



# Functional Organic Materials Group

Interdepartmental Centre for Nanostructured Interfaces and Surfaces (NIS)  
Interdepartmental Centre ICxT (ICT e Innovazione per Società e Territorio)  
Department of Chemistry  
University of Turin

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Dr. A. Fin  
Dr. R. Buscaino  
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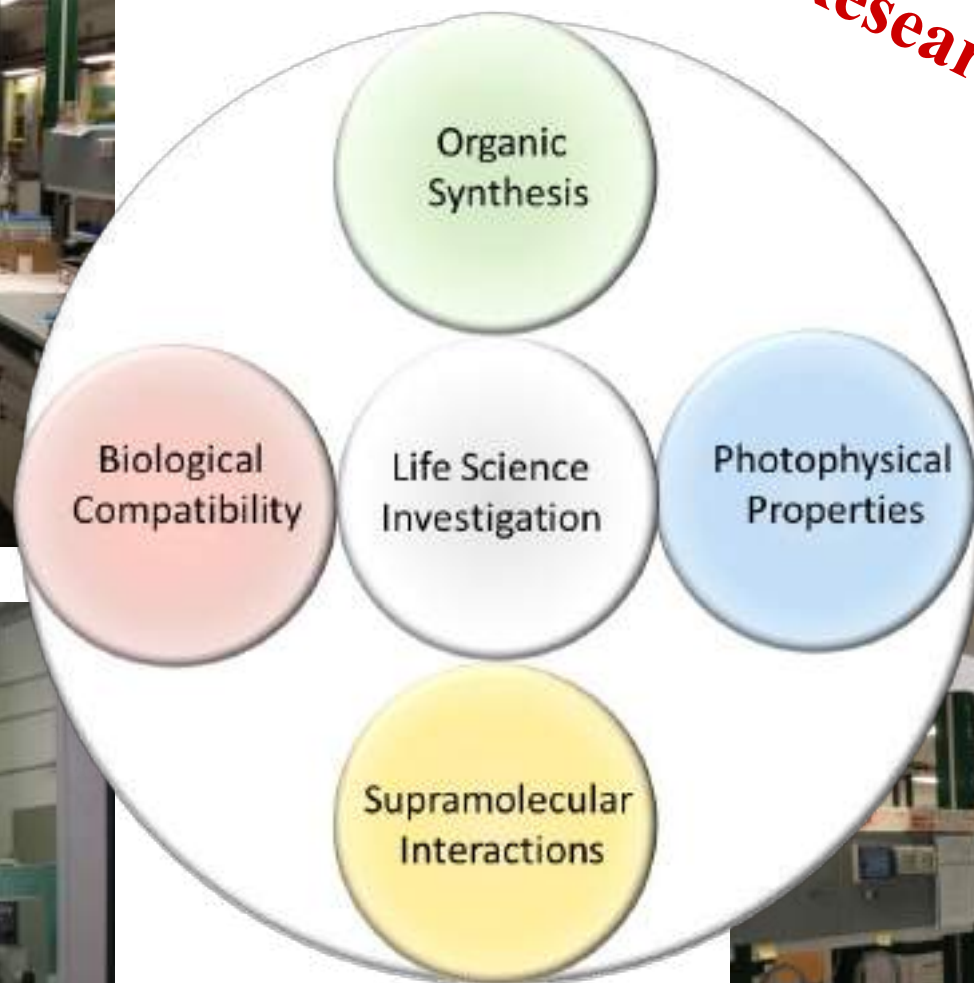
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***A Researcher Daily Life.....***

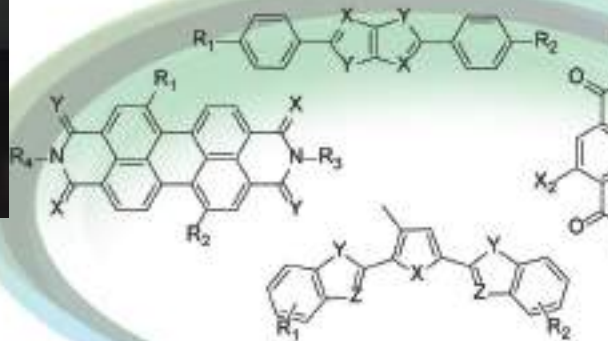




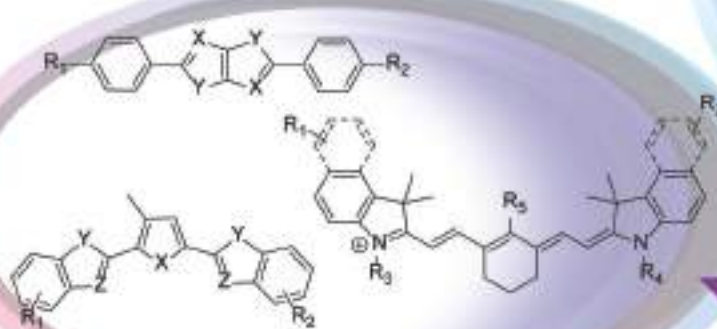
# Synthesis of Functional Dyes and Fluorophores for Smart and High-Tech Applications



Sensitive Dyes for 3DP



Cyclization

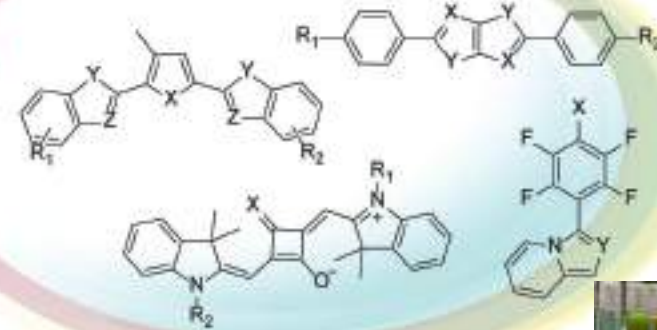


To see or not to see?

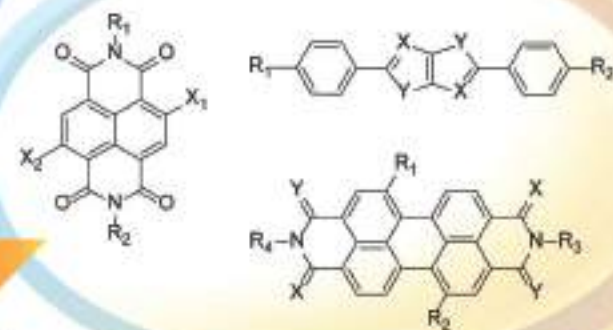
Asymmetric Synthesis

Cross Coupling

Dyes for High-Tech, Complexations & Exotic Interactions



Functionalization



Synthetic Chemical Biology

Multistep Synthesis

Stable Radical Chromophores ?

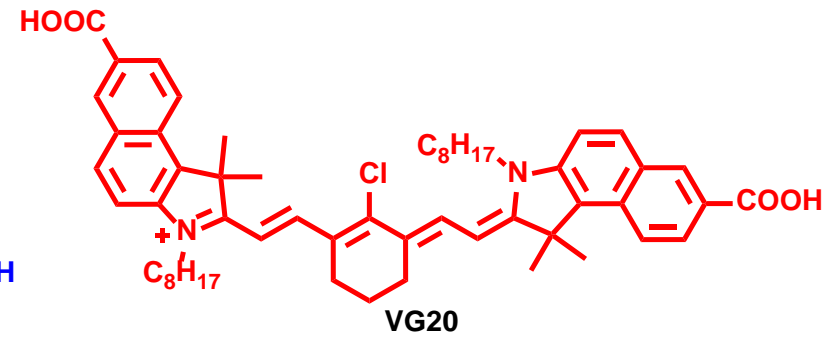
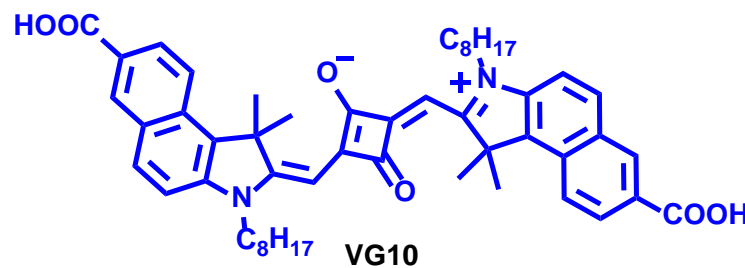
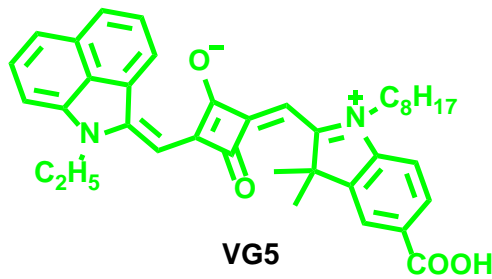


# *Impressive (ground-breaking tandem of transPaRent dyE SenSitised and peroVskite solar cElls)*

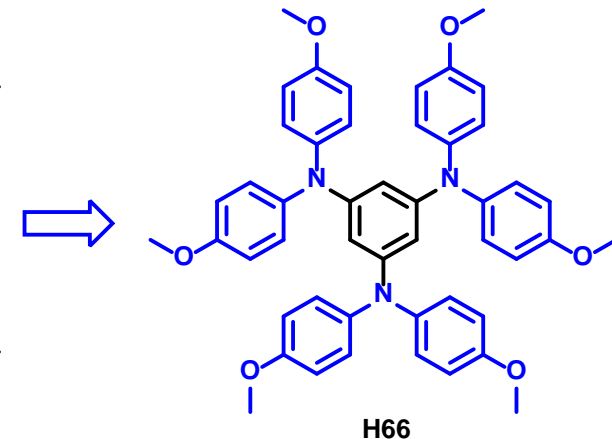
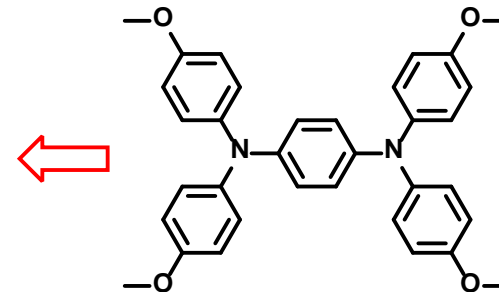
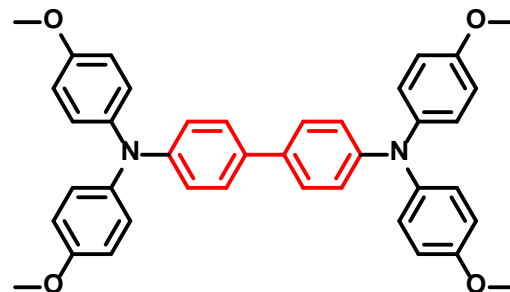
**Contact:** Claudia Barolo, Nadia Barbero, Matteo Bonomo

The growing request for «green» and renewable energy is one of the most urgent question to be solved at a worldwide scale. In this context, the integration of photovoltaic (PV) panels in building appears to be one of the most interesting and efficient strategies.

Development of transparent PV cells converting selectively UV and NIR part of the light while excluding the visible range to reach colorless and fully transparent devices.



Most dyes used as photosensitiser in dye-sensitised solar cells (DSSC) absorb in the whole visible region as well as in the near infra-red (NIR)



H65

H64

H66



# Sustainable Materials for Aqueous PhotoVoltaic

**Contact:** Claudia Barolo, Matteo Bonomo, Guido Viscardi

Nowadays, low-cost solar energy harvesting technologies able to provide enhanced performance under low or weak irradiation and possessing aesthetically pleasing/functional features, suitable for building integration are widely investigated. Among them, dye-sensitized solar cells (DSSCs) are one of the most interesting choices.

Water-based DSSCs are amongst the best solutions providing reduced costs, non-flammability, good stability and environmental compatibility

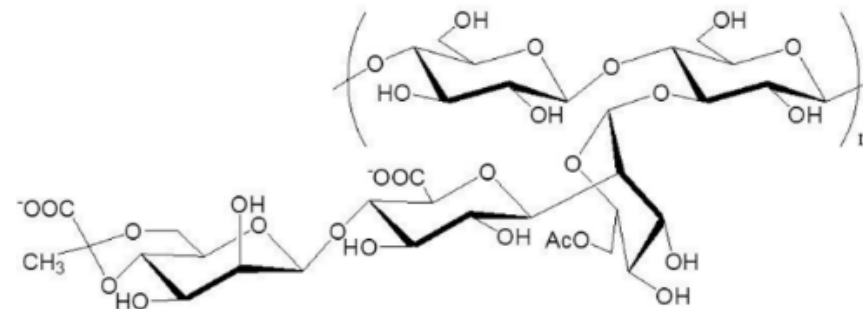
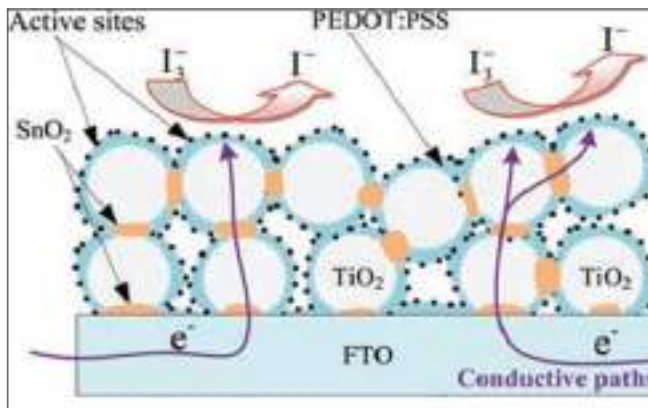
## Vertical Facades



Intermittent and  
Diffuse Light



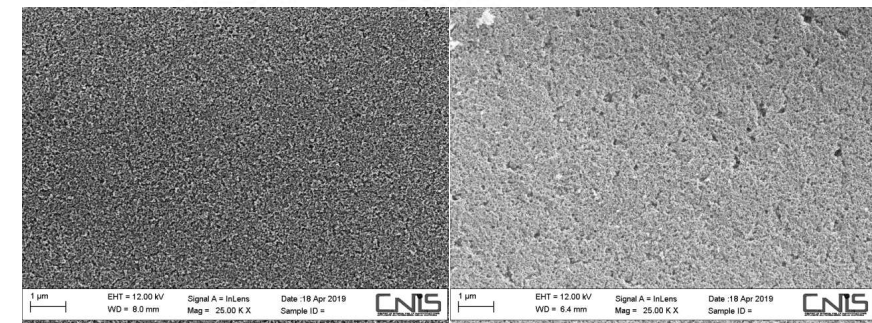
HighVoltage  
Low Power



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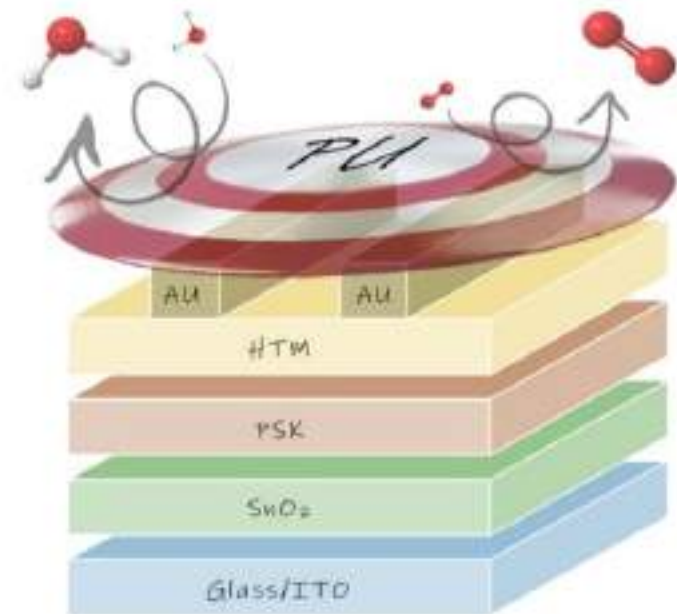
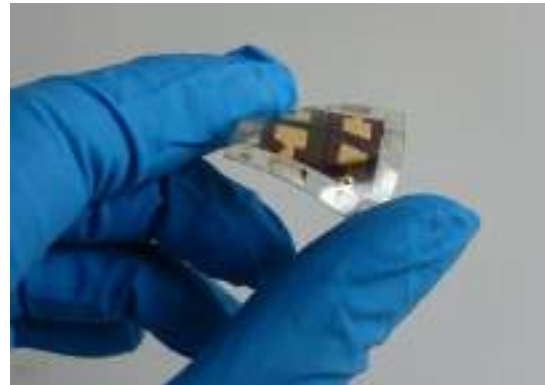


# *Green Polymers as encapsulants for (flexible) emerging PhotoVoltaic*

**Contact:** Matteo Bonomo, Claudia Barolo, Guido Viscardi

Emerging Photovoltaic technologies and especially PSCs, heavily suffer from instability due to intrinsic degradation of the materials used for the realization of the device and to extrinsic degradation related to the interaction with the environment. Degradation rates have been shown to fall exponentially when effective encapsulation/permeation barriers can be developed and applied to perovskite solar cells.

Therefore, the development of a low-cost, effective, light weight and easily scalable encapsulant is a crucial, still unsolved, point for the forthcoming commercialization of Emerging PVs.



impressive

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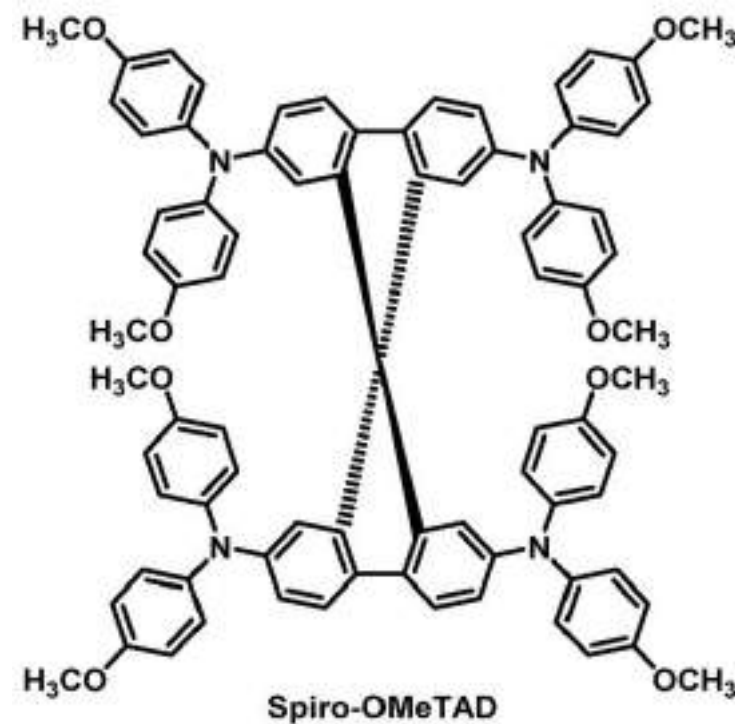
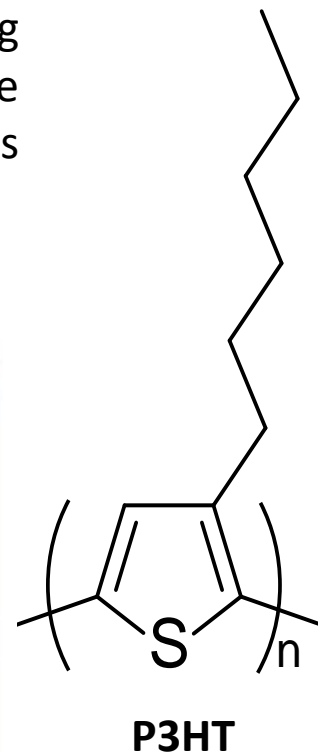
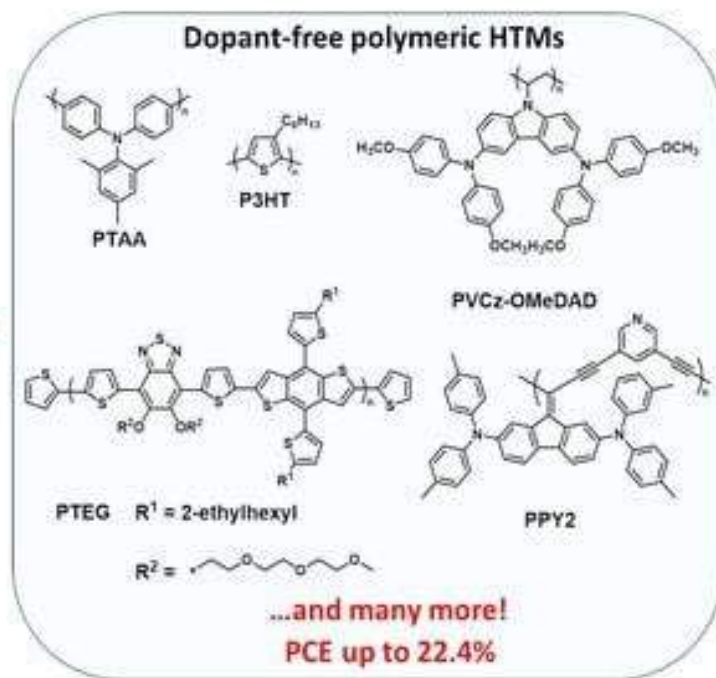
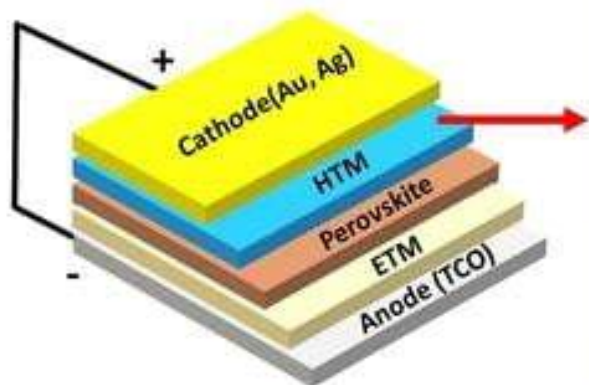




# Synthesis of small molecules and polymers for emerging PV

**Contact:** Pierluigi Quagliotto, Claudia Barolo, Guido Viscardi, Matteo Bonomo

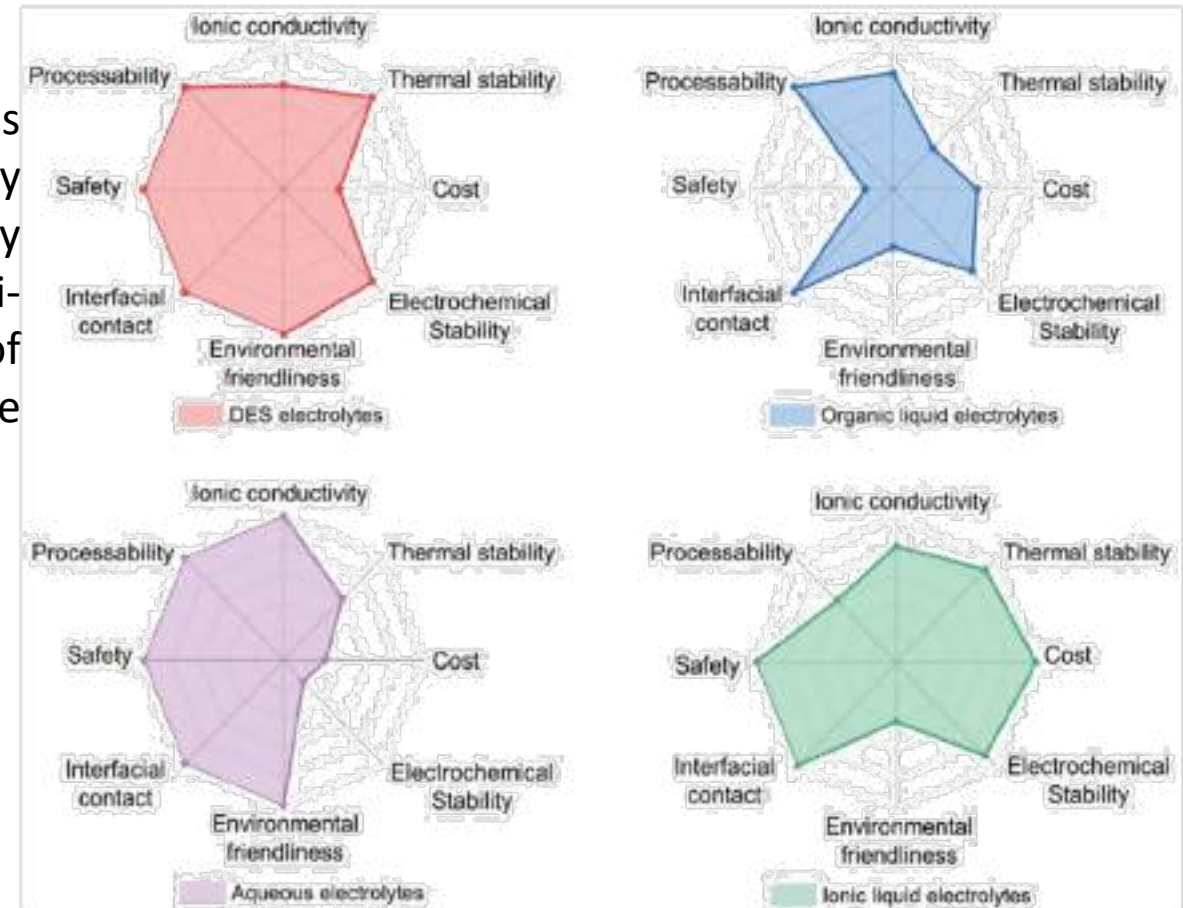
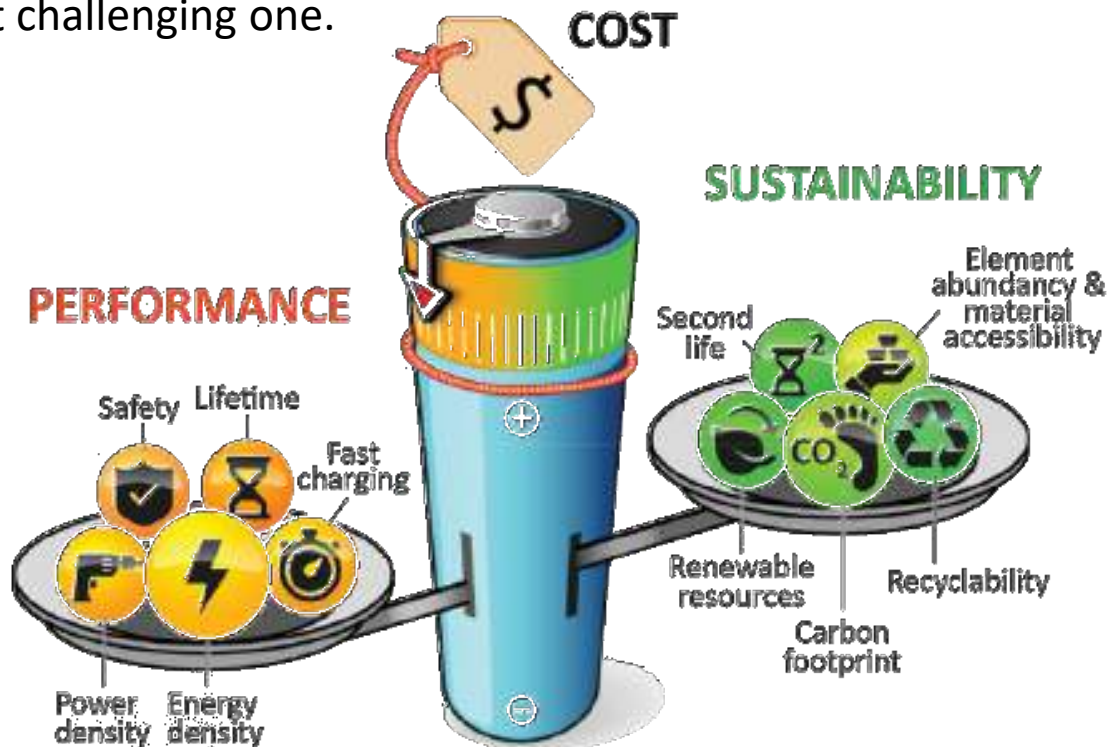
Both Small Molecules and polymers could be effectively employed as Hole Transporting Materials in emerging photovoltaic. Beside assuring a fast and efficient hole transport, HTM should be able to protect the active layer from degradation. Therefore, properly designed materials should be synthesized and characterized to fulfill this scope.



# Sustainable Materials for New Generation Batteries

**Contact:** Claudia Barolo, Matteo Bonomo

In the quest for a sustainable society, energy storage technology is vital and destined to play a central role in the future energy landscape. In this context, numerous research efforts are underway to explore new battery technologies to replace conventional Li-based ones. Yet, a great issue consists in the development of dedicated components among which the electrolyte is probably the most challenging one.



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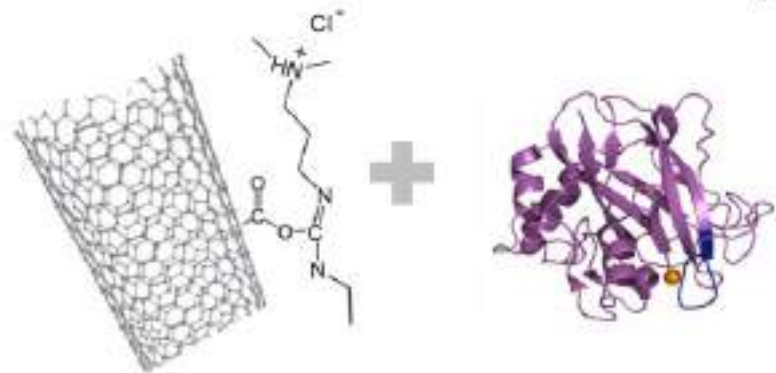
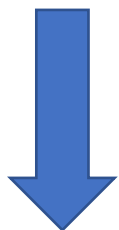


# Cube (Cu-based catalysts for C-H activation)

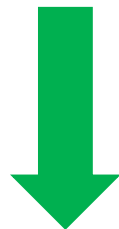
**Contact:** Claudia Barolo, Matteo Bonomo

**Group Leader:** SURFIN (Prof. S. Bordiga)

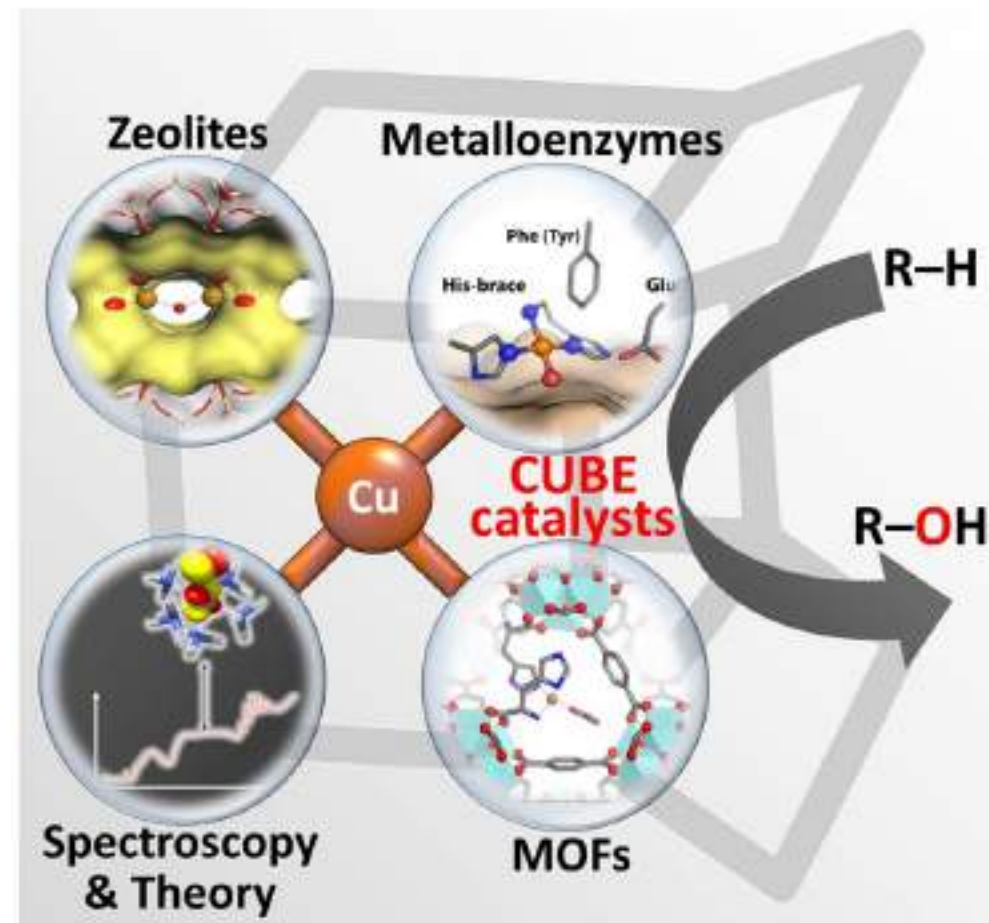
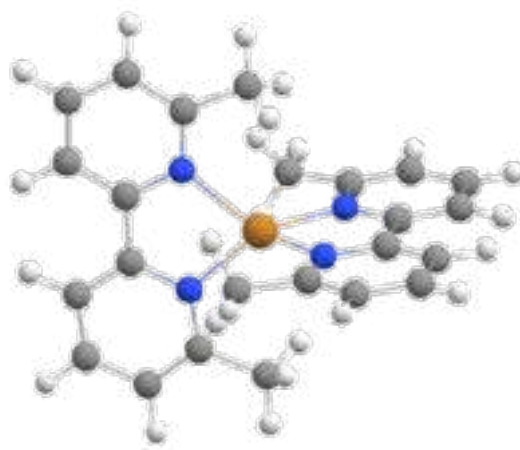
CUBE will synergistically disclose the secrets of Cu-containing biological and synthetic catalysts translating the acquired knowledge into rationally designed new catalysts with unprecedented activity and selectivity toward the C-H activation reaction.



Bioconjugation of  
selected enzymes



Synthesis of designed  
metal complexes and  
supramolecular structures



Possible Exchange Program with  
Partners all around Europe



European  
Research  
Council

# ARTIBLED: Biological Light-Emitted Diodes

**Contact:** Claudia Barolo, Nadia Barbero, Andrea Fin

The LED devices are based on rare-earth element and are characterized by the possibility to tune their color temperature. This project aims to design innovative emissive proteins to assemble high-tech solid-state white emitting devices.

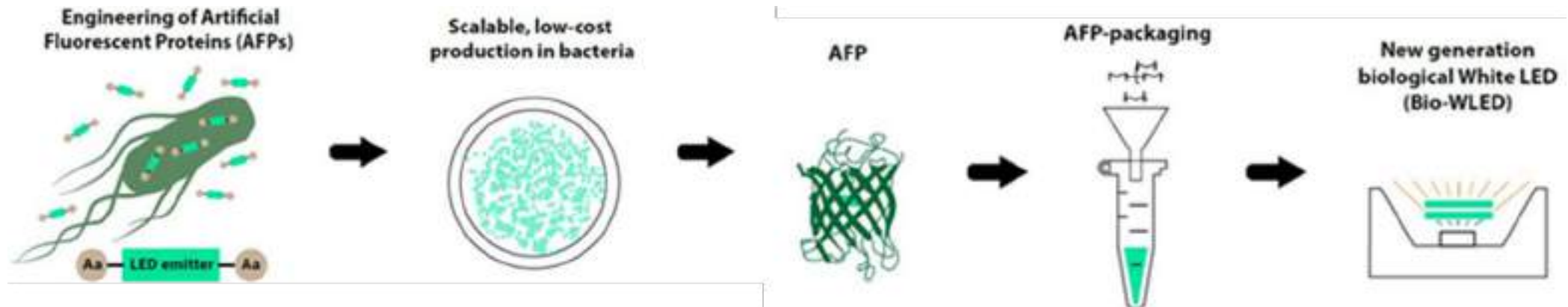
Synthesis and functionalization of small fluorophores to be incorporated into modified protein scaffolds.



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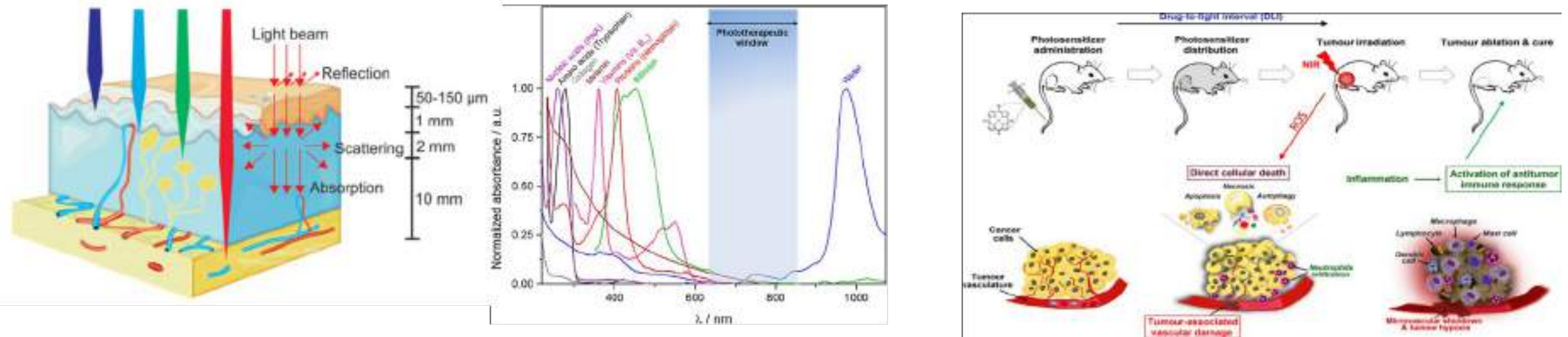




# *New Biomaterials for Photodynamic Therapy (PDT)*

**Contact:** Nadia Barbero

PDT is a photochemistry-based process that uses a photosensitizer, PS, and light of appropriate wavelength to induce cytotoxicity through the generation of oxidative stress. PS molecules have a high tendency towards intersystem crossing (ISC), passing from a singlet to a triplet excited state. As it returns to the ground state, it releases energy, which is transferred to molecular oxygen to generate reactive oxygen species (ROS), such as singlet oxygen ( $^1O_2$ ) and free radicals that are responsible for the oxidative stress and consequent cell death.

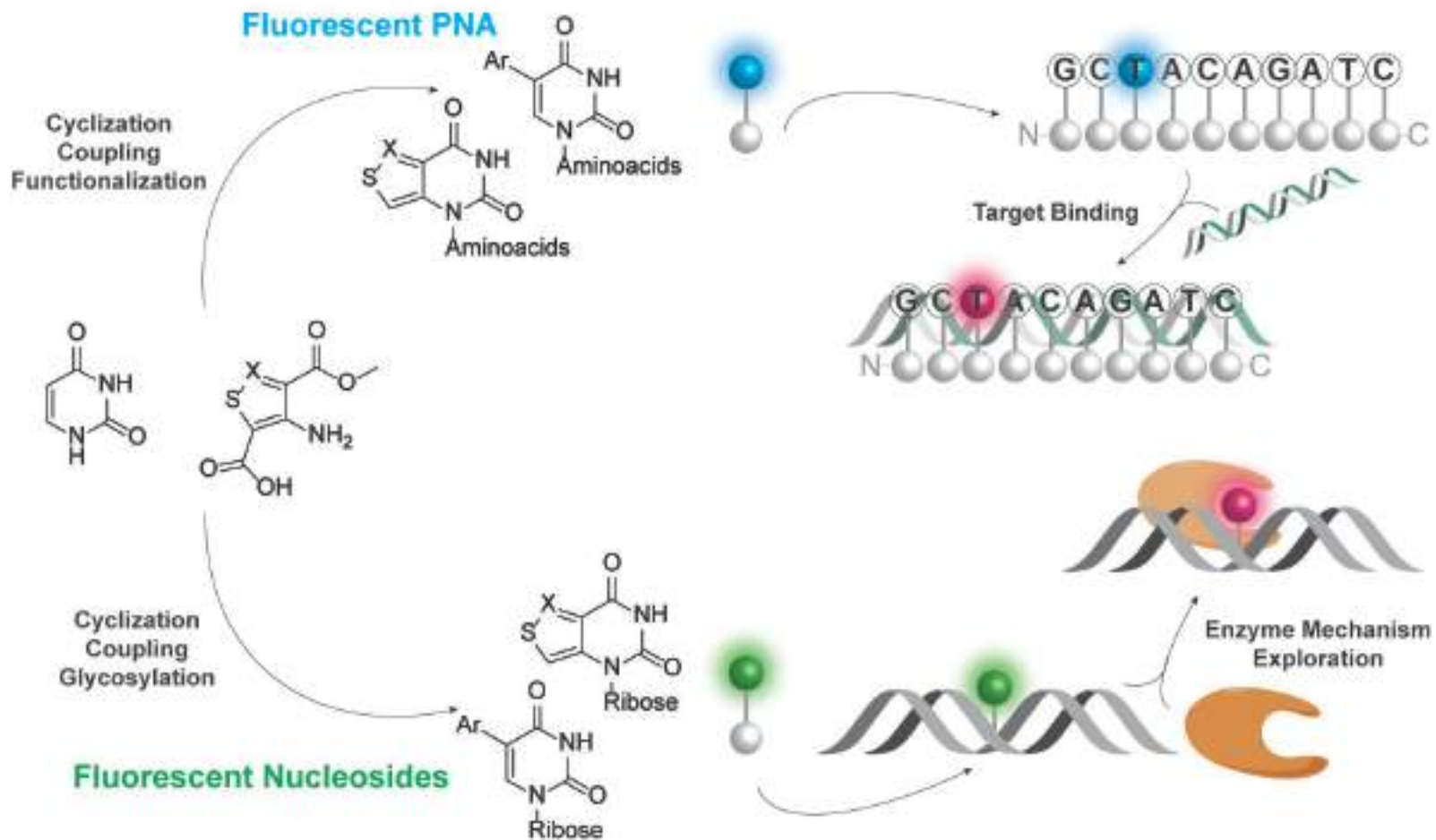


Synthesis of Near Infra-red (NIR) absorbing hybrid materials, study of their photochemical properties and of their interaction with model proteins.

# Fluorescent Nucleobases for Chemical Biology

**Contact:** Andrea Fin, Guido Viscardi

Nucleic Acids are the core of living system. Understanding how DNA, RNA and nucleobase derivatives operate inside the cells is crucial in biological and medicinal chemistry. Isomorphous biocompatible emissive nucleobases allow to shed light on biomolecular structures as well as on enzymatic pathways without interfering or hampering specific pathways and/or interactions.



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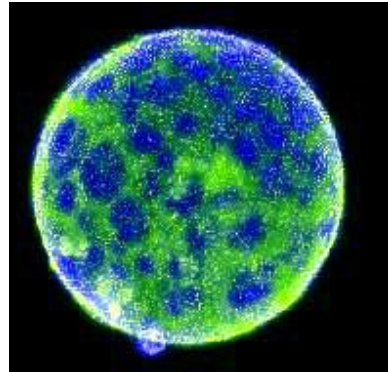




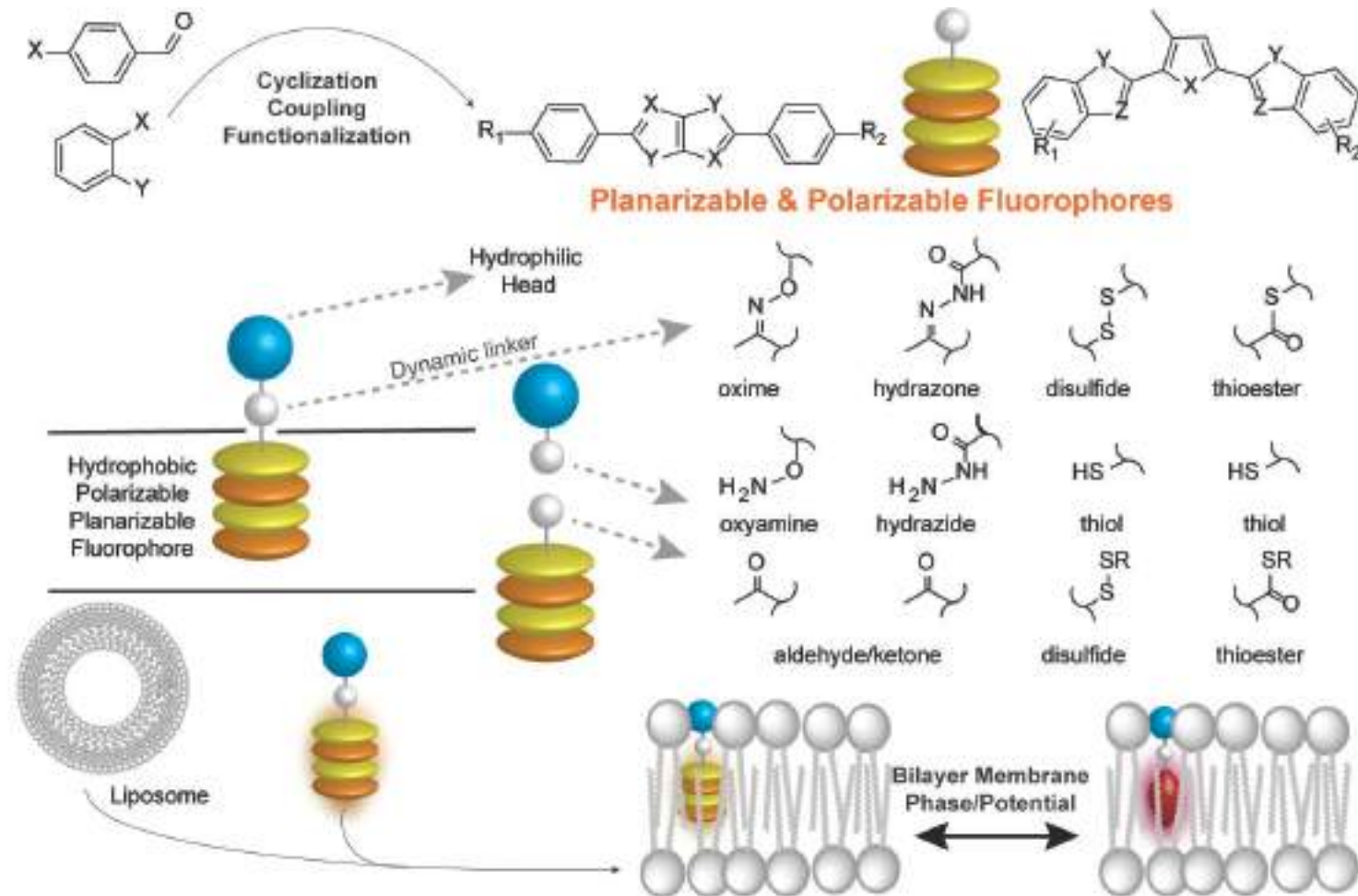
# Emissive Sensitive Probes for Bioimaging

**Contact:** Andrea Fin, Guido Viscardi

The cell membrane properties change rapidly over time and have remarkable effects on the interactions with proteins and ion channels, as well as modulate dynamic processes at the interface. Investigate and visualize how the lipids bilayer nature and properties vary over time is fundamental in many aspects of chemical biology and medicinal chemistry.



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## Experimental Thesis Proposal

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