UFR CHIMIE & BIOLOGIE Université Grenoble Alpes

Master in Chemistry

Sujet de stage de Master 2 (1 page max.)

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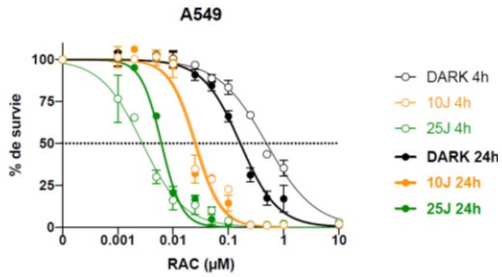
Parcours de Master 2 (*Rayer la/les mention(s) inutile(s)*) :
Chemistry for Life Sciences (CLS)
Organic Synthesis (SOIPA)

Titre du sujet : Iridium(III) complexes for imaging and photodynamic therapy against cancer

Objectifs visés du stage: A series of iridium(III) complexes will be synthesized and studied by the mean of luminescence spectroscopy. In collaboration with the team "Cancer Targets and Experimental Therapeutics" from the Institute for Advanced Biosciences (IAB, Grenoble), their ability as therapeutic and contrast agent will be studied on several cancerous cell lines.

Intérêts pédagogiques et compétences visées: The multidisciplinary subject requires a motivated candidate who will have the opportunity to discover different fields of chemistry, from organic and metal complexes synthesis to physical-chemistry characterization such as emission spectroscopy.

Résumé: Luminescence spectroscopy and microscopy have emerged as powerful tools for real-time, non-invasive monitoring of biomolecules of interest in their native environments with high spatial and temporal resolution.[1] Phosphorescent dyes allow to increase the imaging resolution via the use of a delay between the excitation and the acquisition, allowing the background fluorescence to significantly decrease.[2] The imaging could be also enhanced by increasing the molecular brightness ($B = \varepsilon \times \Phi$, ε = molar absorptivity at λ_{exc} and Φ the luminescence quantum yield).[3,4] We recently put in light bimetallic complexes, which display a fourfold higher brightness value than the corresponding monometallic complexes. In addition, such complexes can be used as photosensitizers (PS) for photodynamic therapy (PDT) which exploits light-activated compounds for therapeutic treatment. The PS is inactive in the absence of light, once excited with a light beam, the PS will generate singlet molecular oxygen ($^1O_2$). The latter will lead to cell death. The first results are very encouraging as the monometallic complex demonstrates to have a IC_{50} of 0.15 μmol.L^{-1} on tumoral cells (A549) under low power light activation (4h incubation, 420 nm, 1.2 J.cm^{-2}) comparing very well with the literature data.[5]



Based on these results, you will start an explorative research in the aim of increasing the molecular brightness of the compounds by the insertion of a linker bearing auxochromes, substituents that will increase ε, between two metal centers.

Approches & matériels utilisés: Organic synthesis (inert atmosphere, Schlenk techniques), structural characterization by single crystal X-ray diffraction, characterization in solution (NMR, mass spectrometry) and emission spectroscopy.

Domaines de compétences souhaitées du candidat: Knowledge in organic chemistry, heterocycles synthesis, will be appreciated.

Dates du stage: January -June 2022 (Master 2 internship)

1 Yuan, L. et al., *Acc. Chem. Res.* **2013**, *46*, 1462.
2 Berezin, M. Y. et al., *Chem. Mater.* **2010**, *110*, 2641.
3 Wu, C. et al., **2008**.
4 Wu, S. et al., *Inorg. Chem.* **2021**.
5 Nam, J. S. et al., *J. Am. Chem. Soc.* **2016**, *138*, 10968.