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40th anniversary of CERMAV

On September 29, 2006, the *Centre de Recherches sur les Macromolécules Végétales* (CERMAV) celebrated its 40th anniversary of scientific activities in the field of polysaccharides and carbohydrates. This celebration provided a unique opportunity to share some key features and accomplishments by CERMAV's researchers with the polysaccharide community worldwide.

CERMAV (http://www.cermav.cnrs.fr/) is a research unit of the *Centre National de la Recherche Scientifique* (CNRS) of the French government. Created in 1966, this center was one of the first institutes to be built on the new campus of the University of Grenoble. Located on the banks of the Isère river, CERMAV is positioned between the Biology and the Chemistry Department of the University on one side, and the Pulp and Paper Technical Center and EFPG, Engineering School on the other. An expansion in 1991 increased the size, by about 50% of the initial floor space, to 3500 m^2. The staff is composed of 22 researchers of CNRS, 10 members of the University faculty, 25 engineers and technicians, and approximately 60 visiting scientists, postdoctoral fellows and PhD students.

The initial goal of CERMAV was to conduct fundamental research on plant chemistry and biochemistry with a strong emphasis on cellulose science. This mandate was later broadened to include also (molecular) biology and physical chemistry of polysaccharide-based materials of both plant and bacterial origin. Today, the goals of CERMAV research are fourfold:

1. Fundamental knowledge of the major constituents of biomass.
2. Biologically active oligo- and polysaccharides.
3. Biosynthesis and biodegradation of oligo- and polysaccharides.
4. New polysaccharide-based materials.

In pursuit of these goals, CERMAV is organized into five distinct research teams:

1. Structure and function of polysaccharides. The overall goal is to establish general structure–property relationships of polysaccharides. A fundamental understanding of the chemical and molecular structure is perceived to be the key to gaining a better insight into the roles polysaccharides play in many recognition phenomena. Research expertise covers the fields of oligo- and polysaccharides including their structural characterization, chemical modification, and conformational analysis, along with the associated physico-chemical and functional properties that are important for such applications as cosmetics, pharmaceuticals and biomedical materials.

2. Structure and properties of glycomaterials. Using environmentally friendly ways to study the components of plant biomass, ultrastructural and morphological characterizations are performed that yield vital insight into the three-dimensional structures and architectures of biomaterials on all levels of dimension, from the nano- to the millimeter-scale. Various glycomaterials are then used in such applications as colloidal suspensions, nanocomposite materials and others, either in their native form or following chemical or enzymatic modification. One line of research involves the development of 'chromato-

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genic chemistry', which aims at producing controlled surface modifications of biomaterials.

3. Glycochemistry and molecular enzymology. Understanding the relationship between structure and function of natural and synthetic oligosaccharides forms the basis of glycobiology. New methodologies for the production of natural and man-made oligosaccharides employ enzymatic and biotechnological processes that provide new tools for structural and functional enzymology, and that have applications in human nutrition, therapeutics and the agrochemical industry.

4. Molecular glycobiology. Studies on structure–function relationships focus on glycosyltransferases, including their sequence analysis, molecular biology, crystallography and molecular modeling; on aspects of the engineering of glycosyltransferases; on structural characterizations of oligosaccharides and nucleotide–sugars; and on protein–carbohydrate interactions.

5. Biochemistry of plant cell walls. Questions of the assembly and supramolecular organisation of plant cell walls are closely related to structure–property relationships in pulp fibers and wood materials, among many others. Studies on the characteristics of plant cell walls are assisted by the preparation of new immunological probes for in situ visualizations and characterizations of lignins and polysaccharides.

CERMAV operates *six organizational units* that offer researchers an accessible and functional environment for experimentation, and these include nuclear magnetic resonance, mass spectroscopy, electron microscopy, computing, X-ray crystallography, and access to scientific literature. This organization allows the sharing of facilities and expertise for tackling complex problems. In addition, CERMAV operates facilities that offer a wide range of techniques, such as ion-chromatography, SEC, HPLC, rheology, optical microscopy, microcalorimetry, static and dynamic light scattering, as well as local access to large instrumentation (neutron reactor at the Institut Laue Langevin, the European Synchrotron Radiation Facility, and solution and solid-state high-resolution NMR spectroscopy).

CERMAV has been affiliated with the *Université Joseph Fourier* (UJF) of Grenoble since 1966, and this affiliation has produced strong and active interactions with three teaching and research departments (Chemistry, Biology, Science and Technology), which provides their faculty and students with the ability to conduct research at the institute, and which lets CNRS researchers take part in undergraduate and postgraduate training. Teaching undergraduate and graduate students is an integral part of CERMAV's mission. Researchers are routinely involved in the teaching at the *Doctoral School of Chemistry and Life Sciences*. In 2004, CERMAV received the support of the European Commission for the *Marie Curie Host Fellowship* program for Early Stage Research Training in the area of Glycosciences. The partnership with UJF has been an important contributor to the success of CERMAV and to achieving its national mission. The constant interaction between teaching and research, and the location of CERMAV are two essential factors that have contributed to the impact CERMAV and its staff have had (and continue to have) on the field of polysaccharide science and technology, on the preeminence of UJF as an educational institution, on the continued health of many French life and health science corporations, and on the careers of many former students and associates.

At the *international level*, CERMAV is involved in several European networks and maintains relationships with approximately 40 foreign laboratories and institutes. There are many collaborative activities with developed and developing countries that are contributing to the high recognition CERMAV and its members are receiving worldwide.

CERMAV is involved in the dissemination of scientific information. In its 40-year history, 210 theses, 100 patents, and 2050 original scientific articles have been contributed. Participation with the *French Group of Polymers* (GFP) enabled the publication of 14 textbooks for students and teachers at the university level, as well for industrial researchers. Strengthened by their expertise in the areas of information technology, researchers have been involved in the compilation of data (available to the general scientific community) based on three-dimensional structures of carbohydrates, and they have been able to study interactions of polysaccharides with proteins.

The research projects CERMAV is involved in are developed through various contracts with industrial partners and public institutions, nationally and internationally. This creates an effective climate for economic development and the transfer of technology. New features are economic developments in the private sector, which arise from basic research, and which assist in the incubation of spin-off companies in biotechnology.

Forty years of excellence in research on polysaccharides have allowed CERMAV to advance the understanding of plant polymers, and this has been recognized as a priority at the European as well as the worldwide level: development of resources of biomacromolecules for new applications in cosmetics and health care products, effective utilization of biomass for value-added materials, and environmental preservation are all related to the goal of achieving planetary sustainability.

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