

# Biogeochemistry of Environmental Pollutants

## Synopsis

In this unit, the basics of biogeochemistry will be provided through the presentation of the water, carbon and nitrogen biogeochemical cycles and the impact of human activities on these cycles.

This will be completed by a general introduction about the sources and fate of pollutants in the environment. A comprehensive overview of the main environmental pollutant classes (*i.e.* organic micro-pollutants and trace metals) and of associated ecodynamics in aquatic ecosystems will be provided. A description of the atmospheric compartment as well as the main associated issues related to air quality and climate change will be described. Finally, the inputs of *in silico* methodologies to predict the physico-chemical and ecotoxicological properties of a substance as well as the role of the dissolved organic matter on the fate of pollutants in aquatic ecosystems will be emphasized.

## Aims

To provide fundamental knowledge for the most comprehensive and in-depth understanding of the fate of pollutants in aquatic and atmospheric environments.

## Objectives

At the end of the Unit, you should:

1. Know the basics of water, C and N cycles
2. Know the basics of typical organic micro-pollutant and trace metal environmental fate
3. Understand the key parameters controlling the climate change and the environmental fate of pollutants in atmospheric and aquatic environments
4. Know the principle of QSAR methods to predict the properties of pollutants
5. Know the synergies and trade-offs between Human health, environmental quality, sustainable development and climate change related to public policy making

## Key Skills Acquired

At the end of this Unit, you should understand:

1. Impacts of human activities on the water, C and N biogeochemical cycles
2. The key parameters controlling the Earth Climate and the environmental fate of pollutants in atmospheric and aquatic environments

## Syllabus

Topics covered include:

- Water, carbon, nitrogen biogeochemical cycles
- Environmental fate of organic micropollutants in aquatic systems
- Biogeochemistry of trace metals
- Role of dissolved organic matter
- QSAR methods for molecular properties prediction
- Introduction to Earth climate and climate change
- Basics on atmospheric chemistry and fate of pollutants in the atmosphere

## Learning & Teaching

- Lectures: 27.66 hr
- Seminars: 2 hr
- Field trip: ½ day

## Teaching Staff

E. Perraudin (Coord.), H. Budzinski, N. Geneste, E. Parlanti, J. Schäfer and E. Villenave

## Semester 1

Timetable slot TBD

ECTS 6

Level Compulsory

## Bibliography

- Interactions between the Geosphere and the Biosphere - The Surface of the Lithosphere and the Biosphere, ed. K. Benzerara, C. Thomazo, 2025.
- Biogeochemistry: An Analysis of Global Change, 4th Edition by W.H. Schlesinger and E. S. Bernhardt, 2020
- Atmospheric Chemistry and Physics: From Air Pollution to Climate Change by J. H. Seinfeld and S. N. Pandis, 2016

## Assessment

- Written theory examination (75%)
- Project oral presentation (25%)

## Course Evaluation

By completion of University Unit Evaluation Questionnaire by students, annual assessment by Unit Coordinator.