

Tipping points, critical transitions, and bifurcations: Can we predict the future?

Leon Glass

McGill University, Canada

Recent work from Marten Scheffer and colleagues has made bold claims [1]. "Complex dynamical systems, ranging from ecosystems to financial markets and the climate, can have tipping points at which a sudden shift to a contrasting dynamical regime may occur. Although predicting such critical points before they are reached is extremely difficult, work in different scientific fields is now suggesting the existence of generic early-warning signals that may indicate for a wide class of systems if a critical threshold is approaching." In a recent paper in *Critical Care Medicine*, Scheffer and colleagues (including me) argue that these results may be applicable in medicine [2]. I will discuss this work from the context of my own interest in bifurcations, problems associated with alternans rhythms [3], and transition to and risk stratification for sudden cardiac death.

References:

- [1] "Early-warning signals for critical transitions" Scheffer et al. *Nature* 461, 53 (2009)
- [2] "Slowing down of recovery as generic risk marker for acute transitions in chronic diseases" Olde-Rikkert et al. *Critical Care Medicine*, 44, 601 (2016).
- [3] "Predicting the onset of period-doubling bifurcations in noisy cardiac systems" T. Quail, A. Shrier, L. Glass, *PNAS* 112, 9358-9363 (2015)