



Friday, 19th October 2012
12.00h CIC Energigune
Seminar room 1

Host:
Dr. Alexandr Bondarchuk

Seminar: "Of surfaces, ions, lipids, and platelets: Interactions of biological model systems with inorganic oxides"

Speaker:

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From:

CIC biomagune

Interactions between surfaces of inorganic materials and biological systems are important in a number of contexts, such as implant integration and biosensor development. They also present basic challenges. We have been studying the behaviour of liposomes—spherical lipid shells enclosing an aqueous compartment—at surfaces of TiO₂ and SiO₂, and activation of platelets (thrombocytes) by the surfaces of these materials. Our interest in titania (TiO₂) is driven by its applications as a biomaterial used in a variety of implants, as well as the effect it has on the liposome behaviour.

Liposome behaviour at surfaces is driven by the favourable lipid-surface interactions, the origin of which (in terms of the contributions of individual forces) remains a subject of some debate. It is further complicated by the kinetic effects (energy barriers associated with liposome deformation and rupture). Our aim is to unravel these contributions so that we can understand and control the morphology and composition of lipid assemblies at inorganic surfaces. On the other hand, liposomes can also be used as probes to study surface properties. In particular, we identified an effect of the surface-bound divalent cations such as Ca²⁺ on the behaviour of phosphatidyl serine (PS)-containing liposomes on TiO₂. This led us to hypothesize that such effects could also be observed in more complex biological systems. We used platelets to examine this hypothesis because of their importance in reactions to biomaterials, and indeed observed that their activation by TiO₂ surface depended on whether Ca²⁺ was present or not; their activation on glass and in solution is independent of extracellular Ca²⁺.

Platelet activation is a crucial step in blood coagulation. It is a complex process involving the expression on the platelet surface and secretion into the surrounding media of a diverse array of adhesion molecules, pro-coagulant, pro-inflammatory, angiogenic, and growth factors. Recent studies suggest that platelet activation is selective and they can tune their microenvironment in response to different stimuli, thus controlling the wound healing process. Indeed our results represent an example of such selectivity.