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# Photocatalysis at interfaces: self-assembled microheterogenous solutions as reaction media for visible-light-induced transformations

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Conversion of sunlight into usable chemical energy, as observed in biological photosynthesis, is a “shining” example of how nature has mastered the control over physicochemical processes occurring around us. It is also a great source of inspiration for scientists, who take a continuous effort to utilize the light as the ultimate source of energy for artificial chemical transformations. The goal is to make them more efficient, cleaner and environmentally friendly. As a result of this work, a field of photocatalysis has been established and quickly became one of the fastest growing areas in modern organic chemistry. Photocatalytic activation gives access to reactive intermediates under mild reaction conditions and using simple and inexpensive equipment.

Although of tremendous importance, the existing photocatalytic methods suffer from common shortcomings. These include: poor photocatalyst stability, undesired back-electron processes, mismatch of redox potentials, as well as unfavourable kinetics due to low concentrations of reactive species. While visible-light photocatalysis offers important advantages over classic organic synthesis, these limitations significantly restrict the use of environmentally benign organic dyes and complexes with earth-abundant metals as photocatalysts. Furthermore, selective modifications of particularly stable compounds are yet to be developed.

In order to address these needs, my group will develop photocatalytic systems based on microheterogenous solutions composed of photocatalysts and two immiscible liquids, possessing large interface. We hypothesize that such an environment will exhibit unique properties, which will enable to overcome the current limitations of photoredox catalysis and provide an access to new chemical reactions. We will focus on aqueous mixtures, as they are highly desirable from the viewpoint of sustainable chemistry. In order to maximize the impact of the expected discoveries, the developed systems will be based exclusively on the catalysts that absorb visible light. In the future, some of the developed systems may be applied in the chemical and pharmaceutical industry. Last but not least, the implementation of the project will also contribute to the overall understanding of the biological processes that involve the harnessing of light.