

Field: Sciences and Biotechnological engineering

Main linking center:Barcelona School of Agricultural Engineering

University teaching need project

The Agri-Food Engineering and Biotechnology department (DEAB) of the Universitat Politècnica de Catalunya (UPC) is mainly integrated by professors and researchers belonging to the Life Sciences field, and only a few of them belong to the Social Sciences field, concretely to the knowledge area of Economics, Sociology and Agricultural policy.

The courses given by the DEAB professors in the Life Sciences field are mainly requested by the Barcelona School of Agricultural Engineering (ESAB) (<https://esab.upc.edu/en/Studies>), and they are essential for bachelor and master degrees of biosystem science which are applied to Agri-Food, Culinary and Gastronomy, Landscape, Environmental and Marine fields. These topics are part of several knowledge areas, such as, Animal production, Agroforestry engineering, Biochemistry and Molecular Biology, Botany, Cell biology, Ecology, Edaphology and Agricultural Chemistry, Food technology, Genetics, Microbiology, Physiology, Plant physiology, Plant production and Zoology. Moreover, the DEAB professors teach in interuniversity masters with other Universities from Spain, such as, the Universidad Politécnica de Valencia, Universitat de Barcelona, Universitat Autònoma de Barcelona and Universitat de Lleida (<https://deab.upc.edu/en/teaching>).

Biosystem science, defined as “ the study of a living organism or a system of living organisms that can directly or indirectly interact with others”, is the base of the bachelor and master degrees given at ESAB and requested to the DEAB. The production of life organisms, its transformation in food or agroindustrial products; its use as environmental indicators and as bioremediation agents or as components of the landscape is a central part of these studies.

The interactions between living organisms in natural or controlled environments are essential

for the animal and plant health, its productivity, quality, and durability of its products, as well as the efficiency of primary products transformation and/or environmental remediation process. Usually, the study of these relationships considers two or three organisms in a microcosm approach for better understanding of their complexity. Nonetheless, this approach has a lack of a holistic point of view, which allows a better understanding of the role of the components of the biosystems at different levels of observation to know the balance of the relationship in natural conditions and to carry out risk assessment analysis of the putative actuations. Currently, the use of omic techniques applied to the biosystems studies allows us to know the functional relationships that are taking part and also to explain and forecast the putative success of them. This approach is based on the microbial ability to change the environment and to modulate the physiology of living organisms resulting in (un)balanced systems as it was proven in medical studies, and more recently in agri-food and environmental scenarios. This approach would be very valuable to students for understanding the success of any food production and transformation system, landscape composition, as well as, any environmental remediation approach based on the activity of living organisms. Then, a candidate able to conduct and teach basic and applied courses and research on Plant Biology, Ecology and/or Microbiology under this point of view will allow a better understanding of biosystems in order to manage them in a sustainable manner according to the attributions of the studies given at ESAB.

University research and transference need Project

The basic and applied research carried out at the UPC's departments, institutes, centers and laboratories marks the meeting point between scientific inquiry, innovation and technological development. These units work to promote a culture of research, innovation and entrepreneurship and establish knowledge networks with researchers and research groups around the world. At the departmental level, the UPC's teaching and research staff organize and coordinate undergraduate and postgraduate courses in one or more knowledge areas and oversee the associated research activities. The DEAB's research activity is carried out by research groups realized by the Catalan Government

(<https://deab.upc.edu/en/research/groups-of-research>). The majority of these research groups are multidisciplinary to achieve a deeper understanding of the case of study and also contribute to the development of the Agri-Food, Landscape and Agro-environmental sectors. The main research lines carried out by the DEAB's staff in the Life Sciences field are related to the characterization of plant germplasm for food and industrial purposes; food technology; ecology; integrated organic waste management and valorization; integrated plant disease management; modeling and simulation of Biosystems; phytosanitary application technology; plant ecophysiology; precision agriculture. The most of these research lines are focused on the study of the interactions that occur between living organisms in different scenarios, because, well is known that the biotic components of an ecosystem interact in a network manner. The number of links or connections between species is an indicator of the complexity of the ecosystem and its level of maturity. The study of Biosystems under a holistic point of view will allow a better understanding of the role of its components, connections and functionality, and the resulting balance to forecast the sustainability of the system and the influence of the putative actuations that could be implemented to improve its efficiency. Nowadays, the use of omic techniques applied to the study of Biosystems will provide essential information to achieve this goal.

Then, a candidate able to conduct a basic and an applied research on Plant Biology, Ecology and/or Microbiology under an ecology network point of view will improve both the knowledge on specific Biosystem and its management, and the competitiveness of the sector by transferring results to it. The candidate could be integrated in any of the existing research groups according to its experience and interest. The DEAB facilitate to all of its members the space and the available infrastructures to develop the research activity.

Desired impact for the University

The DEAB is the only department focused on Life Sciences in all UPC. Consequently, its professors and research staff are the responsible to develop the academic activities in this field. Also, they collaborate with other researcher groups from UPC, as well as, other entities, conforming multidisciplinary groups to improve knowledge and to transfer results and technology to the sector for improving its competitiveness.

The most of the research lines carried out by the DEAB's staff are centered on living organisms and/or its products to improve the sustainability of biosystems, the productivity of the living organisms and the quality of its products, as well as, the process efficiency in which living organisms are involved. The study of biosystems needs to incorporate new technologies that allow a holistic compression regarding its components, its functions, the putative connections between them and the resulting products. This approach is not currently extended in Life Sciences at the UPC. The incorporation of a researcher with expertise in the study of biosystems using –omic technologies, and/or the results from them, is desirable for boosting interest in some of the studies offered by the ESAB, mainly in the Biosystems engineering degree, since it combines biology with technology offering multidisciplinary training in areas, such as, plant biology, microbiology, biochemistry, molecular biology, among others but also for boosting interest in other bachelor and master degrees offered by the ESAB in which living organisms, its products as well as the technological processes involving living organisms are the main object of study. In addition, the UPC has to improve its indicators in the Life Science field. For example, the UPC does not appear in the first 500 universities in the world according the ARWU Ranking of Shanghai 2019 in Life and Agricultural Sciences in which the previous mentioned areas are included. The recruitment of researchers who applied new technologies is encouraged to increase the impact of the research and to gain in reputation in this field in next future. Surprisingly, among the 29 universities from Spain that appear in the ranking,

some of them do not offer studies in Agricultural Science, but they have enough research staff for applying its research to this field (<http://www.shanghairanking.com/Shanghairanking-Subject-Rankings/agricultural-sciences.html>).

The recruitment of teaching and researcher staff experienced in leading competitive research projects, writing academic papers in high quality international journals, in establishing collaborations with other national and international research groups, and to supervise PhD students will contribute to gain visibility of the UPC at the international level in the Life Science field increasing the number and quality of scientific production. Moreover, basic and/or applied knowledge generation and its transmission will improve the intellectual student formation as well the competitiveness and sustainability of the economic activity by the transfer of knowledge and technology to the sector.