PROPOSTA DI TESI MAGISTRALE PRESSO IL GRUPPO DI RICERCA in CHIMICA BIOINORGANICA e MATERIALI LUMINESCENTI (Prof. Piccinelli, Dr. Nardon e Prof. Bettinelli)

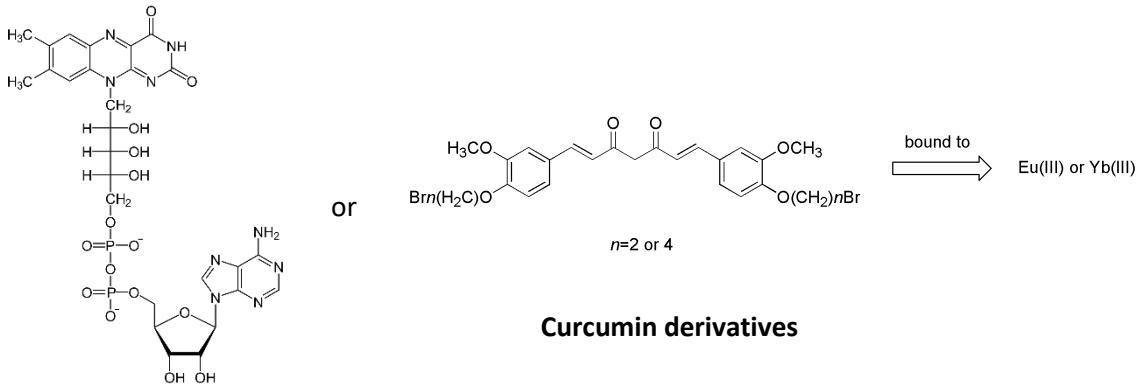
TITLE of THE RESEARCH PROGRAM

STUDY of SPECTROSCOPIC PROPERTIES of SOME ASSEMBLIES made up of BIOMOLECULES (or NATURAL PRODUCTS) and LUMINESCENT LANTHANIDE IONS for BIOMEDICAL APPLICATIONS

Some biomolecules, such as fluorescent flavins and flavoproteins, or natural molecules, such as curcumin derivatives, are well known to exhibit fluorescence upon excitation in the near-UV and visible spectral region [*Phys. Chem. Chem. Phys.*, 2018,20, 16949-16955; *J. Am.Chem.Soc*. 2018, 140, 14562-14566; *Russian J. of General Chem.* 2019, 89, 2577-2583]. This peculiarity paves the way to their use as optical probes in the field of optical imaging in biological environments. Interestingly, both the aforementioned classes of species are two-photon excitable, which in practice means that they can be excited also by a doubled wavelength (*i.e.*, a probe, normally excited around 400 nm, is excitable around 800 nm). This represents a great advantage for *in vivo* applications since a Near-Infrared (NIR) excitation allows a better penetration into human tissues, such as skin.

As for the emitted light, the optical probes based on flavins or curcumin derivatives suffer from lower penetration since they emit light in the visible spectral range (500-550 nm). In order to shift the emission radiation towards more penetrating wavelengths, such as the red or NIR ones, we could take advantage of the luminescence stemming from lanthanide ions, such as Eu(III) and Yb(III). More specifically, the excitation light could be efficiently transferred from the biomolecules to the metal ion, so as to obtain an emission around 620 nm [Eu(III)] or 1000 nm [Yb(III)]. Hopefully, this could be possible if a stable biomolecule/lanthanide ion assembly is formed.

The purpose of the present Master's degree thesis is hence to study the spectroscopic properties of bioinorganic assemblies made up of Eu(III) or Yb(III) ions and fluorescent flavins (such as FAD) or natural products, such as curcumin derivatives (Figure 1). In particular, the student will work jointly to the members of the research team in order to synthetize and characterize se assemblies, followed by their spectroscopic study. The experimental activity will take place at the Luminescent Materials and Bioinorganic Chemistry Laboratory under the supervision of the Prof. Fabio Piccinelli.



FAD **Curcumin derivatives**

Figure 1. Bioinorganic assemblies to study in the proposed Master's degree thesis.

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Durata della tesi: almeno 8 mesi