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Metal complexes for biomedical imaging

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CIC biomaGUNE - Seminar Room

Metal complexes are widely used as imaging probes in various imaging modalities. One important field in molecular imaging involves the detection of physico-chemical parameters of tissues, concentration of ions, metabolites, etc. by applying smart, activatable imaging probes that are responsive to the specific parameter to detect. Magnetic Resonance Imaging is particularly well adapted to the design of responsive probes, involving Gd3+-based or PARACEST (Paramagnetic Chemical Exchange Saturation Transfer) agents. The efficacy (relaxivity or CEST properties) of the probe has to be selectively influenced, based on coordination chemistry concepts, by the particular biomarker that we wish to detect. We have been developing potential smart contrast agents to detect cation or neurotransmitter concentration changes, or to monitor redox state and enzyme activity.[1]

Following recent toxicity concerns related to the use of Gd3+ complexes in MRI, there is an active research for more biocompatible alternatives. Among these, Mn2+ chelates have great promise. However, the lower charge and the lack of ligand-field stabilization energy for Mn2+ are not favorable to achieve high thermodynamic stability, and the highly labile nature of Mn2+ sets an even more difficult challenge to meet. We have been exploring rigid and pre-organized ligand structures which are particularly interesting in this respect.[2]

In this talk, some representative examples from these fields will be discussed.

[1] (a) F. Oukhatar, S. Même, W. Même, F. Szeremeta, N. K. Logothetis, G. Angelovski, and É. Tóth, ACS Chem. Neuroscience, 2015, 6, 219. (b) F. Oukhatar, H. Meudal, C. Landon, C. Platas-Iglesias, N. K. Logothetis, G. Angelovski, and É. Tóth, Chem. Eur. J. 2015, 21, 11226. (c) F. Oukhatar, S. V. Eliseeva, C. S. Bonnet, M. Placidi, N. K. Logothetis, S. Petoud, G. Angelovski and É. Tóth, Inorg. Chem. 2019, 58, 13619. (d) J. He, C. S. Bonnet, S. V. Eliseeva, S. Lacerda, T. Chauvin, P. Retailleau, F. Szeremeta, B. Badet, S. Petoud, É. Tóth and P. Durand, J. Am. Chem. Soc. 2016, 138, 2913−2916.

[2] (a) D. Ndiaye, M. Sy, A. Pallier, S. Même, I. de Silva, S. Lacerda, A. M. Nonat, L. J. Charbonnière and É. Tóth, Angew. Chem. Int. Ed. 2020, 59, 11958. (b) P. Cieslik, P. Comba, B. Dittmar, D. Ndiaye, É. Tóth, G. Velmurugan, H. Wadepohl, Angew. Chem. Int. Ed. 2022, 61, e202115580, (c) D. Ndiaye, P. Cieslik, H. Wadepohl, A. Pallier, S. Même, P. Comba, É. Tóth, Mn2+ bispidine complex combining exceptional stability, inertness and MRI efficiency, J. Am. Chem. Soc. 2022, 144, 22212.