Peter Riley, J Neurol Disord 2018, Volume 6
DOI: 10.4172/2329-6895-C3-032

Abnormal sleep-wake cycles as a neurochemistry cusp catastrophe

Peter Riley
Deakin University, Australia

There are numerous diseases of the nervous system which manifest abnormal sleep-wake cycles and there are many explanatory mechanisms identifying various neurochemical species involvements. The Hobson AIM model of brain activation provides a state-space model which includes sleep-wake states, but which does not readily explain the sometimes abrupt transitions between states observed clinically. The presence of abrupt state changes suggests an underlying non-linear mechanism characteristic of a cusp catastrophe. A simple model is proposed which originates from logistic growth of competing neurotransmitters promoting and demoting neural activation with the addition of a scavenging mechanism modeled as a sigmoid process. The model shows potential state trajectories which include: (1) Smooth transitions from sleep-wake states as a normal process, (2) catastrophic transitions from the wake state to the sleep state, reminiscent of narcolepsy, (3) catastrophic transitions from the sleep state to the wake state, (4) rapid cycling between sleep and wake states, reminiscent of delirium and (5) an intermediate bifurcation point which may correspond to the normal NREM state.

Biography

Peter Riley is a Consultant Medical Physicist employed as a Senior Lecturer for Diagnostic Imaging and Medical Physics with the School of Medicine at Deakin University, Waurn Ponds.

peter.riley@deakin.edu.au

Notes: