



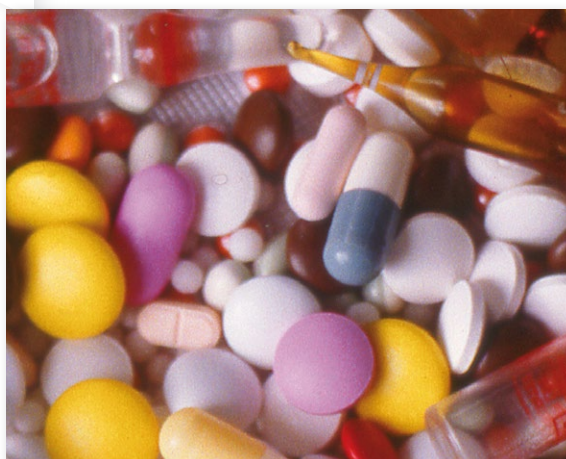
# Pharmacy

**I**n an aging population and with the increasing demand for personalized care, finding solutions to prevent and treat neurodegenerative and cardiovascular diseases, understanding the mechanisms of emergence of viral diseases and developing a network of clinical, pharmaceutical and engineering expertise are the main challenges facing the pharmaceutical industry.

The essential need of the sector is to steer R&D efforts towards a more global approach where basic and clinical research are conducted in parallel. The areas of research concerned are the development of bio-medicines to treat diseases with high unmet needs, increasing the bioavailability of active principles, the development of methods of drug administration that are easier and more comfortable for patients, pharmacogenomics and high throughput screening.

## **The advantages of synchrotron radiation at SOLEIL**

- Access to the molecular organization of biomolecules down to the atomic scale, to understand and predict their behavior.
- Determination of the structural footprint of crystalline materials, for finding counterfeits or studying polymorphism in pharmaceutical powders.
- Access to the structural properties of poorly or non-crystalline materials (colloids, suspensions, etc.).
- Significant increase in spatial resolution for chemical imaging, on the tissue, cellular and intracellular scale.
- Visualization of the internal structures of a biological sample without the use of contrasting agents and hydrated cell imaging at very high spatial resolutions.



## **Main synchrotron applications for the sector:**

- Determination of the three-dimensional structure of biomolecules and their complexes
- Diagnosis of healthy or pathological state of cells and tissues
- Distribution and cellular and/or tissue localization of drugs
- Improved radiographic quality and tomographic reconstruction of tissues and biomaterials, on the nano- and micro scale
- Multi-scale molecule-cell-tissue investigations, prior to preclinical trials.



### **Pharmacy contact:**

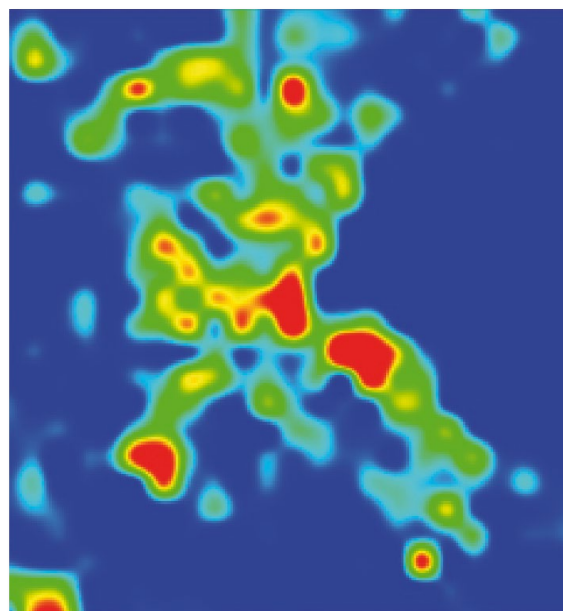
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## Early diagnosis of hereditary renal disease

Under the term «kidney stones» are grouped many different diseases, some of which, including hereditary nephrolithiasis, may progress to end stage renal disease in the absence of diagnosis and appropriate early treatment.

With micro-infrared spectroscopy on the SMIS beamline at SOLEIL it is possible to highlight the presence of crystals, in kidney biopsies, of dihydroxyadenine (DHAd), a compound produced when adenine is poorly metabolized. This diagnosis, done in about an hour, resulted in quickly adapting this patient's treatment at the Necker hospital, allowing him to keep his kidneys.



The infrared spectrum of the crystal observed by optical microscopy is composed of its own spectroscopic signature and that of the underlying biological tissue. The presence of DHAd is confirmed by subtracting the tissue's spectrum from that registered by the crystal.



**Jean Boutin, Director of the Molecular and Cellular Pharmacology Division of the SERVIER Research Institute**  
**In the context of medical chemistry research, we want to obtain the maximum information on the nature of the interaction between a molecule (drug candidate) and its target.**

*The structural data provided by the X-ray diffraction experiments are of course crucial and can guide the chemists who design these molecules, in an almost «visual» way.*

*The increased performance of the synchrotron beamlines used can further improve the information provided by 3D images, by increasing their resolution.*

*Research is also planned both upstream and downstream in the process of obtaining new molecules, especially to characterize the crystalline forms of pure products in powder form, using techniques such as SAXS.*

*Moreover, the potential of different beamlines at SOLEIL is not limited just to X-rays: the study of living cells by confocal imaging of fluorescent chromophores is a tool adapted to our research.*