Modelling the Mechanobiology of Aneurysm Evolution

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In this talk, I will present a general computational framework for modelling the mechanobiology of abdominal aortic and cerebral aneurysm evolution [1, 2]. Aneurysms appear as dilations of the arterial wall and generally occur in the intracranial arteries and the abdominal aorta. Intracranial aneurysms (IAs) occur on the side or at bifurcations of brain arteries and appear like small berries inflated by the pressure of the blood. Although the aetiology of IA and AAA differs, if left untreated, both types of aneurysm may rupture with associated high levels of morbidity and mortality. Unfortunately, interventional procedures are not without risk. This presents a dilemma for the clinician: is intervention necessary or desirable? Hence there is a need to develop robust rupture risk indicators for aneurysms to identify the subjects who would actually benefit from intervention. It is envisaged that models of evolution may assist in this ambition [1,2]. However, whilst such models are proving useful to explore hypotheses relating to the underlying mechanobiology of the arterial wall, further sophistications are needed for them to realise application within a clinical setting.

[1] Watton PN, Ventikos Y, Holzapfel GA (2011) Modelling Cerebral Aneurysm Evolution. In: *T. McGloughlin (ed.) Biomechanics and Mechanobiology of Aneurysms*, Springer-Verlag. 7:373-399.

[2] Aparicio A et al (2013) Modelling the Influence of Endothelial Heterogeneity on the Progression of Arterial Disease: Application to Abdominal Aortic Aneurysm Evolution, *International Journal of Numerical Methods in Biomedical Engineering* (in press)