



**Phd Project:** Epigenetic Signatures of Pollution in Tree Rings: Linking Molecular Memory to Environmental Stress (available through CSC to only Chinese students)

**Supervisors:** [Dr Marco Catoni](#)

**Deadline:** 30th January 2026

**Project Description:** Trees are long-lived, sessile organisms that must adapt to changing environments to survive and reproduce. Recent advances in genomics reveal that environmental information can be recorded at the molecular level through epigenetic marks, such as **DNA methylation**, which do not alter DNA sequence but can persist through cell divisions and even across generations. In plants, these marks form an epigenetic “memory” of developmental and environmental conditions.

In trees, wood consists of lignified, dead cells that preserve DNA fragments. Because temperate trees form annual growth rings, their wood archives both physical and molecular records of environmental history. While dendrochronology has long exploited physical ring properties, the epigenetic dimension remains unexplored.

This project aims to uncover **how trees molecularly encode and retain environmental information related to pollution exposure across growth rings**. By extracting DNA from different rings and profiling methylation patterns, the PhD researcher will correlate epigenetic changes with historical records of air and soil pollution (e.g., heavy metals, particulate matter, CO<sub>2</sub> accumulation). This pioneering approach will integrate dendrochronology, ecology, and epigenetics, providing unprecedented insight into how trees respond at the molecular level to anthropogenic stress over decades.

The project will require to merge molecular, computational, and ecological methodologies. We will adapt newly developed protocols of DNA extraction from oak wood to produce libraries for high-throughput sequencing analysis, to generate genome-wide single cytosine resolution maps of DNA methylation of wood cells located in different portion of a tree ring sample. Then, we will analyse tree-rings from oak samples located at the BIFoR facility (University of Birmingham). We will determined physical changes in wood associated to pollution and we will determine the associated portion of epigenetic changes found in each ring portion. Finally, we will compare and validate our result with analysis performed on oak seedling drought stressed in controlled condition (greenhouses), to determine a final set of DNA regions that can be associate to air or soil pollution.

**References:** Zeng, Z., Raffaello, T., Liu, M.-X., and Asiegbu, F.O. (2018). Co-extraction of genomic DNA & total RNA from recalcitrant woody tissues for next-generation sequencing studies. *Future Science OA* 4, FSO309.

**Funding note:** This opportunity is available only to Chinese student under the [China Scholarship Council](#) sponsorship. Eligible Chinese PhD candidates are requested to apply for their [Birmingham PhD programme](#), specifying that they intend to apply for CSC in their application, to obtain a conditional offer. At the same time, contact the lab ([m.catoni@bham.ac.uk](mailto:m.catoni@bham.ac.uk)), sending CV, motivation letter and the UoB application number, for internal selection in Birmingham. Selected candidates will receive the UoB Nomination Letter necessary for their application to CSC by March. CSC has final decision about the students to be supported (<https://www.csc.edu.cn/>). English Language test is necessary.