DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

Every machine uses power to apply forces and control movement to perform an intended action, triggered by different power sources, including natural forces such as wind, water and light, and by chemical, thermal, or electrical power. Modern machines include systems of mechanisms that enable specific applications of output forces, plan movements and monitor performances. Although contemporary machines are often very sophisticated and complex systems that consist of many structural elements and mechanical components, they all base on the principles of simple machines. The idea of a simple machine originates from the Greek philosopher Archimedes who discovered the principle of mechanical advantage in the lever around the third century BC. He expressed his realization that there was no limit to the amount of force amplification that could be achieved by using the lever's mechanical advantage in his famous remark: "*Give me a place to stand on, and I will move the Earth.*". We do not know if Archimedes had envisioned a similarly great potential of his simple machines at the scale as small as atoms, of which hypothesis had been formulated about two centuries earlier by another Greek philosopher Democritus. What we know nowadays, thanks to advanced knowledge in the field molecular biology, is that many biological systems consist of such simple machineries, engaged in particular processes in living organisms (*e.g.* ribozymes are complex RNA machines that perform chemical tasks).

Due to a continuous industrial demand for further miniaturization of devices, material engineers constantly look for molecules with potential technological applications, often looking for inspirations in molecular biology. This leads to the development of synthetic so-called "bioinspired" materials, whose structure, properties or function mimic those of natural materials or living matter, and find particular industrial applications (*e.g.* light-harvesting photonic materials that mimic photosynthesis). The other way around scientific and technological strategy is to use materials commonly used for industrial purposes as so-called "biomaterials" and apply them as substance building medical implants, prostheses and devices. This project engage both strategies, by employing photoswitching compounds, widely used in Materials Science to build photo-mechanical responsive systems (*e.g.* in optical switching and data storage devices), as molecular machines hindering particular protein-protein interactions. From one hand, the results of this project may lead to a development of industrially useful methodologies for structure moderating technology of bioinspired protein-based materials. From the other hand, the finding of the project may become the basis for development of new molecular machines inhibiting or destructing pathological assembles of proteins with a potential application in molecular medicine.

These molecules will be derivatives of azobenzene (azo), a molecule able to reversibly change its shape and properties in response to photo-excitation with no evidence of toxicity in living organisms. These features makes azos very important functional materials for applications in biology and medicine, already used for modulating protein folding, enzyme activity or membrane transport. The designed azo compounds, able to undergo photo-induced excitation followed by the release of the gained energy due to change in their shapes, shall exert a mechanical force on the targeted protein, leading to perturbations of its shape. The proposed project aims at exploring the photoresponsive nature of newly designed azo-derivatives with regard to their abilities to target particular proteins and alter their native propensity to build macromolecular assemblies by (i) blocking the sites responsible for protein-protein interactions or/and by (ii) destroying already aggregated proteins, in order to explore the potential of these smart materials for the generation of novel low-cost relevant nanomachines for biotechnology enabling the control of production and degradation of materials based on protein frameworks.