Programming molecules to diagnose and treat diseases

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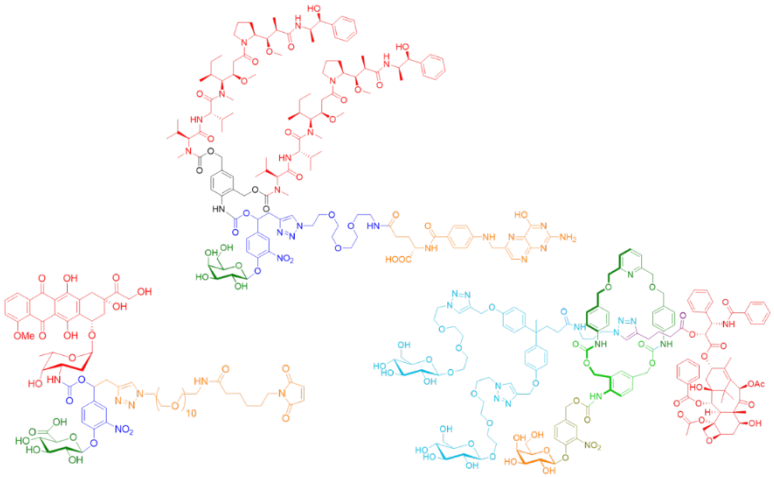
Our research team is focused on molecular programming as a tool to explore and manipulate complex biological systems, such as living cells or whole organisms. Within this framework, our work involves engineering molecules whose structure incorporates a chemical program, allowing them to autonomously execute specific tasks within biological environments. The fundamental principle of this concept is the spatiotemporal control over the formation and/or breaking of chemical bonds, including covalent bonds, weak interactions, and/or mechanical bonds. Our molecular systems[1] include programming components like self-immolative linkers, chemical amplifiers, self-opening macrocycles, enzyme-responsive biorthogonal triggers, artificial cell membrane markers etc … enabling stringent control over their interactions with living systems.

We employ this molecular programming concept to develop novel diagnostic and therapeutic strategies, with a particular focus on the fight against cancer.

Some examples of our programmed molecular systems



References

[1]Selected recent examples: a) *Click-and-Release Formation of Urea Bonds in Living Cells Enabled by Micelle Nanoreactors.* L. Madegard, M. Girard, E. Blochouse, B. Riss Yaw, A. Pallazolo, Mélanie Laquembe, D. Audisio, P. Poinot, S. Papot, F. Taran *Angew. Chem. Int. Ed.* **2025**, *64, e202422627*. b) *An enzyme-responsive self-immolative recognition marker for manipulating cell-cell interactions. C. Plumet, S. D. Katsakos, M. Girard, J. Clarhaut, B. Renoux, I. Opalinski, S. Papot, Adv. Sci.,* **2024**, *11*, 2470221. *c) Induced-volatolomics for the design of tumour activated therapy. R. Châtre, E. Blochouse, R. Eid, F. Djago, J Lange, M. Tarighi, B. Renoux, A. Le Pape, J. Sobilo, J. Clarhaut, C. Geffroy, I. Opalinski, W. Tuo, S. Papot, P. Poinot, Chem Sci.* ***2023****, 14, 4697-4703. d) Stimuli-Responsive Catenane-Based Catalysts. A. Bessaguet, I. Opalinski and S. Papot, Angew. Chem. Int. Ed.* ***2023****, 62, e20221678. e) In Vivo Synthesis of Triple-Loaded Albumin Conjugate for Efficient Targeted Cancer Chemotherapy. R. Châtre, J. Lange, E. Péraudeau, P. Poinot, S. Lerondel, A. Le Pape, J. Clarhaut, B. Renoux, S. Papot, J. Control. Release* ***2020****, 327, 19-25. f) Volatile Organic Compound (VOC)-Based Probe for Induced Volatolomics of Cancers. J. Lange, B. Eddhif, M. Tarighi, T. Garandeau, E. Péraudeau, J. Clarhaut, B. Renoux, S. Papot, P. Poinot, Angew. Chem. Int. Ed.* ***2019****, 58, 17563-17566.*