Hamilton Institute

How the brain keeps the eyes still
… and what happens if it fails

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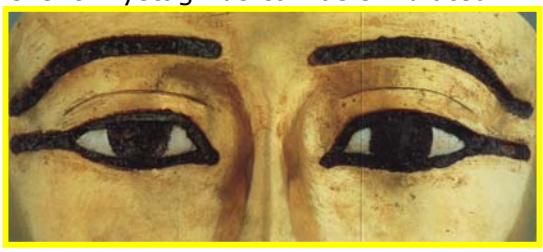
Abstract
Everyday we make rapid eye movements (saccades) to look around, we pursue moving targets and we hold our eyes steady. In this way, we keep objects of interest on a specific high resolution part of the retina, the fovea. On occasions fixation can become unsteady. This may be congenital or acquired. Over the years, the study of normal and abnormal oculomotor behaviour has relied on control theory concepts, but more recently we have been using a non-linear dynamic approach.

In this talk I will introduce you to a fixation disorder called congenital nystagmus. It develops at birth or shortly afterwards, and persists throughout life. Clinically it is an involuntary, bilateral oscillation of the eyes, that is present in approximately 1 in 4000 of the population. The oscillations in each eye are strongly correlated and occur primarily in the horizontal plane. Each nystagmus cycle is made up of three phases: a low velocity phase (foveation), a slow drift away and a fast return phase. Using dynamical systems theory and, in particular, delay embedding techniques (method of delays), we found that in congenital nystagmus the behaviour of the oculomotor system during the foveation period is linear and that the stability of the fixed point can be characterised by three eigenvalues.

We have also recently developed a new model to explain congenital nystagmus. Central to this is our contention that there is an instability of the burst cell generator, found in the saccadic control system. These burst cells typically have an "on" direction of eye movement, during which they fire and an "off" direction (the breaking signal), during which they are almost silent. Nystagmus can be simulated by an abnormal breaking signal. By varying the parameters of the model we can produce several types of congenital nystagmus waveforms. Finally I will endeavour to indicate how it may be possible to improve vision in congenital nystagmus.



Venue: Seminar Room, Hamilton Institute, Science Building, NUI Maynooth

Time: 1.00 - 2.00pm (followed by tea/coffee)

Travel directions are available at www.hamilton.ie

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