SPECIAL SEMINAR

Thursday May 8, 15:00 h, Aula Denina

SPEAKER

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Facing World Challenges with Science: from Sustainable Polymers to Antivirals

In 2070 the world will be inhabited by 11 billion people. One of the main problems humanity will have to face is the sustainability of its materials production and consumption. By then, close to 1 billion tons of plastic will be produced yearly. Even if all polymers were to be bio-sourced and bio-degradable, there would still be a huge sustainability challenge both in terms of sourcing (to avoid problems such as deforestation or competition with food production) and of disposing (as those quantities would end up polluting the Earth at the very least by shifting ecosystems balances in significant ways). Clearly, humanity has to move towards the principles of circular economy where materials, once produced, remain in usage for the longest possible amount of time, taxing the Earth the minimum possible.

Interestingly, when pausing to observe Nature's main polymers (*e.g.*, proteins) it is possible to admire the circularity in their use. A vast over exemplification of protein metabolism shows that when a living specie eats, it will digest a protein down into its monomers (the 20 proteogenic amino-acids), then the ribosomal synthetic cell machinery will reassemble them into completely different proteins in no way related to the original ones. One could state that Nature is teaching us the ultimate circular economy example for materials use, where recycling leads to the formation of materials that have limited commonality with the original ones, with the key building blocks (amino acids or nucleic acid bases) that are constantly in use.

In this talk, I will show the progresses my group is making towards showing that natural sequence-defined polymers can indeed be recycled into other polymers that have little in common with the original ones in the laboratory. Results involving various types of proteins and of nucleic acids will be presented. Efforts to translate this concept in the world of synthetic polymers will also be introduced.

Viral infections are a great threat for modern society; there are thousands of people that die every year because of them (mostly in under-developed countries) and many more have a lower quality of life because of them. Furthermore, it has become apparent that pandemic infections can have enormous consequences on global health as well as on the economy of the entire world. In this talk I will summarize a decade-long effort in my laboratory to develop broad-spectrum antivirals. The approach that will be presented is different from most biological approaches as it is focused on an extracellular mechanism that affects the structural integrity of the viruses rendering them non infective irreversibly. I will discuss the development of the compounds that we are investigating and their putative mechanism. In vitro, ex vivo, and in vivo examples of the efficacy of such compounds will be discussed.

Speaker Bio

Prof. Francesco Stellacci received his degree in Materials Engineering at Politecnico di Milano in 1998 with Prof. Zerbi. He then moved to the University of Arizona for a post-doc with Prof. J.W. Perry in the Department of Chemistry. In 2002 he became an Assistant Professor in the Department of Materials Science and Engineering at MIT (Cambridge, USA). There he became Associate Professor with tenure in 2009. In 2010, he moved as a Full Professor to EPFL in the Institute of Materials, later joining also the Institute of Bioengineering and the Global Health Institute. From 2015 to 2022 he was the Director of the Integrative Food and Nutrition Center. Stellacci has published more than 200 papers and has more than 15 patents and patent applications. He has won numerous awards, among which the Technology Review TR35 'top innovator under 35', the Popular Science Magazine 'Brilliant 10', and the EMRS EU40. He is a Fellow of the Royal Society of Chemistry, of the Global Young Academy, of the European Academy of Sciences, and the Academia Europaea.