ZERNIKE INSTITUTE COLLOQUIUM

Thursday, November 20th, 2014

16:00h, Lecture Hall: 5111.0080 **Coffee and cakes from 15:30h**

HYDROGEL-ACTUATED INTEGRATED RESPONSIVE SYSTEMS (HAIRS): MOVING TOWARDS ADAPTIVE MATERIALS

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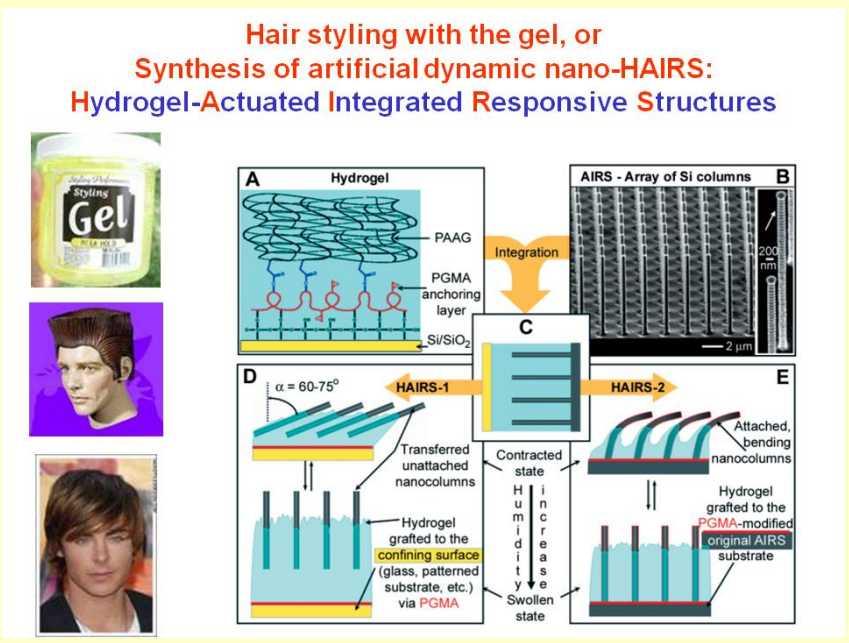
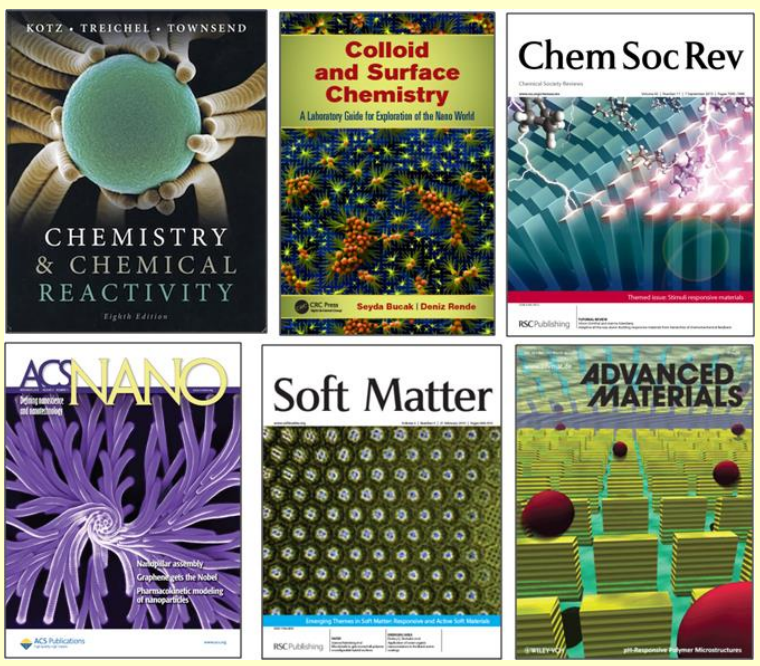
Dynamic structures that respond reversibly to changes in their environment are central to self-regulating thermal and lighting systems, targeted drug delivery, sensors, and self-propelled locomotion. Since an adaptive change requires energy input, an ideal strategy would be to design materials that harvest energy directly from the environment and use it to drive an appropriate response. New synthetic approaches that would lead to such adaptive materials present a real challenge for materials chemistry in the 21st century.



To address this challenge, I will describe the design of a novel class of reconfigurable materials that, similar to skeletomuscular systems, use a hybrid architecture to interconvert energy between different forms and scales. To specify the materials' functions, we use surfaces bearing arrays of nanostructures put in motion by environment-responsive gels.

Their unique topography and chemistry can be designed to confer a wide range of adaptive optical, wetting, adhesive, anti-bacterial, motion-generating, and other behaviors, similar to their natural counter-parts used by lotus leaves to shed water, geckos to stick to surfaces, cephalopods to change color, echinoderms to keep their skin clean, and fish to sense flow.



Using both experimental and modeling approaches as well as new fabrication methods, we are developing these hydrogel-actuated integrated responsive systems (HAIRS) as new materials with reversible optical and wetting properties, as a multifunctional platform for controlling cell differentiation and function, and as a first truly homeostatic system with autonomous self-regulation [1-3].

References:

[1] A. Sidorenko, T. Krupenkin, A. Taylor, P. Fratzl, J. Aizenberg, "Reversible Switching of Hydrogel-Actuated Nanostructures into Complex Micropatterns", *Science* **2007**, 315, 487-490.

[2] B. Pokroy, S. H. Kang, L. Mahadevan, J. Aizenberg, "Self-Organization of a Mesoscale Bristle into Ordered, Hierarchical, Helical Assemblies", *Science* **2009**, 323, 237-240.

[3] X. He, M. Aizenberg, O. Kuksenok, L. D. Zarzar, A. Shastri, A. C. Balazs, J. Aizenberg, "Synthetic Homeostatic Materials with Chemo-mechano-chemical Self-regulation", *Nature* **2012**, 487, 214-218.

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