Laudatio for the Award Ceremony of the Prix Schläfli Chemistry 2018 of the Swiss Academy of Sciences (SCNAT) for Dr Xiaojiang Xie

The Jury of the Prix Schläfli Chemistry 2018 of the Swiss Academy of Sciences (SCNAT), consisting of Professors C. Copéret (ETHZ, President), C.E. Housecroft (University of Basel), K. Koch (PHBern), S. Sturla (ETHZ), T. Bürgi (University of Geneva), C. Bochet (University of Fribourg), T. Gude (SQTS), Olivier Wenger (University of Basel) has decided to award the prize to Dr Xiaojiang Xie for developing an artificial light-harvesting system using a light driven proton pump in a polymer membrane; irradiation of the membrane from alternating the sides illuminated with ultraviolet or visible light produces an alternating current thereby converting solar into electrical energy.

The current rise in the global consumption of energy demands a change from unsustainable fossil fuels to renewable energy. Of the renewable sources available, solar energy is the most attractive. Photovoltaics based on silicon are well established, and newer technologies encompass dye-sensitized and perovskite solar cells. However, in his doctoral thesis, Xiaojiang Xie introduces an exciting means of converting solar into electrical energy. The concept is based upon the principle of using photoswitchable spyropyran molecules to create light-driven electrochemical gradients and convert light into electricity. Spiropyrans are photochromic compounds and when irradiated with UV light, the ring closed form undergoes ring-opening to give the merocyanine form; the reaction is reversed with visible light. When spiropyran is hosted in a liquid polymer membrane, a proton gradient is generated across the membrane when the system is irradiated. After illumination, the protonated, ring-opened molecules are transported from one side of the polymer membrane along a concentration gradient to the inner membrane side. Here, irradiation with visible light regenerates spiropyran. The overall result is a continuous uptake and transport of protons across the membrane. The system produces an open-circuit voltage of 210 mV in just a few minutes of irradiation. Since illumination by light of different energies (UV or visible) reverses the direction of the current, this light driven proton pump could be a valuable means of generating an alternating current. The maximum photocurrent is generated when the membrane is in contact with acidic solutions without competing cations. The results have been published in *Nature Chemistry* (2014) and represent the first example of a solar energy conversion system based upon a polymeric liquid membrane light-harvesting system utilizing photoswitchable spiropyran driven by a combination of ultraviolet and visible light.

Dr Xiaojiang Xie studied for his Bachelor in Chemistry at Nanjing University, China followed by his Master degree at the University of Geneva. He remained at the University of Geneva for his doctoral studies working in the field of analytical chemistry and chemical sensors under the supervision of Prof. Eric Bakker. Xiaojiang Xie obtained his PhD in 2015. In 2017, he was commended as a 'Young Thousand Talent' by the Chinese Government and from 2016, he has been an Associate Professor at the Southern Univeristy of Science and Technology in China.

Prof. Catherine E. Housecroft, Platform Chemistry of the Swiss Academy of Sciences (SCNAT)

Award Ceremony, 25 May 2018 before the Delegate Assembly of the SCNAT, Bern

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