

ICube Laboratory, Strasbourg, France

The diagram illustrates the experimental workflow for Raman spectroscopy on Alzheimer's disease brain tissue. The process begins with an **Alzheimer's disease brain (post-mortem)**, showing a **frontal lobe** and **brain tissue (snap frozen)**. This is followed by **pathology sections (unstained)**. The workflow then branches into two main paths:

- Auto-Fluorescence:** This path involves **z-projection** of **unstained** sections, showing **auto-fluorescence** (Ex: 470 nm; Em: >500 nm) and a **Fluorescence** image for **plaque confirmation** (Ex: 470 nm; Em: >500 nm).
- Raman:** This path involves **Raman** measurements under identical conditions, resulting in a **Raman spectrum** plot. The spectrum shows peaks at **1333.72** and **1449.64** cm⁻¹. This is followed by **Raman data processing**, which includes:
 - Outliers removal (cosmic rays)
 - Smoothing of each spectrum
 - baseline removal
 The final step is **Raman spectra** analysis, which includes **Raman intensity maps** and **data analysis (MCR-ALS; Clustering)**.

Background and Objective:

- I. Data Preprocessing: Acquire hyperspectral Raman data, remove fluorescence background, and build a reproducible cleaning pipeline.
- II. Machine Learning & Mapping: Apply unsupervised ML (clustering, dimensionality reduction) to deconvolute spectra and produce spatial biochemical distribution maps.
- III. Validation: Compare Raman-derived molecular maps against standard biological reference methods (e.g., histology or immunostaining).

The internship location is at the ICube laboratory in Strasbourg. There will be an opportunity to continue this Master's internship into a PhD thesis in collaboration with Yale School of Medicine, USA. If you are interested, please contact **Hamideh SALEHI** (hsalehi@unistra.fr).