Instructor: Uwe C. Täuber
Office: Robeson 109
Phone / email: (540) 231-8998; tauber@vt.edu
Office hours: Monday, 2.15 - 3.15 pm; Wednesday, 4.00 - 5.00 p.m.,
or by (email) appointment.

Prerequisites: PHYS 2206 or 2306
Lectures: Monday, Wednesday, Friday, 1.25 - 2.15 p.m., Robeson 122.
Copies of my lecture notes will be available.
Questions and discussion in class are always welcome!

Homework: Weekly homework problems will be assigned (30 % of final grade),
due on Fridays in class. Teamwork is encouraged for solving the
homework assignments, but each student must turn in her/his indi-
vidual solution. Copying or use of sample solutions is prohibited.
Should you encounter any difficulties, please feel free to ask me
(or our GTA) for assistance (during office hours or via email).
Your answers will be graded, and sample solutions provided.

Graduate TA: Guangpu Luo, Robeson 301/301A.

Exams: Midterms: Wednesday, Feb. 18; Monday, Mar. 30, 1.25 - 2.15 p.m.
Final exam: Tuesday, May 12, 3.25 - 5.25 p.m., comprehensive.
The Virginia Tech undergraduate / graduate honor codes apply to
all homework assignments and exams.

Distribution: 30 % homework, 20 % each midterm test, 30 % final exam.

Literature: The lectures will draw from the following recommended texts:
P. Nelson, *Biological Physics – Energy, Information, Life*
(W.H. Freeman & Co., New York 2004);
P. Nelson, *Physical Models of Living Systems*
(W.H. Freeman & Co., New York 2014);
of the Cell* (2nd ed., Garland Science, New York, 2013);
Course content: Selected topics from modern biological physics that range from cellular mechanics and hydrodynamics to biochemical kinetics and population dynamics will be discussed, with emphasis on physical aspects of biological phenomena. The necessary mathematical tools for their modeling and quantitative description will be developed.

Topics:

1. Introduction
2. Brownian motion, friction, and diffusion
   2.1. Discrete random walks
   2.2. Continuous random walks
   2.3. Stochastic processes, diffusion, and drift
   2.4. Langevin-Einstein theory of Brownian motion, applications
3. Motion in a viscous environment
   3.1. Fluid hydrodynamics
   3.2. Motion at high Reynolds number: swimming and flight
   3.3. Motion at low Reynolds number, laminar flow
   3.4. Metabolic rates and allometric scaling
4. Thermal equilibrium, entropic forces
   4.1. Thermal equilibrium and entropy
   4.2. Temperature, laws of thermodynamics
   4.3. Canonical ensemble and variants
   4.4. Entropic forces
5. Chemical kinetics
6. Macromolecules
7. Molecular machines
8. Nerve impulses
9. Population dynamics and epidemics
10. Pattern formation
11. Genetic switching and cellular oscillators

Notice: If you require any adaptations or accommodations because of a documented disability, if you need special arrangements in case the building must be evacuated, or if you have any emergency medical information to share with me, please contact me as soon as possible.