Direction
des **ressources humaines**
Université de Strasbourg

Position description

1. Position identification

Title of post : Phosphate capture enhancement using designed recyclable iron oxide nanostructures

Type of contract : Post-doctoral

Category (A,B or C) : Doctorat + un an de psot-doc

Contract/project period : 18 months **Expected date of employment : 01/02/2023**

Proportion of work : 100%

Workplace : ICUBE (and partially at IPCMS)

Desired level of education : PhD + one year of post-doc

Experience required : PhD

Contact(s) for information on the position (identity, position, e-mail address, telephone) :

Date of publication : 05/12/2022

Closing date for the receipt of applications : 20/12/2022

2. Research project or operation

Phosphate is a very dangerous toxin in blood and dialysis is the only way to remove them from blood of patients suffering of chronic kidney disease. The current processes (hemodialysis and peritoneal dialysis) do not allow removing high phosphate amount. PHODIA project proposes here to investigate the addition of iron oxide nanostructures (IONS) into dialysate used for peritoneal dialysis to enhance phosphate removal from blood. Our process would also allow envisioning this more comfortable and cheapest peritoneal dialysis process than the hemodialysis one as the most adapted dialysis method. IONS will be designed to remove high amount of phosphates and to be recyclable. The creation of a set-up will allow evaluating the phosphate capture in peritoneal dialysis conditions (diffusion/hydrostatic pressure/osmotic pressure) allowing selecting the most effective designed IONS and avoiding too much tests with animals. In vitro experiments will evaluate their cytotoxicity and interactions with peritoneal membrane.

3. Activities

➢ **Description of the research activities :**

The first objective of the PhD projet will be to synthesize IONPs with small sizes and encapsulated in organic capsules or mesoporous silica based capsules optimized to ensure a good colloidal stability in dialysate, no

transfer of IONPs from dialysis solution to blood vessels and a high phosphate capture. The selected synthesis method will be then scaled-up.
The adsorption of phosphate of designed IONPs will be then studied as well as the possibility of IONPs to remove other toxins. It will be also verified that essential compounds will not be removed during the PD process.
Another objective is the building of an in vitro set-up mimicking the conditions of the PD treatment to test and optimize IONPs design and extraction. It will aim at reproducing as closely as possible the exchanges that take place through the peritoneum during a dialysis session, as well as the physical and chemical conditions of exchange and at allowing feasibility tests without immediate recourse to animals trials.
The goal is to formulate dialysates containing a minimal and controlled amount of IONPs to extract a higher and controlled amount of phosphates during a PD procedure and possibly to reduce the duration of the PD treatment. This project would establish PD as an efficient procedure for controlling CKD and increase its use for better comfort in adult patients and better effectiveness in children, for whom it is the only possible treatment.

➢ **Related activities :**

Synthesis of iron oxide nanoparticles, organic or mesoporous silica encapsulation, construction of a device mimicking peritoneal dialysis in cooperation with competent researchers in this field, validation of the device and testing of the nanoparticles encapsulated in this device.

4. Skills

➢ **Qualifications/knowledge** :

Synthesis and characterization of iron oxide nanoparticles
Synthesis and characterization of mesoporous silica by sol-gel or other methods
Purification of solutions by dialysis
Knowledge in biology: cytotoxicity, cell cultures

➢ **Operational skills/expertise :**

He/she will have expertise in synthesis and functionalization of nanoparticles for health and in purification systems. This project will suit a candidate interested in experimental work, with a strong interest in the synthesis of nanoparticles, their organic or silica encapsulation and their structural and biological characterizations, combined with a good knowledge of solid state chemistry and physics. Process engineering skills would be a plus for the part concerning the construction of the device simulating PD and the development of a process for larger scale synthesis of the synthesized nanoparticles.

➢ **Personal qualities :**

Collaborative work, autonomy, enthusiasm, dynamism

5. Environment and context of work

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

This post-doctoral research project is experimental and technological. It concerns the elaboration of oxide nanoparticles with a high specific surface, the adsorption of organic molecules on their surface and the development of a device mimicking peritoneal dialysis. He will rely on the numerous synthesis and characterization techniques of the IPCMS and the imaging techniques and knowledge in peritoneal dialysis of the ICUBE laboratory. The candidate will work between two laboratories in Strasbourg very close geographically: mainly within the UF6237 Preclinical Imaging lab (located in the Hautepierre university hospital) of the ICUBE laboratory, which has developed techniques for quantitative in vivo animal monitoring of peritoneal dialysis by imaging, and within the Functionalized Nanoparticles team of the IPCMS, which has developed strong competences in the synthesis, functionalization and organization of oxide nanoparticles for biomedical, energy and environmental applications.

➢ **Hierarchical relationship :**

Responsable hiérarchique officiel : Dr Philippe Choquet ICUBE
Co-responsable : Pr Sylvie Begin IPCMS

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

Work between two laboratories: ICUBE and IPCMS whose location is very close

To apply, please send your CV, cover letter and diploma to :