Experimental Projects for incoming Erasmus students at the Faculty of Sciences, University of Girona. Academic year 2023-24

Title of the activity	Description	Degree or specific knowledge required	Period	Responsible professor	Research group
Design and preparation of activated membranes for the removal of contaminants	Polymeric membranes containing specific reagents are very effective for the removal of different contaminants found in waters, such as organic compounds (antibiotics, pesticides…) or inorganic species (arsenic, heavy metals, anions…). In this experimental project different membranes will be prepared and tested to solve a specific environmental problem. The student will acquire knowledge on separation systems, instrumental analysis and the typical skills of an analytical laboratory.	Chemistry , environmental engineering, environmental science	2nd semester	Dra. Claudia Fontàs claudia.fontas@udg.edu	Chemistry department/Environmental and analytical chemistry group
Simulation of non-conjugated fluorescent polymers	Fluorescence is usually found in molecules and materials with conjugated pi systems. However, a novel class of polymers has been recently discovered that do not have conjugation but show strong fluorescence. The aim of this project is to simulate their photophysics to understand the origin of the fluorescence and derive basic principles for the design of new luminescent materials. The student will learn the advanced use of quantum chemistry and molecular mechanics programs applied to a practical problem. Interested students can get in touch with the responsible professor by email.	Some knowledge in computational chemistry is a plus.	1rst or 2nd semester	Lluis Blancafort lluis.blancafort@udg.edu	Institute of Computational Chemistry and Catalysis, Research group in Theoretical Chemistry and Molecular Modelling and Engineering
Aromaticity and antiaromaticity of large conjugated rings: porphyrins and phthalocyanines	The aim of the project is to understand how the aromaticity influences the physicochemical properties of large conjugated circuits in the ground state and the first excited state. We will investigate which are the most favourable circuits for electronic delocalization and ring current formation. The student will acquire expertise on the use of standard quantum chemistry programs and in-house programs used to determine the aromaticity of molecules.	Non-advanced knowledge about quantum chemistry is necessary	2nd semester	Miquel Solà Miquel.sola@udg.edu	Chemistry Department / Institute of Computational Chemistry and Catalysis / Dimocat group
Genetically modified plants to understand the function of periderm genes.	In our laboratory we are working with potato and Arabidopsis, which are genetically modified to determine the function of specific genes in the periderm (potato tuber skin, and Arabidopsis root periderm). Then, we are a plant molecular biology lab using in vitro culture, molecular biology, cloning, expression analyses and histological techniques. The student will be enrolled in some of the active projects in the lab using these methodologies.	Biology, Biotechnology or related degrees. The student should be familiar with molecular biology techniques and interested in plants, or at least curious to them. It is a requisite to be highly motivated for the work.	2nd semester	Olga Serra Olga.serra@udg.edu	Laboratori del suro
Bio-electrochemical dialogues for water remediation or CO2 recycling into biofuels-proteins	A wide diversity of microorganisms have the ability to exchange electrons with both electrodes or other cells. The research field studying these exchanges is called electromicrobiology. It has the potential to contribute to a broad range of environments, from human intestine to water systems. Microbial electrochemical technologies developed so far enables that the microbial metabolism to be deliberately linked to a solid-state electron donor or acceptor, which can be a mineral particle or an electrode. The electron transfer between the microbe-electrode could be driven by a power source. The	Environmental engineering, environmental science, chemistry, biotechnology or similar.	2nd semester	Sebastià Puig sebastia.puig@udg.edu	LEQUIA

	selected candidate will contribute to unveil bio-electrochemical "chats" between microorganisms (microbe-electrode or microbe-microbe interactions) for the bioremediation of polluted waters or bioelectroCO2 recycling into biofuels-proteins. The student will start his/her own research based on his/her skills.				
Peptides as new pesticides	The main goal of this line of research is the development of peptides that can be considered as good candidates to be applied in the control of plant diseases. Peptides will be selected and improved using criteria of low cytotoxicity and high stability to proteases. This project involves the design, synthesis and biological evaluation of all the compounds prepared. The student will acquire knowledge on the solid-phase synthesis of peptides, on the common organic synthesis protocols and on the techniques used for the characterization of the compounds synthesized.	Chemistry, pharmacy, biotechnology	1st or 2nd semester	Lidia Feliu and Marta Planas lidia.feliu@udg.edu marta.planas@udg.edu	Department of Chemistry, LIPPSO group
Development of new transition-metal-catalysed cyclization reactions	The aim of the project is to develop new transition-metal-catalysed cyclization reactions which allow the transformation of simple reagents to complex organic compounds in a straightforward manner. The student will acquire expertise on the synthesis of organic compounds, the optimization of transition-metal-catalysed reactions and the characterization of organic compounds.	Chemistry, pharmacy or biotechnology degrees. Basic knowledge in organic synthesis and characterization techniques (NMR and mass spectrometry).	1st or 2nd semester	Anna Pla anna.plaq@udg.edu	Department de Química / Institut de Química Computacional i Catàlisi (IQCC) / Metalls de Transició en Síntesi Orgànica (METSO)
Condition and reproduction of the sardine in the Mediterranean Sea	In our laboratory the student will use techniques related to the analysis of the reproductive strategy and the state of health of marine fish. Specifically, he/she will work on the determination of the energetic reserves in the sardine specimens of the Mediterranean and on the estimation of the reproductive parameters related to the annual cycle, spawning and fecundity.	Biology, Environmental Sciences or similar	1st or 2nd semester	Marta Muñoz marta.munyoz@udg.edu	Institute of Aquatic Ecology, Research Group on Marine Resources and Biodiversity www.udg.edu/grmar
Synthesis of unnatural amino acids and bioactive peptides	Synthesis in solution of different unnatural amino acids following the methodology developed in our research group or set up novel methodologies to improve the unnatural amino acids synthesis. Solid-phase synthesis following standard fluorenylmethoxycarbonyl (Fmoc) / tert.butyl strategy of peptides containing unnatural amino acids The student will acquire expertise on both solution and solid phase synthesis of organic compounds and this work will also allow the student to learn different techniques of analysis and characterizations such as High-performance liquid chromatography (HPLC) or nuclear magnetic resonance.	Knowledge of organic chemistry Skill with the own methodologies of an organic synthesis laboratory	1rst or 2nd, preferably 1rst	Dra. Montserrat Heras montserrat.heras@udg.edu	Chemistry / LIPPSO research group
Electrode to cell electron transfer in modular bioelectrochemical systems	Bioelectrochemical systems (BES) are currently being explored as innovative methods for CO2 conversion into organic molecules. The concept is called bioelectrosynthesis. It is envisioned as a sustainable technology and enables the conversion of electric power into chemical energy, thus facilitating its storage. Among their specific limitations, the electron-to-cell transfer mechanisms at the molecular level is driving our attention. The student will	Biology or Biotechnology degree. Knowledge in basic microbiological techniques. Experience in R tools. A highly motivated student with interests in	1st or 2nd semester	Lluis Bañeras lluis.banyeras@udg.edu	Institute of Aquatic Ecology/Group of Molecular Microbial Ecology

	gain knowledge in running BES systems using defined microbial cultures. Electron transfer mechanisms will be analysed from a molecular perspective using sound methodologies (metagenomics and transcriptomics).	molecular biology and microbial Physiology.			https://www.udg.edu/en/grupsrecerca/gEMM
Development of simple and sustainable analytical methods based on the use of X-ray fluorescence spectrometry for metal and inorganic species determination	There is an increasing interest in the development of analytical methods for environmental monitoring in the frame of Green Analytical Chemistry principles. In this context, the research proposed is focused on the development of simple and sustainable analytical methods using novel sample treatment approaches (i.e, microextraction strategies) and different low-power X-ray fluorescence systems (XRF) for the reliable determination of inorganic compounds as well as metallic nanoparticles in environmental matrices, which is at present an analytical challenge. The student will acquire knowledge on X-ray fluorescence spectrometry, sample treatment procedures in the frame of green analytical chemistry and the typical skills of an analytical laboratory.	Chemistry, Environmental Sciences.	1st and 2nd semester	Eva Marqui eva.margui@udg.edu	Chemistry Department/Environmental and Analytical Chemistry Group.
Molecular markers for the identification of the pathotype "Adherent-invasive Escherichia coli"	The student's activity will be related to the main research line of the lab which is focused in the investigation of the mechanisms of pathogenicity of the Adherent-Invasive Escherichia coli (AIEC) pathotype. The ultimate purpose of our research is to find genetic elements that could be used as molecular markers for the identification of the AIEC pathotype, which are non-existent to date, as well as putative targets for new treatments or prevention measures.	Biology, Biotechnology or related degrees. The student must have previous experience with bacterial culture and work under sterile conditions. It is essential that the student is highly motivated for the job, and that he/she works responsibly and with enthusiasm.	1st semester (and 2nd semester if the student has been trained during the 1st semester and can work independently)	Margarita Martínez Medina marga.martinez@udg.edu	Biology / Microbiology of the Intestinal Disease group
Marine Macroalgae Forest Conservation	The main aim of the project is to study the processes that determine macroalgae forests functioning. We are interested in promote restoration actions of these forest, taking into account the actual framework of climate change and specially climate warming. In the project we will run studies on the thermal tolerance of different species as well as cultures submitting healthy populations to cumulative number of stressors that may seriously compromise the viability of marine forest in the Mediterranean Sea. Form more information www.marineforest.com As is a multidisciplinary project, students will be ascribed to the different ongoing task in function of their skills and affinities. Interested students can get in touch with the responsible professor by email.	The student should be involved in bachelor degrees on Environmental Sciences, Biolog and Marine biology. Knowledge on data analysis is welcome.	1st or 2nd semester	Emma Cebrian Emma.cebrian@udg.edu	Institut d'Ecologia Aquàtica.
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Enzyme-like C-H functionalization catalysts	The objective of the project is to create small molecule coordination complexes that catalyse enzyme-like regio and enantioselective C-H functionalization reactions. Electronic, steric and/or supramolecular elements will be implemented on the catalysts in order to confer selectivity properties. Use of peptides as catalyst synergistic elements and use of the reactions in functionalization of complex molecules will be considered. Study of reaction intermediates will be also considered. Student will acquire synthetic expertise in the preparation and characterization of paramagnetic transition metal complexes, in homogeneous catalysis, including asymmetric catalysis and in chromatographic analyses.	Basic knowledge on organic or inorganic synthesis	1st or 2nd semester	Miquel Costas Miquel.costas@udg.edu	Institut de Química Computacional I Catàlisi
Polarization of molecules in a solvent described through atomic charges	Molecules in solvent environment usually become more polar. This polarization can be effectively described by changes in atomic partial charges. The student will use the orbital perturbation theory to calculate the changes in atomic charges caused by the solvent and subsequently apply them to calculate solvation energies. Both analytical equation derivation, computer programming, and numerical calculations will be performer by the students. The work is purely theoretical, i.e., no laboratory experiments are planned.	Chemistry or Physics student; basic knowledge of theoretical chemistry; basic knowledge of computer programming.	1st or 2nd semester	Sergei Vyboishchikov vyboishchikov@googlemail.com	Institut de Química Computacional i Catàlisi
Bioinspired molecular receptors for enzyme-like catalysis	Our group's ultimate goal is to reproduce complex functions of macrobiomolecules, such as enzymatic catalysis, employing manmade molecular receptors. The specific goal of this project is the preparation and study of a synthetic host inspired by terpene cyclases, a synthetically and pharmacologically relevant family of enzymes. The student will be involved in the synthesis and characterization of the receptor, and their use in bioinspired transformations. The student will acquire expertise in the synthesis, isolation and purification of elaborated organic compounds, and their characterization by advanced spectroscopic techniques, as well as in fundamental aspects of supramolecular chemistry.	Basic knowledge of organic chemistry and spectroscopic characterization techniques (NMR, mass spectrometry).	2nd semester	Agustí Lledó agusti.lledo@udg.edu	Institut de Química Computacional i Catàlisi (IQCC) / Chemistry Department
Antimicrobial applications	The aim of the project is to develop new antimicrobial solutions mainly based on our antimicrobial peptides but also incorporating other technolgies. The student will acquire expertise on the synthesis of peptides o their conjugation to other products, also the possibility to perform activity tests is open if the student has adequate background	Chemistry (Organic better), Biotechnology.	1st or 2nd semester	Eduard Bardaji eduard.bardaji@udg.edu	LIPPSO – Chemistry department
Development of heterogeneous transition metal compounds as	The goal of this work is the synthesis of new Ruthenium complexes anchored onto graphene supports and their characterization as well as the optimization of these compounds as catalysts for the oxidation of organic subtracts under homogeneous and heterogeneous conditions. The development of this work will	The student should be doing a chemistry or biotechnology degree. Basic knowledge in	2nd semester	M. Isabel Romero marisa.romero@udg.edu	Quimica / Catàlisi i Sostenibilitat

recyclable catalysts for the chemical and photochemical oxidation of organic subtracts.	allow the student to learn different techniques of synthesis, characterization and analysis such as nuclear magnetic resonance, gas chromatography (GC) etc., and this work will also allow the student to become familiar with the research work carried out in an inorganic chemistry laboratory.	synthesis and spectroscopy is welcome.			
Effect of climate change on microbial activity and organic matter decomposition	The student will be involved in research on organic matter degradation and microbial functioning in different environments, shallow lagoons, saline systems, rivers, soils, measuring microbial biomass (prokaryotes and fungi), biofilm characterization, enzymatic degradation activities (extracellular enzymes), respiration and nutrient dynamics, organic matter quality, organic matter decay rates, heterotrophic functional diversity, and how they respond to climate change scenarios (drought, warming). Depending on the specific period of the student visit, she/he will work more on aquatic or terrestrial environment, more field or more laboratory and/or data analysis.	Biology / Environmental Sciences or similar	1st or 2nd semester	Anna M. Romaní anna.romani@udg.edu	Institute of Aquatic Ecology/Ecology of inland waters (GRECO)