

## **Complexity & Criticality (in the brain and beyond): two sides of the same coin**

Dante Chialvo<sup>1,2,\*</sup>

<sup>1</sup> *Instituto de Ciencias Físicas (ICIFI-CONICET), Center for Complex Systems and Brain Sciences (CEMSC3),  
Escuela de Ciencia y Tecnología, Universidad Nacional de Gral. San Martín, Campus Miguelete, San Martín,  
Buenos Aires, Argentina*

<sup>2</sup> *Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICET), Buenos Aires, Argentina*

\* [dchialvo@gmail.com](mailto:dchialvo@gmail.com)

Why is life complex and – most importantly – what is the origin of the over abundance of complexity in nature? This is a fundamental scientific question which, paraphrasing the late Per Bak, "is screaming to be answered but seldom is even being asked". In this lecture, we will discuss recent attempts across several scales to understand the origins of complexity on biological function from the perspective of critical phenomena. We illustrate the use of the approach to the study of the large-scale brain dynamics, and also for the characterization of spontaneous fluctuations of proteins, the microbial collective dynamics and the physiological complexity of the cell mitochondria network.