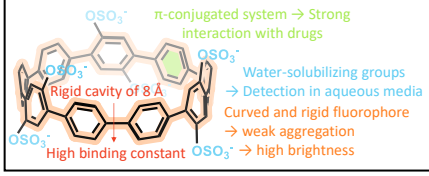
Post-doctoral fellow in molecular chemistry - Water-soluble nanohoops: A New generation of macrocycles for fluorescence sensing of psychoactive and performance-enhancing Drugs

The research group, based at the Institute of Chemical Sciences of Rennes (ISCR), University of Rennes, is internationally recognized for its expertise in the field of nanohoops.[1]

The main goal of this project is to establish design rules for nanohoops, possessing predictable recognition and emission properties, to be used as fluorescent sensors of drugs. Water-soluble macrocyclic fluorophores are of great interest in biological detection. Potential applications include the detection and monitoring of drugs, such as therapeutic follow-up of psychotropic or analgesic compounds, real-time sensing in biological matrices (blood, saliva, urine), and rapid, non-invasive screening for substance abuse in clinical settings. In addition, these sensors could support environmental analysis, e.g. by detecting drug residues in wastewater. In most cases, these supramolecular hosts consist of a macrocycle connected to a fluorescent unit, which may damage stability. In addition to being intrinsically fluorescent, [n]cyclo-*para*-phenylene (**[n]CPP**) derivatives, also called nanohoops, display well-known encapsulation properties. Due to their rigidity, nanohoops are expected to display improved properties (higher brightness and association constant) compared to more flexible non-conjugated macrocycles, in which fluorophores are separated by methylene or ethylene spacers. Thus, by adjusting the number of phenylenes, the nanohoops can combine fluorescence with an appropriate cavity size, making them promising hosts with visible fluorescence in aqueous environments, provided that they are rendered water-soluble. Due to their strained structure, the synthesis of nanohoops with solubilizing groups is indeed challenging, and only two examples have been reported to date (with limited encapsulation properties). **The scientific methodology will be divided into four main tasks: i) the synthesis of 8 water-soluble, rigid and fluorescent macrocycles, ii) the study of their structural, spectroscopic and water-solubility properties, iii) the study of their encapsulation ability, and iii) their use as fluorescent sensor of drugs. This final part will be carried out collaboratively.**

Figure 1. *Design of a rigid, fluorescent and water-soluble macrocycle*



Candidates should have excellent skills in organic synthesis and should have defended their PhD thesis no more than two years ago. Experience in spectroscopy, host-guest studies, or molecular modelling would be considered an asset. Contract start date: Between 1 December 2026 and 15 January 2027. Candidates are encouraged to contact C. Poriel (DR CNRS) / C. Quinton (CR CNRS) for further information.

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