Peptide-based luminescent coordination capsules and cages – towards bio-inspired cavities illuminated by chiral light

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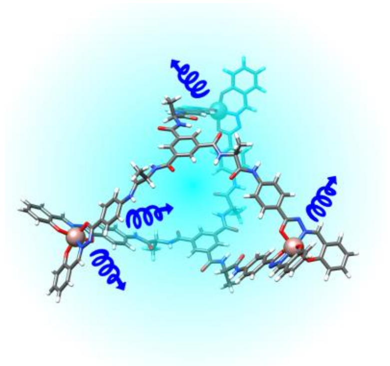
Molecular capsules can be considered molecular-scale boxes and used similarly: for the separation, storage, transport, and release of their cargo (typically other small molecules). These applications are important, for example, for drug delivery or separation techniques. However, with some additional structural features, the capsules can do much more. For example, if they are chiral – they can do chiral recognition, if they contain a catalytic metal center - they can perform catalysis. If they contain both - they can perform enantioselective catalysis, which is the heart of modern drug synthesis. If they are luminescent they can emit light and photo-activate their cargo. If they are chiral and luminescent – they can emit chiral light called CPL.



- **Peptide-Based Cages**
- **Chirality at Metal Centers**
- **Circularly Polarized Luminescence**
- **Chiral Recognition**
- **Catalysis/photocatalysis**

In this project, we plan to obtain capsules that "can do even more" by combining more unique features: chirality, presence of metal centers, ability to emit light, and functionality originating from using natural building blocks (peptides). Peptides are natural building blocks with their functions already pre-programmed, they are also available, modular, and inherently chiral. However, they have several disadvantages that make them particularly difficult building blocks, therefore, there are only a few examples of their use in the construction of chiral coordination capsules.

Our initial results show that unique novel capsules with the desired features can be obtained by rational design of the elements. The execution of this project will lead to new capsules and their complexes and increase the general understanding of the principles of construction of peptide and metal-based capsules and cages. We will also test the properties of the obtained materials towards binding and recognition, their adaptability toward various environments, and their ability to generate selective chiroptical signals. We anticipate that thanks to such features, the obtained capsules and cages may be used in the detection of the handedness of various biologically important molecules as nanovessels for the light-initiated selective synthesis of right- or left-handed molecules.