

# COMPLEX BIOLOGICAL SYSTEMS

*By Dr. Pier Luigi Gentili\**

*\*Chemistry, Biology, and Biotechnology Department of the University of Perugia*

*Email: [pierluigigentili@gmail.com](mailto:pierluigigentili@gmail.com)*

## SYLLABUS

- 1) Introduction to Natural Complexity. Properties of Complex Systems and living beings.
- 2) Analysis of the II Law of Thermodynamics.
- 3) Non-equilibrium Thermodynamics. Flows and Forces. Linear and Non-Linear regimes. Entropy Production and evolution criteria for the out-of-equilibrium systems.
- 4) Linear analysis of the stability of the stationary states: stable, unstable, and oscillatory stationary states.
- 5) Oscillatory bio-chemical reactions.
- 6) Chemical waves.
- 7) Turing structures.
- 8) Periodic Precipitations.
- 9) Deterministic Chaos.
- 10) Fractal structures.
- 11) Natural and Computational Complexities. Strategies to face the Complexity Challenges.

### TEXTBOOK:

P. L. Gentili, "Untangling Complex Systems: A Grand Challenge for Science", CRC Press (FL, USA), 2018.