Project 2.3 RED LIGHT – a tool for organic and biomolecular chemistry

Supervisor: professor Dorota Gryko
Institute: of Organic Chemistry
Unit: Group XV
www: https://ww2.icho.edu.pl/gryko_group/index.html

Background:

Although light-driven processes are appreciated in biological sciences, photoredox catalysis has barely started to add new tools for modifications of biomolecules. This promising strategy has already opened new research opportunities in organic synthesis and has begun to influence molecular biology and medicinal sciences. Currently existing methodologies utilize UV or visible light but due to required energy, they are mostly limited to blue light activation. Red and infra-red light is, however, more compatible with biological systems as it has the advantages of low energy, less health risks, deeper material penetration profile, and increased photoexcitation through biological tissue. Therefore, their application is more attractive for bioorthogonal reactions. But, such transformations, even in the synthetic chemistry toolbox, are scarce while biological photolabeling with red light has yet to be developed.

Aim:

The goal of this proposal is to develop a diverse set of new chemical reactions driven by red light with the ultimate goal of using them for photo-controllable bioorthogonal chemistry.
- we address this challenge by focusing on devising C–C bond forming reactions induced by red light,
- subsequently, based on the activation energy and properties of given catalysts we will design reactions suitable for red light-activation,
- in the next step, suitable bond forming reactions will be selected based on the general requirements for bioorthogonality and photocatalysts and conditions will be readjusted to physiological conditions.

In particular, the main tasks will involve:
- developing water-soluble photocatalysts,
- developing red-light induced reactions in water
- analytical characterization of synthesized compounds,

Requirements:

- Master's degree in chemistry;
- experience in organic or related;
- other skills include analysis and interpretation of experimental data (NMR, MS, UV/Vis);
- demonstrated experience in research work will be an asset;
- effective written and oral communication in English