Special Colloquium

UCR Mathematics Department

DR. MARK ALBER

UNIVERSITY OF NOTRE DAME

"COMBINED MULTI-SCALE MODELING AND EXPERIMENTAL STUDY OF BACTERIAL SWARMING AND BLOOD CLOT FORMATION"

As with most phenomena in biology and medicine, insight into emergent organizational and tissue level properties can be gained by, and indeed require, combination of multi-scale mathematical and computational modeling and experiments. This approach will be demonstrated in this talk using several examples.

Surface motility such as swarming is thought to precede biofilm formation during spread of infection. Population of swarming bacteria P. aeruginosa, major infection in hospitals, will be shown to efficiently propagate as high density waves that move symmetrically as rings within swarms towards the extending tendrils. Multi-scale model simulations suggested a cell-cell coordination mechanism of wave propagation which was recently shown to moderate swarming direction of individual bacteria to avoid antibiotics [1]. Then a novel model [2] will be discussed which systemically couples bacterial, extracellular polymeric substances (EPS) and solvent phases in a biofilm.

In the second half of the talk a three-dimensional multi-scale model will be described and used to simulate receptor-mediated adhesion of deformable platelets at the site of vascular injury under different shear rates of blood flow [3]. Newly established correlations [4] between structural changes and mechanical responses of fibrin networks exposed to compressive loads will be also discussed. Fibrin plays an important role in wound healing, tissue regeneration and is widely employed in surgery as a sealant and in tissue engineering as a scaffold.

Tuesday, February 24th, 2015

Room 284, the 2nd Floor of the Surge Building

Tea Time: 3:30 - 3:40 p.m.

Vision Talk: 3:40 - 4:00 p.m.

Questions / Break: 4:00 - 4:10 p.m.

Scientific Talk: 4:10 - 5:00 p.m.

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