitive entrance examination to the National Institute of Agronomy, which he entered in 1945. The teaching given at that time at 'Agro' was extremely classical. It included more classical botany than plant physiology, and very little photosynthesis, if any. This was nevertheless enough to trigger in Roux's mind a lifelong interest in photosynthesis. Remarkably enough, at the same time, he realized that the future of photosynthesis research had to involve physicochemical approaches, and he thus decided to complement his training by taking courses in physics and physicochemical biology at the Sorbonne faculty in Paris. He was initiated to research by a one year stay in the laboratory of Gabriel Bertrand, at Institut Pasteur, where he studied several elements using atomic absorption spectrography.

In 1948, graduating as an agronomy engineer, he entered the National Institute for Agronomic Research (INRA). At the Versailles unit of INRA, he built from scratch a spectroscopy laboratory, and initiated the use of radioactive tracers in metabolic studies of the photosynthetic cell. These methods, coupled to chromatographic and electrophoretic techniques, enabled him, in particular, to show that the balance of $^{14}CO_2$ incorporation into proteins versus sugars depended on the wavelength of the light used to grow the cells. These results, which later were shown to be due to a wavelength dependency of the relative amounts of photoproduced NADPH and ATP, were among the very first to show that higher plant photosynthesis does not merely involve a single photochemical event.

His continued interest in developing isotopic methods in photosynthesis and plant physiology led him, in 1954, to accept the offer from Prof. Jean Coursaget to join the Biology department that he was creating in the French Atomic Energy Commission (Commissariat à l'Energie Atomique, CEA) at Saclay. There, Eugène Roux started a photobiology group specializing in photosynthesis. During the following 30 years, he made full use of the large technical and intellectual resources of this organization, in order to build one of the leading groups in photosynthesis research. He also made significant contributions to the creation and development of the radioagronomy unit of CEA, in the Cadarache facility.

In the early days of the group, his interests included biosynthesis of chlorophylls, which were followed using $^{14}$C-glutamic and -$\delta$ aminolevulic acids. Also, the origin of photosynthetic oxygen always preoccupied him. Direct photolysis of water, because of the large free energy change involved, appeared unlikely to him, and led him to hypothesize the involvement of metaphosphate ions. Although not confirmed by experiment, this idea induced him to use $^{18}O_2$ as a tracer and to have quantitative gas analysis methods developed by Pierre Guérin de Montgareuil. These methods have been further adapted very successfully, in Cadarache, to measurements of gaseous exchanges by whole higher plants. A third, permanent interest of Roux was in ATP synthesis. There also he pioneered, in France, the use of isotopic labelling. Later, always preoccupied by ultimate molecular mechanisms, he was never fully satisfied with the chemi-

osmotic theory, which he considered as giving dangerous 'intellectual comfort' to many scientists in the field. This early period of the CEA photosynthesis group included his coorganizing the first international congress on photosynthesis, which was held in Gif sur Yvette in 1962. It was also the period during which E. Roux established several friendly contacts, most of them very long lasting, with leading foreign scientists, in particular from eastern European countries.

Ultimately, a detailed understanding of primary phenomena, on the molecular and atomic levels, from light absorption to ATP synthesis, constituted the constant and essential preoccupation of Eugène Roux. In order to progress towards this goal, he gradually constituted a multidisciplinary group at Saclay, which, over the years, mastered the application of a large set of complementary methods for probing the photosynthetic membrane; in addition to isotopic labelling, and chromatographic and electrophoretic techniques, cited above, many spectroscopic methods were developed, including time-resolved (down to picoseconds) absorption and emission electronic spectroscopies, linear and circular dichroism, infrared and resonance Raman spectroscopy, electron paramagnetic resonance and, more recently, nuclear magnetic resonance. A successful matching between the unusual personality of E. Roux and the utmost variety of his colaborators' origins and training (e.g., in biology, biochemistry, physical chemistry, chemistry, physics and theory) led to the success of this research group. Indeed, E. Roux combined an original, often iconoclastic scientific mind, with an absolute liberalism towards the thoughts and actions of his younger collaborators. He never compelled any of them to work along one of his own views. These indeed could just be taken as provocative, stimulating invitations to look beyond the current fashion or prevailing dogma.

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