MimicLS

In living matter, self-assembly benefits from the evolutionary processes that tune interactions to optimize the properties, morphology and functionality of the resulting biomaterials. Nature exploits the primary sequence of natural macromolecules (*e.g.*, proteins) that fold into particular motifs that self-organize into complex structures representing various properties. In contrast, man-made polymer materials are far away from advanced functionalities as represented by living systems.

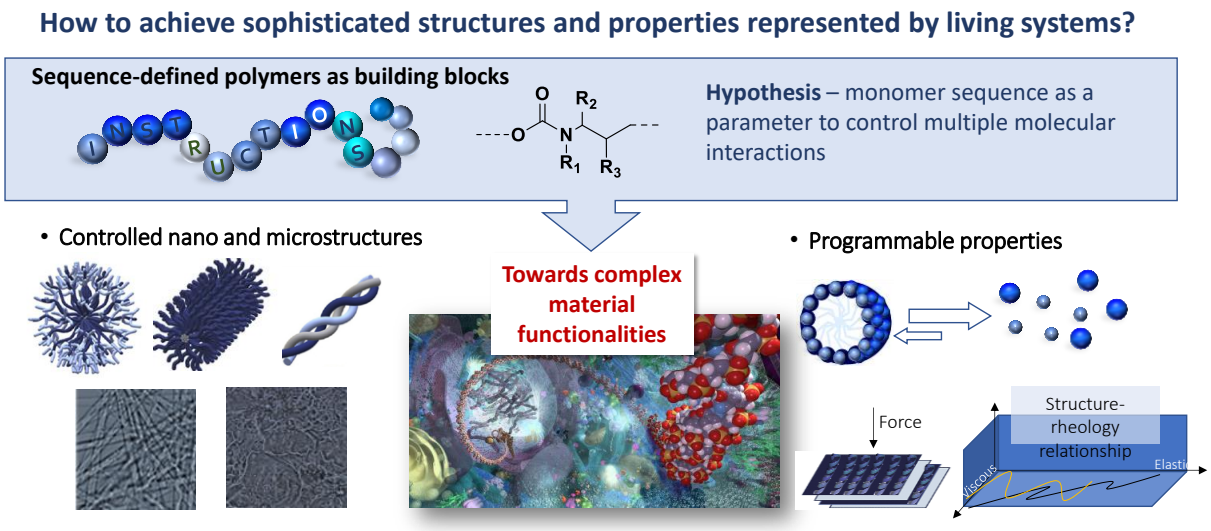
Nowadays, the progress in polymer synthesis enables full control of monomer sequence with a biological precision. However, to enable their practical use the sustainable and highly efficient approach has to be developed. It is expected that sequence-defined macromolecules can be designed to fold into particular 3D structures by selection of the proper monomer alphabet, as it is observed for natural macromolecules. Yet, very little is known about single chain folding of non-natural macromolecules with defined primary structure and their assembly into complex supramolecular structures has not been investigated, so far.

Two research Teams of complementary competences:

(i) ***Roza Szweda`s Functional Macromolecules Team at Łukasiewicz-PORT***, Poland, expert in precision polymer chemistry,

(ii) ***Takuji Adachi`s Group from Faculty of Sciences at University of Geneva***, Switzerland, physical chemist and specialist in optical spectroscopy on self-assembled materials, developing *in-situ* spectroscopy tools,

jointly took a challenge to investigate fundamental self-assembly process of abiotic, sequence-defined polymers. The ***project aims to obtain the knowledge on sequence-regulated, hierarchical polymer self-assembly, which is required for creating synthetic materials with the structural sophistication and complex function as represented by living matter***.



The project includes three main research objectives: (i) development of synthesis method of high-molar mass, sequence-defined polycarbamates based on mechanochemistry approach; (ii) their self-assembly studies and (iii) characterization of material properties. We aim to understand how the monomeric sequence and stereochemistry of non-natural polycarbamates affects their aggregation into hierarchical, complex architectures in solution and solid state. We will apply *in-situ* microspectroscopy methods to get an insight into mechanism of their self-organization process. The dependence of primary structure on material rheological properties will be examined, that will enable fine-tuning of material characteristics and functionalities. Control of monomer sequence and knowledge on sequence-property relationship will be an excellent tool for *de novo* design of functional materials for divers applications, *e.g.* nanoelectronics, tissue engineering, drug delivery.