

## Porphyrins and biomolecules: A long-lasting friendship

**Alessandro D'Urso**

Università degli Studi di Catania, Italy



### Abstract

Porphyrins are quite versatile molecules successfully used in many fields: from nanotechnology to biomedicine. These hetero-aromatic macrocycles present remarkable electronic properties which bring to attractive spectroscopic features. The non-covalent interactions of water-soluble achiral porphyrins with chiral templates have been exploited to detect and/or amplify the matrix handedness. The interaction of achiral cationic porphyrins with DNA has been extensively studied and utilized as reporters of different sequences of DNA bases. We have reported that a cationic Zn(II)porphyrin (ZnT4) and an anionic Ni(II)porphyrin (NiTPPS) were able to spectroscopically detect the left-handed Z-DNA under highly competitive conditions. Moreover, thanks to its peculiar properties, NiTPPS/Spermine/Z-DNA complex shows to be quite a versatile system. In fact, as response to pH perturbations, it is able to reversibly release the chiral information stored in the porphyrin and/or in the DNA helix portion of the supramolecular complex. Finally, using pH and temperature as input and porphyrin ICD as output, our system behaves as a reversible AND logic gate. To improve the efficiency of our probe we have designed porphyrin spermine derivative able to induce, detect and stabilize the Z form of DNA. Even we have exploited the stabilizing ability of spermine porphyrin, with G-quadruplex structures, obtaining some interesting results. Recently we investigated the potency of porphyrins as inhibitor and modulator of proteasome, which is the protein involved in many biological processes. The inhibition of proteasome is promising strategy to cure of tumors.

### Biography

Alessandro D'Urso is associate professor at Chemical Science Department of University of Catania. His research activity is mainly focused on Interactions of water-soluble porphyrinoids with biomolecules, as inhibitors of proteasome and as chiroptical reporters of nucleic acids conformations. He got the PhD in Chemistry in 2010 at University of Catania. In 2009 he was a visiting scholar at the University of Wyoming (Supervisor: Prof. Milan Balaz) working on chiroptical sensors for Z-DNA. In 2010 he was invited as a research assistant at the Chemistry Department of Doane College (Prof. Andrea Holmes). Then in 2012 he has been a Postdoctoral Research Scientist at Columbia University, Chemistry Department in the lab. of Prof. Koji Nakanishi and Prof. Nina Berova working on "stereochemical studies on the interactions between metalloporphyrin sensors and DNA oligonucleotides. In 2012 he got national grant FIRB 2012 as principal investigator, with the project "Spectroscopic and Structural Characterization of Proteasoma Inhibitors". He has been awarded with: 1) "SPP/JPP Young Investigator Award 2016" and 2) "Best Poster Award at 14th International Conference on Chiroptical Spectroscopy 2013 in Nashville, USA". In 2010 he was selected as one of 45 runners-up of the Reaxy PhD Prize on over 300 applications and from 2012 he belong to the Guidance team of the Reaxy Club. In 2013 he joined a board of directors of Young Group of Società Chimica Italiana as vice coordinator, representing the division of Chemistry of Biological Systems. He is author of over 50 papers published in international peer-reviewed journals and he counts more than 800 citation (h-index = 16).

### Publications

1. Interactions of mono spermine porphyrin derivative with DNAs
2. Photodegradation of Antibiotics by Noncovalent Porphyrin-Functionalized TiO<sub>2</sub> in Water for the Bacterial Antibiotic Resistance Risk Management
3. Optimization of ZnO Nanorods Growth on Polyethersulfone Electrospun Mats to Promote Antibacterial Properties
4. Long-Range Chiral Induction by a Fully Noncovalent Approach in Supramolecular Porphyrin-Calixarene Assemblies
5. 5,10,15-Tris(4-sulfonatophenyl)corrole Synthesis
6. Polyethersulfone Mats Functionalized with Porphyrin for Removal of Para-nitroaniline from Aqueous Solution
7. Chiral Recognition of L- and D- Amino Acid by Porphyrin Supramolecular Aggregates
8. Design principles of chiral carbon nanodots help convey chirality from molecular to nanoscale level
9. Interactions Between Spermine-Derivatized Tentacle Porphyrins and The Human Telomeric DNA G-Quadruplex
10. Chirality Enhancement of Porphyrin Supramolecular Assembly Driven by a Template Preorganization Effect
11. Combined Approach To Remove and Fast Detect Heavy Metals in Water Based on PES-TiO<sub>2</sub> Electrospun Mats and Porphyrin Chemosensors

10<sup>th</sup> World Congress on Chemistry & Medicinal Chemistry | Rome | Italy | 28-29 February, 2020

Abstract Citation: Alessandro D'Urso, *Porphyrins and biomolecules: A long-lasting friendship*, Chemistry 2020, 10th World Congress on Chemistry & Medicinal Chemistry, Rome, Italy, 28-29 February, 2020, 19