Biological systems are inherently stochastic and highly nonlinear. With a focus on ecological systems, this course will present a variety of phenomena that may arise in biological systems due to these two properties, ranging from oscillations in the abundance of two interacting populations to the formation of regular patterns in spatially extended systems. Guided by these paradigmatic examples, we will develop the mathematical framework needed to formalize them and discuss how it could be extended to other scenarios.

BIBLIOGRAPHY (there might be overlap between the content of some of the chapters).

- "Stochastic Numerical Methods: An Introduction for Students and Scientists". Raul Toral, Pere Colet. Wiley-Vch (Chapter 8).

  Free online version at: https://ifisc.uib-csic.es/raul/CURSOS/SP/Introduction_to_master_equations.pdf https://ifisc.uib-csic.es/raul/CURSOS/SP/Master_equations.pdf

- "Mathematical Biology I. An Introduction". J.D. Murray. Springer. Chapters 1, 3, 13, 11.
- "Mathematical Biology II. Spatial Models and Biomedical Applications". J.D. Murray. Springer. Chapters 2, 5.
- "Nonlinear Dynamics and Chaos with Applications to Physics, Biology, Chemistry, and Engineering". S.H. Strogatz. Chapters 2,6.
- "Mathematical Models in Biology". Leah Edelstein-Keshet. SIAM. Chapters 4, 6, 10
- "Diffusion and Ecological Problems: Modern Perspectives". A. Okubo, S.A. Levin. Chapters 1,2.

SUGGESTED READINGS classical works in which some of the examples that we will study where first introduced.

- Turing, Alan Mathison. "The chemical basis of morphogenesis." Bulletin of mathematical biology 52.1-2 (1990): 153-197.
- Fisher, Ronald Aylmer. "The wave of advance of advantageous genes." Annals of eugenics 7.4 (1937): 355-369.