- Friday, October 31, 2008
  Pattern formation in migraine with visual aura: From mechanism to control

  My current research focuses on problems at the interface of applied nonlinear science, as a branch of physics, and neurology, in particular migraine research. A World Health Organization report describes migraine as one of the four most disabling chronic medical disorders. I will present models and data on a pathological spatio-temporal wave pattern related to visual field defects in migraine with aura, termed spreading depression (SD), from the perspective of nonlinear dynamics, in particular from theories of spatio-temporal pattern formation. I then ask the question How can the methodical and technological innovations from nonlinear science contribute to a better treatment of this condition? For many research groups, SD is the key target in future therapeutic approaches. Control of complex dynamics, such as SD, has evolved as one of the central issues in applied nonlinear science within the last few years. Major progress has been made in particular with respect to extending the methods of chaos control to spatio-temporal patterns. My first goal is to establish links between an abstract mathematical description and experimental data obtained by functional magnetic resonance imaging of the visual cortex, and patient symptoms reports of visual migraine aura. My second goal is to investigate (i) the design of control methods that prevent the progressive recruitment of cortical tissue into this dysfunctional state occurring during migraine and (ii) how these methods can be transferred from bench to bedside.

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