



## TRIBOLOGY AND BIO-INSPIRED SURFACE ENGINEERING

Lecturers: Stéphane VALETTE

| Lecturers : 16 | TC : 8 | PW : 0.0 | Autonomy : 8 | Study : 0.0 | Project : 0.0 | Language : AN

### Objectives

The objective of the course is to establish the relationships between surface functionality and surface morphology, in a biomimicry approach. In terms of surface functionality, the focus will be on the wettability and optical properties of natural textured surfaces. The course should develop knowledge in biomimicry and bio-inspiration of surfaces by offering a description of biological surfaces in terms of morphology and surface chemistry. The morphology and chemistry of plant and animal surfaces will be studied in detail. The morphology/chemistry/wettability relationships of these surfaces will be the focus of this training action. The physics of wetting and adhesion will be studied in detail. The different wettability models will be presented both

**Keywords :** biomimicry, bio-inspired surface, vegetal surface, animal surface, morphology, wetting, adhesion, structural color, adhesion, biodiversity, ecological transition

### Programme

Physics of wetting and adhesion I  
Physics of wetting and adhesion II  
Physics of wetting and adhesion III  
Physics of wetting and adhesion - Applications  
Structures and functions of plant surfaces for biomimetic innovations  
Structures and functions of animal surfaces for biomimetic innovations  
Wetting of bio-inspired surfaces  
Bibliographic review: bio-inspired super-hydrophobic surfaces  
Biomimicry and optical properties: structural coloring

### Learning outcomes

- - Know the morphology of natural surfaces (plant and animal) - shapes, dimensions, multi-scale aspects
- - Know the main chemical compounds forming the surface of plant leaves or insect cuticles
- - Know the physical laws of wettability
- - Know how to establish the relationship between wettability and surface morphology - Know how to establish the relationship between structural coloration and surface morphology

### Independent study

**Objectifs :** Preparation of exercises for training classes.  
Bibliographic study of recent biomimicry and surface engineering publications: training in the scientific approach in the context of the ecological transition

**Méthodes :** Bibliographic study of recent publications, synthesis and oral presentation

### Core texts

Eddie Y. K. Ng, Yuehao Luo, Eddie Yin-Kwee Ng, *BIO-INSPIRED SURFACES AND APPLICATIONS*, World Scientific, 2016  
Edward Yu. Bormashenko *PHYSICS OF WETTING - PHENOMENA AND APPLICATIONS OF FLUIDS ON SURFACES*, De Gruyter, 2017  
Robin H. A. Ras and Abraham Marmur *NON-WETTABLE SURFACES: THEORY, PREPARATION AND APPLICATIONS*, Royal Society of Chemistry, 2017

### Assessment

Final mark = Knowledge mark = 70% final exam mark + 30% bibliographic assessment mark