

CERMAV
Centre de Recherches sur les Macromolécules Végétales
<http://www.cermav.cnrs.fr/>



On September 29, 2006, CERMAV celebrates its **40th anniversary** of scientific activities in the field of polysaccharide and carbohydrate molecules. This celebration provides a unique opportunity to share, with our world-wide scientific community, some key features and accomplishments of our research institute.

CERMAV is a research unit of the **Centre National de la Recherche Scientifique (CNRS)**. Created and built in 1966, this institute was one of the first buildings to be erected on the new university campus of Grenoble. Located by the Isère river, CERMAV stands between the Biology Department and the Chemistry Department of the University, and the Pulp and Paper Engineering School. In 1991, it was extended by 50% of its initial surface (now 3500 m²). CERMAV staff consists of 22 researchers of the CNRS, 10 teaching-researchers of the University, 25 engineers and technicians, and approximately 60 visiting scientists, postdoctoral fellows and PhD students.

The aim of CERMAV is to conduct **fundamental research**. Initial efforts were targeted on plant chemistry and biochemistry with a strong emphasis on cellulose science. However, these activities were later redefined and extended to the biochemistry, biology, chemistry and physical chemistry of polysaccharide materials of both plant and bacterial origin. Today, the aim of CERMAV research is four fold:

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

CERMAV is organized into **five research teams**:

1. **Structure and function of polysaccharides**: The overall goal is to establish relationships between structure and properties. Fundamental structural knowledge is a key step towards a better understanding of the roles played by polysaccharides in many recognition phenomena. Research expertise covers the fields of oligo- and polysaccharides including their structural characterization, chemical modifications, conformational analysis, along with the associated physico-chemical and functional properties, and applications in cosmetics and biomedical domains.
2. **Structure and properties of glycomaterials**: Using environmentally friendly ways to study the components of plant biomass, ultrastructural and morphological characterization are performed yielding key information about the three-dimensional structure and architectures, along with nano-biomaterials. These are then later used either in their native form or after chemical and enzymatic modifications. The applications are many fold in the field of colloidal suspensions, nanocomposite materials,... One line of research involves the development of 'chromatogenic chemistry' with the aim of making controlled surface modifications of these bio-materials.

3. **Glycochemistry and molecular enzymology:** Synthesis of oligosaccharides for the study of structure/function relationships in glycobiology; new methodologies for the production of natural and non-natural oligosaccharides by enzymatic synthesis or via a biotechnological processes (new tools for structural and functional enzymology, with applications in human nutrition, therapeutics and the agrochemical industry).
4. **Molecular glycobiology:** Structure-function studies of glycosyltransferases (sequence analysis, molecular biology, crystallography and molecular modeling); engineering of glycosyltransferases; structural characterization of oligosaccharides and nucleotide-sugars and protein-carbohydrate interactions
5. **Biochemistry of plant cell walls:** Assembly and supramolecular organisation of plant cell walls, structure-property relationships in pulp fibres and wood materials, preparation of new immunological probes for *in situ* visualization and characterization of lignins and polysaccharides.

Six functional units offer the scientific community an accessible, functioning experimental environment to include nuclear magnetic resonance, mass spectroscopy, electron microscopy, computing, X-ray crystallography, and access to scientific literature. This arrangement allows the sharing of facilities and expertise for tackling complex problems. In addition, CERMAV possesses a wide range of techniques (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, European Synchrotron Radiation Facility and solution and solid state high resolution NMR spectroscopy).

CERMAV has been associated with the **Université Joseph Fourier (UJF)** since 1966, cemented by the important feature which allows supervisors of three Teaching and Research Departments (Chemistry, Biology, Science and Technology) to conduct research and lets CNRS researchers take part in supervising undergraduate and postgraduate training. This partnership with the UJF is an important contributory factor in the realization of the national mission statement; the presence of teaching-researchers and its location on the campus are two essential factors which explain the strong involvement of the staff in training and educational actions. Complementing the mission requirements of the research supervisors, researchers are involved in the teaching of undergraduate and graduate students. Naturally the studies at the doctoral levels remain in a privileged domain within the framework of the doctoral schools, in particular as part of the **Doctoral School of Chemistry and Life Sciences**. In 2004, CERMAV has received the support of the European Commission under the **Marie Curie Host Fellowship** for Early Stage Research Training in the area of Glycosciences.

At the **international level**, CERMAV is involved in European networks and maintains relationships with approximately 40 foreign laboratories and institutes and there are many collaborations with developed and developing countries.

The scientific topics of CERMAV are developed through various research contracts involving many links with **industrial, national and international partners**, providing an effective climate for economic development and the transfer of technology. New features are economic developments arising from basic research studies, and the setting up of spin-off companies in biotechnology.

CERMAV is involved in the spreading of **scientific information** (210 thesis, 100 patents, and 2050 original papers); participation with the French Group of Polymers (GFP) allowed to publish 14 books for students and teachers of University, as well for industrial researchers. Strengthened by their expertise in the area of new information technologies, researchers have been involved in the compilation of **data bases** on three-dimensional structures of carbohydrates and interacting proteins (available to the wider scientific community).

40 years have allowed CERMAV to achieve strong basic knowledge on actual topics, recognized as a priority at European and worldwide levels: environment preservation, biomass valorization, development of natural sources of molecules for new applications in cosmetics and medical and pharmaceutical domains.