



## CONVOCATORIA DE PRÁCTICAS INTERNACIONALES

### CONVENIO UCLM/CERFA 2022

#### PROYECTO 5

---

#### Afiliación del supervisor y Enlace a afiliación / Supervisor affiliation and Affiliation link

Bioactive and Responsive Polymers/ Leibniz-Institut für Polymerforschung Dresden e.V. (Leibniz Institute of Polymer Research)

<https://www.ipfdd.de/de/forschung/institut-makromolekulare-chemie/bioaktive-und-responsive-polymere/>

#### Título del Proyecto/ Project Title

Responsive Polymeric Vesicles with Dual Therapeutic Action

#### Perfil preferencial del estudiante

Bachelor Student or Master student (Chemistry or Nanoscience and Molecular Nanotechnology )

#### Fechas orientativas/Available Dates

01.06.2022 to 30.09.2022

#### Programa/ Detailed program of the traineeship period (aprox. 100-200 palabras)

The development of new therapeutic drugs is progressing rapidly, although there are already many very promising, *in vivo* application is more complicated, often uncontrolled distribution in the body, rapid degradation and excretion and severe side effects. Polymer vesicles (polymersomes) have attracted growing attention for drug delivery. Different therapeutic cargoes can be loaded in the lumen or membrane, and can be protected against (enzymatic) degradation in the biological environment. Moreover, membrane permeability of polymersomes can be modified to respond to different stimuli or targeting moieties can be incorporated on the surface for a targeted and controlled drug delivery.

The extracellular matrix (ECM) is one of the major components of tumors that plays multiple crucial roles, it has influence on the malignancy and growth of the tumor but also its response toward therapy. Previously, enzyme post loaded polymersomes have been established in our group using two enzymes capable to degrade ECM such as collagenase (MMP-1) and hyaluronidase (HAYL). These smart nanocarriers have been shown to improve enzyme stability and activity compared to naked enzyme. Therefore, **the aim of this work is to fabricate co-loaded polymeric vesicles, the combination of an antitumor drug and a therapeutic enzyme obtaining a smart dual action nanocarrier capable of increasing the therapeutic efficacy.**

To achieve this objective, the following steps will be followed:

- Fabrication and characterization of pH responsive and crosslinked polymersomes
- Optimization of curcumin loading using: (a) *post* or *in situ* loading approaches; (b) naked curcumin (hydrophobic molecule, loaded in the membrane) or  $\beta$ -cyclodextrin complex (hydrophilic complex, loaded in the lumen or surface).
- Efficiency evaluation of dual cargo loading with HAYL and MMP-1. Study of enzyme size as a limiting factor.
- Stability study of the co-loaded nanocarriers by release studies and in the presence of simulated body fluids and peptidases.



**Competencias a adquirir por parte del estudiante/** Knowledge, skills and competences to be acquired by the trainee at the end of the traineeship (expected Learning Outcomes) (aprox. 100 palabras)

- Overview of current polymeric drug delivery systems and therapeutic enzymes.
- Self-assembly of block copolymers and biohybrid structures.
- Characterization methods: Dynamic light scattering, zeta potential, Cryo-TEM, fluorescence and UV-VIS spectroscopy. - Improved laboratory skills, experiment planning and discussion of results.
- Use of electronic LabBook using LabArchives software.

**Seguimiento/** Monitoring Plan (aprox. 50 palabras)

The student will be included in the round of progress meetings every two weeks. These progress meeting are headed by Dr. Silvia Moreno and Dr. Jens Gaitzsch. The student must prepare a presentation and explain latest results and the working plan for the following days. Additionally, the student will be direct supervised by S. Moreno weekly, and supported in the lab work by others students and technicians.

Once per month, an additional meeting will be organized for discussion with the Head of Department, Dr. Appelhans.

**Evaluación/** Evaluation plan (aprox. 50 palabras)

The work developed during the traineeship will be evaluated considering the following aspects:

- Good communication skills, responsibility and motivated and positive attitude (meet deadlines, punctuality, attends meetings, taking notes, responds to feedback by improving performance).
- Learning capacity, independence and ability to complete assigned daily tasks.
- The writing of reports showing the capacity of discussion and analysis.
- Ability to adapt to a new work environment and multicultural research group.

**Conocimientos técnicos o experiencia requerida (si procede) /** Technical knowledge or experience required (if applicable)

Language competence required: English B2, German language is useful for the German bureaucracy, but not necessary.

Chemistry, Computer Skills

**Especificaciones extra de la institución de acogida (si procede) /** Additional specifications of the host institution (if applicable)

N/A

**Disponibilidad para evaluar informes de covalidación de créditos (Si/No) /** Availability to evaluate credit covalidation reports (Yes / No)

YES

**Otra información relevante /** Any additional important information

Además del soporte económico del Programa Erasmus+ Placement de la UCLM, los estudiantes recibirán el paquete de **Ayudas CERFA-Fundación Ramón Areces**. En la convocatoria 2022, éste se divide en dos conceptos:

- Ayuda económica en concepto de viaje: 400 euros
- Curso práctico destinado a ofrecer formación sobre gestión de carrera profesional

Toda la información aquí: <https://cerfa.de/ayudas-cerfa-fra/>