H.F.R.I.
Hellenic Foundation for Research & Innovation

Description of the funded research project

1st Call for H.F.R.I. Research Projects to Support Faculty Members & Researchers and Procure High-Value Research Equipment

Title of the research project: **SUNLIGHT-DRIVEN PHOTOORGANOCATALYSIS: NOVEL AND GREEN ORGANIC TRANSFORMATIONS AND SYNTHESIS OF COMPOUNDS FOR THE CHEMICAL INDUSTRY**

Principal Investigator: Christoforos Kokotos

Scientific Area: Natural Sciences

Host Institution: National and Kapodistrian University of Athens, Department of Chemistry

Collaborating Institution(s): 1. Ecole polytechnique fédérale de Lausanne
2. University of Bologna

Budget: 200,000 Euros

Duration: 36 months

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Research Project Synopsis

SUNLIGHT-DRIVEN PHOTOORGANOCATALYSIS: NOVEL AND GREEN ORGANIC TRANSFORMATIONS AND SYNTHESIS OF COMPOUNDS FOR THE CHEMICAL INDUSTRY

Nowadays, international financial and environmental circumstances encourage the hunt of alternative energy sources for the development of sustainable organic transformations, both in academic and industrial scale. PhotoOrganocatalysis employs light irradiation (such as sunlight irradiation) for the catalysis of organic transformations, which cannot be carried out by conventional methods and constitutes a revolutionary technique, which is environmentally friendly. The aim of this proposal is the introduction and study of novel photochemical organic processes that will use common household lamps or sunlight as a cheap and green source of irradiation, reducing the need of special apparatus and expensive irradiation sources and having as ultimate goal their ease in application. Metal complexes and small organic molecules, that bear the appropriate building features in order to convert the irradiation to useful chemical energy, are employed as the photocatalysts. These novel photochemical protocols aim in the ease in reproducibility, even from non-trained research staff, the environmentally friendliness and low cost. Finally, after careful mechanistic studies of these new photocatalysts, the synthesis of chemical compounds that are of interest for the Chemical and Pharmaceutical Industry will be demonstrated.

Project originality

SUNLIGHT-DRIVEN PHOTOORGANOCATALYSIS: NOVEL AND GREEN ORGANIC TRANSFORMATIONS AND SYNTHESIS OF COMPOUNDS FOR THE CHEMICAL INDUSTRY

The project originality lies on the development of innovative reaction platforms with unique perspectives, in order to introduce novel methodologies and technologies that cannot be performed with traditional Organic Synthesis, in order to create valuable strategies for addressing challenges of molecule construction in pharmaceuticals, drug discovery and chemical industry. As a notable outgrowth, this research programme will lead to the invention of several new C-C, C-N, C-O and C-X bond forming technologies. The use of visible light will enable SET, HAT or energy transfer processes with photoexcitable organic molecules that will develop new reaction methods for organic synthesis that are not accessible with "classic" Organic Chemistry, targeting strategies for increasing process efficiency, controlling reaction selectivity and reducing the environmental impact of chemical synthesis. A central goal of our research is the development of photochemical methods that can conveniently be conducted by any synthetic organic chemist, using sources of visible light that are already present in a standard Chemistry Laboratory.

Expected results & Research Project Impact

SUNLIGHT-DRIVEN PHOTOORGANOCATALYSIS: NOVEL AND GREEN ORGANIC TRANSFORMATIONS AND SYNTHESIS OF COMPOUNDS FOR THE CHEMICAL INDUSTRY

Organic Synthetic Chemistry constitutes one of the basic pillars of research in Chemistry and has wide applications in Chemical and Pharmaceutical Industry, as well as in the synthesis of high-added value chemicals. This research proposal aims at the development of novel organic reactions, where the use of light irradiation from low-cost sources (household lamps, LED lamps or sunlight) will be employed and small organic molecules will be used as the catalysts, always in line with the principles of Green Chemistry and Sustainable Development. Our goal is the proposal of new organic transformations that will find immediate use in Chemical Industries. The project aims to hire and train a number of researchers-students in Organic Synthesis, in an effort to help in solving the problems of unemployment and brain drain of Greece. I hope this proposal will provide a critical mass of highly trained researchers with Green Chemistry awareness. We hope that our environmentally-friendly character will be passed around on and we will try to raise environment awareness. Hopefully, this action will set the appropriate conditions for companies to work with us and develop green photochemical processes that will serve their needs for the synthesis of high-added value products, which is expected to have positive impact in the economy of Greece.

The importance of this funding

SUNLIGHT-DRIVEN PHOTOORGANOCATALYSIS: NOVEL AND GREEN ORGANIC TRANSFORMATIONS AND SYNTHESIS OF COMPOUNDS FOR THE CHEMICAL INDUSTRY

H.F.R.I. funding via the 1st Call for Research Projects to Support Faculty Members will help continue without any problems my research in the field of Photochemistry and in the general area of Organic Catalysis and Synthesis and pursue high risk innovative ideas in Organic Chemistry. It provides me with the opportunity to transfer expertise that I gained in Princeton University, USA and in Merck Catalysis Center in Greece and train new scientists in the field of Photocatalysis and its applications. It will ensure the proper workchart flow, since trained researchers will be hired and in conjunction with new researchers-students, that will be trained along them, a team of high intellectual caliber will be created that will compete with groups from the best Universities and Research Centers around the world. H.F.R.I. funding provides us all starting materials, equipment and consumables, in order to pursue our research.

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