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Molecular Imaging in Tissue and Cells by Mass Spectrometry : COMPUTIS, a new european project



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COMPUTIS

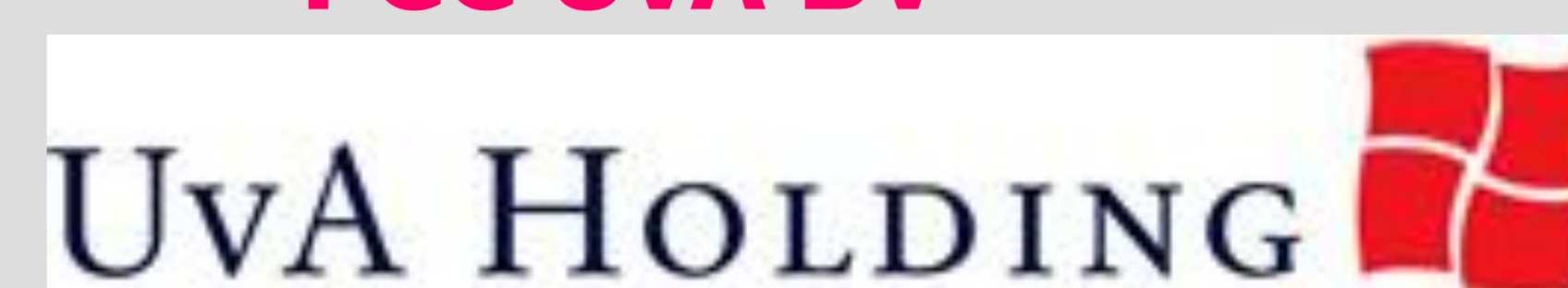
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GIESSEN



Key words : bioanalytical chemistry, mass spectrometry,
massive data processing and information treatment



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INTRODUCTION AND CONTEXT

Significant improvements in desorption and ionisation techniques such as SIMS or MALDI associated with TOF mass spectrometers have literally revolutionized our ability to analyze organic molecules as large as peptides or proteins. They offer levels of sensitivity and mass accuracy which allow **detection**, **characterization** and **identification** with very small sample amounts.

Recent developments showed the possibility of extrapolating these techniques to produce actual molecular image of flat samples with a full mass spectrometry at each pixel down to micrometric scales. The project "COMPUTIS" will aim to develop improved technologies for Molecular Imaging Mass Spectrometry (MIMS), enabling innovative approaches in functional genomics, proteomics and metabolomics, as well as for investigation of **tissues** and **cells**.

THE PROJECT

- Priority in the 6th FP/ thematic : Priority 1 LSH-2004-1.1.1.0-1, on Multidisciplinary functional genomics approaches to basic biological processes
- Instrument : Specific Targeted Research Project
- Duration : 42 months (3.5 years), Starting date : 1st January 2006
- Budget : Total Eligible Cost around 3.07 M€ - Grant Commission 2.2 M€
- Objectives of the project :
 - Innovative MS imaging instrumentation through the application of novel desorption, ionisation and detection techniques,
 - Advanced diagnostics methods for identifying diseases by study of molecular images
 - Monitoring of therapeutic effects on expression patterns of damaged and abnormal cells and tissues

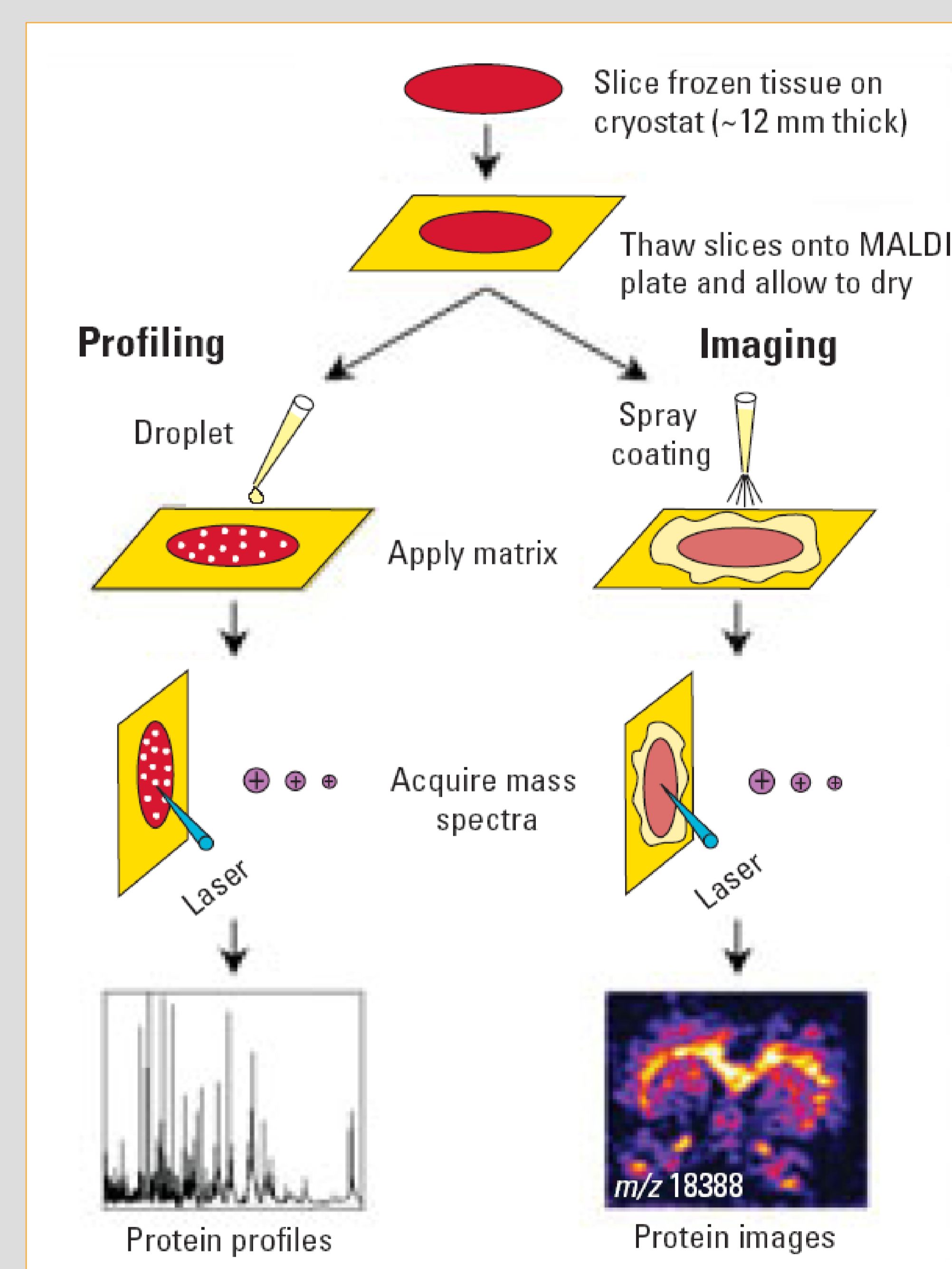
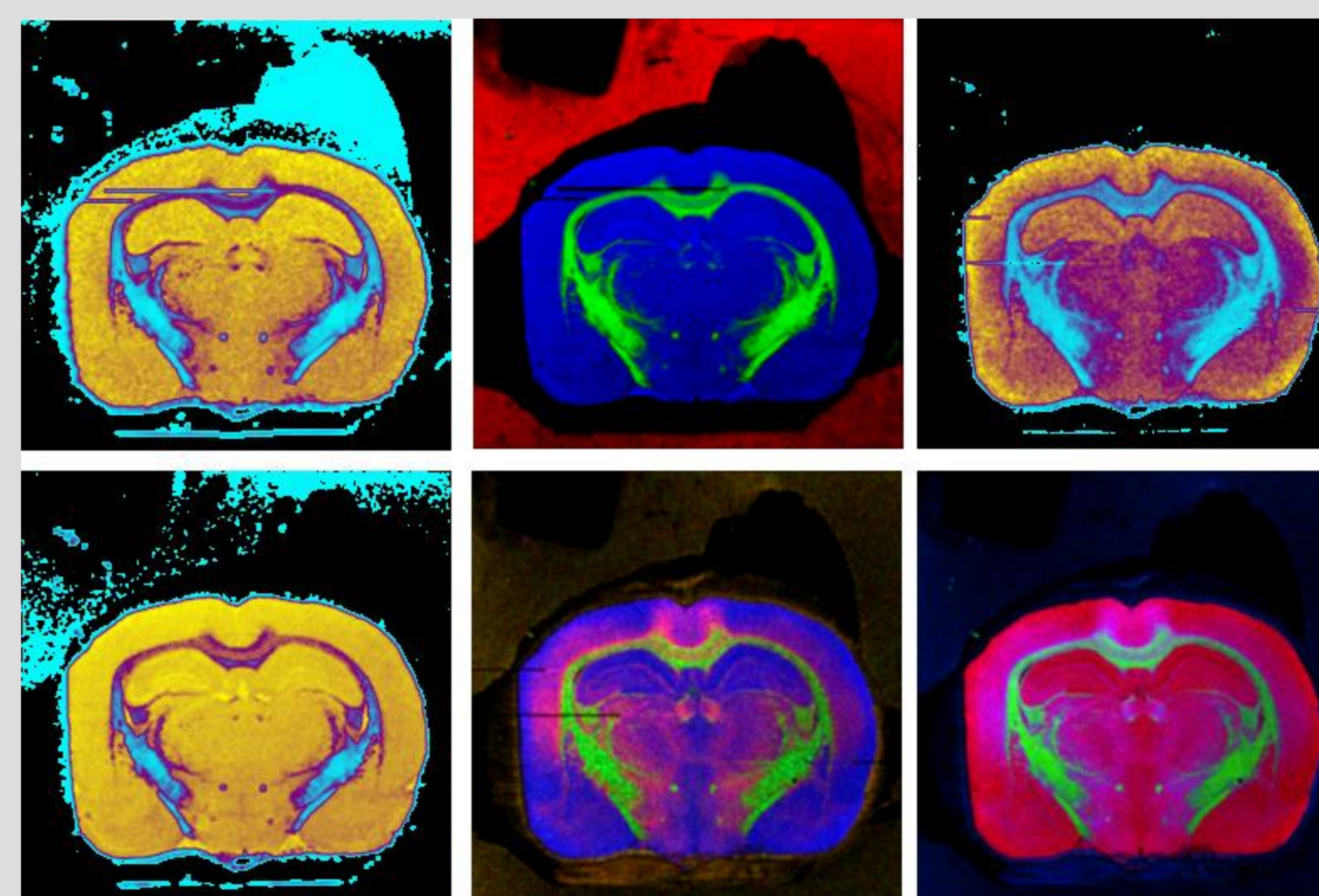


Illustration of Profiling and Imaging of biological sample by Mass Spectrometry [from P. Chaurand et al., Anal. Chem., March 1, 2004]

THE PROJECT PARTNERSHIP



THE PROJECT DEFINITION



Examples of images from secondary ions mass spectrometry (TOF-SIMS) of different lipids (choline, phosphocholine, phospholipids, fatty acid, cholesterol, vitamin E) on the surface of a rat brain sample. Images sizes : 18x18 mm², 256x256 pixels of 70x70 μm². Possibility to get images with a spatial resolution < 1 μm

[from A. Brunelle et al., CNRS-ICSN]

Imaging MS needs further development to make it routinely accessible to users. Application of these methods requires :

- ☞ appropriate instrumentation
- ☞ sample preparation methodology
- ☞ computerization : high performance massive data acquisition and processing