

Position description

1. Position identification

Title of post : Postdoctoral fellowship in nanosciences and biomedical innovation	
Type of contract : Fixed-term contract	
Category (A,B or C) : A	
Contract/project period : 18 months	Expected date of employment : 15/02/2025
Proportion of work : 100%	
Workplace : CBST Laboratory, UMR 7199 CNRS-Unistra, Faculty of Pharmacy, Illkirch, France	
Desired level of education : PhD	
Experience required : PhD with a post-doctoral experience < 2 years	
Contact(s) for information on the position (identity, position, e-mail address, telephone) : Pr Françoise Pons, co-leader of the Smart Nanoparticles team, pons@unistra.fr, +33 (0)3 68 85 42 03	
Date of publication : 15/11/2024	
Closing date for the receipt of applications : 15/01/2025	

2. Research project or operation

Evaluation of carbon dots for light-controlled siRNA delivery and photodynamic therapy

The proposed post-doctoral position is part of the CaDoRNA research project funded by the National Research Agency. This project aims to design, synthesize and evaluate the biological activity of carbon dots (CDs) allowing light-controlled delivery of siRNA, associated with photodynamic therapy. CDs are carbonaceous nanoparticles which possess exceptional properties: ease of synthesis and functionalization from widely available raw materials, nanometric size, chemical stability, high solubility/dispersibility in water, and intrinsic fluorescence allowing their monitoring in the cell by imaging. Furthermore, they have been described very recently as potent nucleic acid delivery agents in vitro and in vivo. The CDs that will be developed as part of the CaDoRNA project will be doped by a photosensitizer and decorated on the surface by cationic species via a chemical bond sensitive to singlet oxygen. Thus, they will act as siRNA vectors, thanks to their cationic charges allowing the nucleic acid to be complexed, and will produce under light irradiation, thanks to the photosensitizer, singlet oxygen which will allow precise spatio-temporal release of the siRNA but also photodynamic therapy (PDT).

3. Activities

➤ **Description of the research activities :**

The post-doctoral fellow will be responsible for evaluating the biological activity of the CDs produced by the chemists of the team, in collaboration with a doctoral student. This will involve studying the cellular internalization and distribution of CDs/siRNA complexes, as well as the intracellular dissociation of these complexes in cells under irradiation, in connection with the effectiveness of transfection of the complexes. The implementation of this work will mainly use cell culture techniques, fluorescence imaging (confocal and epifluorescence), and flow cytometry. If this work provides proof of concept that CDs doped with a photosensitizer allow light-controlled delivery of siRNA associated with increased transfection efficiency, work aiming at evaluating the therapeutic potential of these new nucleic acid vectors will be undertaken. In this regard, the pathology that we wish to target is atopic dermatitis, an inflammatory skin disease, the prevalence of which continues to increase in industrialized countries and of which certain current treatments are heavy and/or restrictive, leaving room for new innovative drugs, including topical drugs based on nanoparticle vectorized siRNA.

➤ **Related activities :**

To carry out this research, the recruited person will have to design and write experimental protocols, implement these protocols in compliance with health and safety rules, as well as analyze their results and record them in electronic and paper form (laboratory notebook) and format them to present them to the various project partners.

The recruited person will also have to participate in the common life of the laboratory by carrying out common tasks, supervising student interns, participating in team, unit or project meetings, presenting its results in internal seminars or during scientific days, and participating in the writing of scientific articles.

4. Skills

➤ **Qualifications/knowledge :**

- Research training in cell biology
- Knowledge of the issues of delivering therapeutic active ingredients with nanoparticles at the cellular scale

➤ **Operational skills/expertise :**

- Cell culture
- Cellular fluorescence imaging (confocal and epifluorescence)
- Quantitative image analysis

- Flow cytometry

➤ **Personal qualities :**

- Motivation for the research and the proposed topic
- Dynamism
- Commitment and seriousness
- Sense of organization
- Autonomy and taking initiative
- Ability to work in a team and communicate

5. Environment and context of work

➤ **Presentation of the laboratory/unity :**

The post-doctoral fellow will work within the "Smart NanoParticles" team of the Synthetic and Therapeutic Chemo-biology laboratory (CBST, UMR 7199). The CBST is a joint research unit affiliated with the CNRS and the University of Strasbourg, and located at the Faculty of Pharmacy on the Illkirch campus. Its research activities, which rely on four research teams, are focused on: 1- the design of new chemical tools such as bioactive molecules, photosensitive probes, or intelligent particles capable of responding to their environment, 2- the development of new reactions in living organisms, such as bioconjugation and biorthogonal reactions, 3- the understanding of the fundamental biological or biophysical mechanisms of cellular communication, and 4- the development of new therapeutic solutions. The "Smart NanoParticles" team which will welcome the recruited person is co-directed by Alexandre Specht and Françoise Pons. Made up of chemists and biologists, this team is developing smart drug-delivery systems which, following stimulation, are capable of controlling the location, time and released quantity of a agent therapeutic, in order to achieve precision medicine. To do this, the team synthesizes and evaluates, in in vitro and in vivo models, various types of nanoparticles (lipid nanoparticles, carbon dots, photoluminescent, bioluminescent particles or doped with photosensitizers) capable of releasing, under the effect of various internal or external stimuli (pH, hydrolases, light), active ingredients of varied nature (nucleic acids, antibacterials, "conventional" antitumor drugs, anti-inflammatory molecules). The recruited person will therefore evolve in an interdisciplinary environment.

➤ **Hierarchical relationship :**

The post-doctoral fellow will be supervised by Alexandre Specht and Françoise Pons, head of the team, as well as by Pascal Didier (UMR 7021), partner of the CaDoRNA project. He will also interact with the other project partners.

➤ **Special conditions of practice (notice attached):**

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To apply, please send your CV, cover letter and diploma to : Alexandre Specht &
Françoise Pons