DESCRIPTION FOR THE GENERAL PUBLIC

A microcapsule, i.e., a small and usually round structure with a relatively stable shell, can be used for storage, transportation, and release of cargo species such as drugs, dyes, flavourings, living organisms, etc. These tiny containers can be composed of different synthetic or natural materials, including microgels, polymer macromolecules, block copolymers, proteins, colloidal particles, and other materials. The microcapsules composed of colloidal particles are often called colloidosomes. The research field related to colloidosomes started to blossom several years ago, and many scientific advances have been demonstrated.

However, most of the effort was dedicated to the investigation of *homogenous* colloidosomes, i.e., microcapsules with a shell composed of only one type of material. Researchers know that the functionality of the colloidosomes can be greatly extended if the capsules are designed to have *heterogeneous* shells—i.e., one or more regions (patches) of a shell is composed of material with specific properties that differ from the rest of the shell. Such *patchy colloidosomes* possess advantageous properties when compared with their *homogenous* counterparts. For example, owing to specific interactions between patches, they can either self-assemble into complex structures; specifically adhere to a surface; release their cargo species in a specific direction; or guided-align, -orient, or -propel; and these are the properties I will explore as part of the proposed research.

By launching the proposed project, I wish to both broaden the current knowledge and also open new areas within the field of soft-matter science related to microcapsules. The high level of novelty inherent in the proposed project translates directly into the significant impact of the project results on the development of the research field and related scientific disciplines. Developing a new understanding of the basic physical properties and processes in such soft and complex matter systems is one of the aspects with a formidable potential for materials development. Thus, the proposed studies on universal problems have practical relevance to fields of actual importance to society, ranging from material science (e.g., the self-assembling of patchy colloidal microcapsules into suprastructures); micro- and nano-technology (e.g., patchy colloidosomes used for templating scaffolds and porous materials); pharmaceutics (e.g., patchy colloidal microcapsules for drug transportation and release); and the paint industry (e.g., in wood protectors—used for the slow, targeted release of active ingredients to prevent, for example, fungi growth), etc.

The foundation for this project was laid by thorough fundamental studies conducted during my post-doctoral fellowships at NTNU, Trondheim in Norway; and subsequent studies at the Institute of Physical Chemistry at the Polish Academy of Sciences. Some of the results of my work are summarized and published in popular science magazines or scientific blogs, and can be found here: link (ScienceDaily, June 26, 2014), link (Phys.org, June 26, 2014), link (Frogheart, July 5, 2013), link (Nauka w Polsce, June 27, 2014).