NEW BOOKS

BECK F, HÜTT M-TH AND LÜTTGE U (eds.) 2003. *NONLINEAR DYNAMICS AND THE SPATIOTEMPORAL PRINCIPLES OF BIOLOGY*. DEUTSCHE AKADEMIE DER NATURFORSCHER LEOPOLDINA, HALLE, 405 p. ISBN: 3-8047-2077-3 (pb)

The volume is a collection of papers presented at a symposium of the German academy "Leopoldina" in 2002. Main aim was to bring together people from various disciplines to sketch their view about a dynamic approach to understand pattern and processes in biology. Therefore, the whole book is structured into four subsections: an outline of the general framework, the role of nonlinear dynamics in biology, the interplay of chaos and synchronisation and new attempts in understanding spatiotemporal patterns in biology. Each section is opened by a short comment paper, which tries to summarize and to combine the subsequent papers. The volume ends with a four pages synopsis of the symposium as a whole. Unfortunately, the individual chapters primarily cover a broad variety of subjects shedding new light onto the fascinating questions how patterns and processes in biology can be better understood, but now real new "theory" or "conceptual approach" is developed. Much emphasis is laid on a lot of temporal phenomena with much more contributions from modelling than from experimental work.

The first section entitled "Framework" contains three papers about the statistical physics of biocomplexity, especially the "positive" role of noise in molecular motors, about time as a coding space in neuronal processing, where distributed neural responses are used to explain the mechanism of perception, and about stochastic resonance and the way how noise may amplify the transmission of spatio-temporal coherent structures (with examples from chemistry, neurobiology and human perception).

The next section entitled "Nonlinear Dynamics and Biology" contains eight papers, which try to present examples of nonlinear processes in various fields of biology. Swarming motions of freshwater zooplankton organisms in an external light field, behavioural stochastic resonance with examples from a particular fish species, oscillations in minimal enzyme reaction systems, statistical properties of Ca^{++} puffs, models of active Brownian molecular motion, temporal scales of cortical interactions and the development of a bipolar deep brain stimulation based on stochastic phase resetting are covered as well as the calcium dynamics associated with electrically stimulated action potential in a green algae. This list of subjects shows again the variety of topics which stay more as a collection of many particular examples without any serious approach to unify the findings so far.

Session number three is entitled "Chaos and Synchronisation" and covers several papers which are focussed on the interplay how oscillators, chaos and noise can produce synchronous temporal patterns. One talk discusses how fast chaotic degrees of freedom can act as white noise, another one shows how chaotic systems can become phase synchronised without loosing their chaotic nature. Other papers deal with similar aspects of hearing and of cold reception by humans.

Some spatial aspects are considered in the fourth section about "Understanding Spatial Patterns in Biology", although two talks were mainly about the molecular mechanisms how temporal (in microalgae) and spatial (in Hydra organisms) patterns may arise. Two modelling papers deal with spatiotemporal patterns both in plankton dynamics as well as in a network of coupled biochemical oscillators (of Thron type). One interesting talk presents recent findings of the spatial variability of photosynthesis in single leaves as displayed by the technique of chlorophyll fluorescence, although these images are merely shown as a fact but not spatially analysed for particular patterns.

As a summary, I can agree with the conclusions of the chairman of session 3, that "it was impossible for me to survey these talks in a way that a single thread or governing theme becomes possible. They are more appropriately compared to the nodes of a highly connected network with strong links … and different facettes of the rich interplay between chaos, synchronisation and noise" (p. 241). Many new and interesting modelling results and experimental findings about nonlinear phenomena in biology are published, but nearly exclusively oriented to temporal patterns, no image analysis or any other spatial object's approach is used. I wouldn't buy

the book for my own bookshelf because of its heterogeneity and variety in subjects, but the volume could be valuable to many readers from different disciplines as part of an institutional library. A real breakthrough in the formulation of general spatiotemporal principles in biology has still to come.

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