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Foreword

UNESCO proclaimed 2015 as the international year of light and light-based technologies. This internationally celebrated event has opened the way for thoughtful discussions of how light-based technologies could help mankind make a transition to a sustainable planet. Light plays a key role in our daily lives and will become even more important in a world increasingly dependent on technologies that require energy to function. The energy that has led to our technological advancement is mainly based on fossil fuels. Their extensive use has led to a steady increase in CO_2 emissions, which in turn has drastically affected the global climate. After several political attempts to reach a common objective to reverse the current trends in emissions, a historic agreement was reached at COP21 held in Paris in December 2015, the year of light. Remarkably, fully 195 countries are engaged in cutting emissions of greenhouse gases. We view this event as an urgent call to chemists and other scientists to develop new materials and methods for the production of clean solar fuels. The grand challenge facing us is the development of scalable integrated artificial photosynthetic devices built from robust materials for optimal light capture and conversion.

Chemists are exploring ways to capture sunlight for conversion of renewable feedstocks such as H_2O and CO_2 to hydrogen and reduced forms of carbon. Arguably the best way to split water or reduce CO_2 is by employing semiconducting materials coupled with metal oxides or metallic nanoparticles as catalysts. But we have much work to do, as to date the robust materials we have at our disposal are not ready to be deployed on a grand scale. Recently, polymeric organic materials have emerged as potential candidates to perform these highly demanding chemical transformations. This field holds great promises, but low photocatalytic yields and problematic stability issues are among the hurdles that must be overcome. Many chemists are investigating molecular-based assemblies consisting of a chromophore and a catalytic unit for light driven water splitting or CO_2 reduction. We think this approach is very attractive, as it should be possible to design and construct molecules that capture visible light and drive redox reactions with high efficiencies. Basic research has already produced several promising photosystems, and as a bonus, the mechanisms leading to fuel formation have been uncovered in some cases. We predict that a sustained effort from the international community of scientists and engineers will take the field from promising laboratory findings to full technological deployment.

We will succeed if we work together, sharing results and personal views, and it is our hope that this issue of *Comptes rendus Chimie* will serve as a stepping stone along the way to a sustainable planet. We thank all who have accepted our invitation to contribute to this dossier on Artificial Photosynthesis.

Let there be light to shape our future.

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