COURSE OUTLINE
Math 5110
Mathematical Biology
Fall Semester, 2002

Week	Topic	Book sections	Extra reading
August 22	Introduction to math biology		
August 27	A whiff of differential equations	4.1	[1]
September 3	Linear difference equations	1.1-1.10	[2]
September 10	Nonlinear difference equations	2.1-2.6	[3]
September 17	Systems of nonlinear equations	2.7-2.10	[4]
September 24	Applications of systems	3.1-3.6	[5, 6]
October 1	Harvesting and game theory	Adler 3.3, Murray 1.6	[7, 8]
October 8	Review and midterm		
October 15	Intro to ODEs	4.1-4.10	[9, 10]
October 22	Birth-death processes	Pielou 1.1	[11, 12]
October 29	Delay differential equations	Murray 1.3-1.5	[13, 14]
November 5	The phase plane	5.1-5.10	[15]
November 12	Ecology and competitive exclusion	6.1-6.6	[16]
November 19	Kinetics	7.1-7.4	[17]
November 26	Switches and cooperativity	7.5-7.8	[18, 19]
December 3	Fitzhugh-Nagumo	8.1-8.5	[20]

Book sections are in Edelstein-Keshet unless otherwise noted. The extra readings are for students who are interested in learning more and pursuing the original literature. They are coordinated with the Mathematical Biology Journal Club.

References

[1] Ludwig, D., Jones, D. D., and Holling, C. S. Qualitative analysis of insect outbreak systems: the spruce budworm and forest. *Journal of Animal Ecology* **47**, 315–332 (1978).

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[3] May, R. M. and Oster, G. Bifurcations and dynamic complexity in simple ecological models. *American Naturalist* **110**, 573–599 (1976).

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[5] Nicholson, A. J. and Bailey, V. A. The balance of animal populations, part 1. *Proceedings of the Zoological Society of London* **1935**, 551–598 (1935).

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[7] Clark, C. W. *Mathematical Bioeconomics : the Optimal Management of Renewable Resources.* Wiley, (1990).

[8] Charnov, E. Optimal foraging: the marginal value theorem. *Theoretical Population Biology* **9**, 129–136 (1976).

[9] Kermack, W. O. and McKendrick, A. G. Contributions to the mathematical theory of epidemics. *Royal Statistical Society Journal* **115**, 700–721 (1927).

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[14] Mackey, M. C. and Glass, L. Oscillation and chaos in physiological control systems. *Science* **197**, 287–289 (1977).

[15] Volterra, V. Fluctuations in the abundance of a species considered mathematically. *Nature* **118**, 558–560 (1926).

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[17] Briggs, G. E. and Haldane, J. B. S. A note on the kinetics of enzyme action. *Biochemistry Journal* **19**, 338–339 (1925).

[18] Pauling, L. The oxygen equilibrium of hemoglobin and its structural interpretation. *Proc. Nat. Acad. Sci.* **21**, 186–191 (1935).

[19] Monod, J., Wyman, J., and Changeux, J.-P. On the nature of allosteric transitions: a plausible model. *Journal of Molecular Biology* **12**, 88–118 (1965).

[20] Fitzhugh, R. Impulses and physiological states in theoretical models of nerve membranes. *Biophysical Journal* **1**, 445–466 (1961).