Course content: MCB 501, Imlay section.

Chemistry and evolution of bioenergetics, enzymology, pathway logic, and substrate networks.

1. What processes must cells conduct in order to be viable?
2. How do thermodynamics determine what processes require energy? Which ones yield it?
3. Why are pathways configured the way they are? Can we predict them?
4. Knowing the reaction that an enzyme catalyzes, can we predict its mechanism and structure?
5. How do new pathways evolve?
6. How do new enzymes evolve?
7. How do cells transform relatively inert substrates?
8. How do cells perfectly balance the fluxes of substrates into competing pathways?
9. Can we re-engineer cells into chemical factories?
10. Why are electron-transfer chains configured the way they are?
11. How can profoundly different types of respiratory processes evolve?
12. How can proteins guide electron movement?
13. How can proteins push protons across membranes?
14. How do the dynamic motions of proteins contribute to their function? How is this motion stimulated?
15. Does accidental chemistry occur inside cells?

Two open-book exams: One in mid-November; a second at the final-exam time. Periodic homework.

Jim Imlay. B303 CLSL. Office hours: Friday 2-3 pm, drop by, or email jimlay@illinois.edu.
Use a good biochem book as a support text.

MCB 501: Advanced Biochemistry

Professor: Joe Sanfilippo

Lectures: 8:30 – 9:50 AM Mondays and Wednesdays
- B102 CLSL

Discussion: 9:00 – 10:20 AM or 10:30 – 11:50 AM Fridays
- B102 CLSL or 1105 Siebel Center

Course Summary: This course is required of first-year MCB PhD students. Graduate students from other units may also enroll.

The primary goal of this course is to understand how scientific discoveries are made. The course will be focused on how to formulate and answer scientific questions. We will approach each question as if the answer was not known. Class time will be interactive and we will collectively propose and discuss the positive/negatives of different approaches.

	Week 1
8/23 (M)	Lecture – What is molecular biology?
8/25 (W)	Lecture – FtsZ, Min system, geometry
8/27 (F)	*Discussion* – FtsZ, Min system, geometry
	Week 2
8/30 (M)	Lecture – FtsZ, Min system, geometry
9/1 (W)	Lecture – Bacterial flagellum, motors, PMF
9/3 (F)	*Discussion* – Bacterial flagellum, motors, PMF
	Week 3
9/6 (M)	NO CLASS – Labor Day
9/8 (W)	Lecture – Bacterial flagellum, motors, PMF
9/10 (F)	*Discussion* – Muscles, actin, myosin, motors
	Week 4
9/13 (M)	Lecture – Muscles, actin, myosin, motors
9/15 (W)	Lecture – Muscles, actin, myosin, motors
9/17 (F)	*Discussion* – Muscles, actin, myosin, motors
	Week 5
9/20 (M)	EXAM #1
9/22 (W)	Lecture – Chlorophyll, synthesis, biosynthesis
9/24 (F)	*Discussion* – Chlorophyll, synthesis, biosynthesis
	Week 6
9/27 (M)	Lecture – Chlorophyll, synthesis, biosynthesis
9/29 (W)	Lecture – Heme, synthesis, biosynthesis
10/1 (F)	*Discussion* – Heme, synthesis, biosynthesis
	Week 7
10/4 (M)	Lecture – Heme, synthesis, biosynthesis
10/6 (W)	Lecture – Heat-shock, protein stability
10/8 (F)	*Discussion* – Heat-shock, protein stability
	Week 8
10/11 (M)	Lecture – Heat-shock, protein stability
10/13 (W)	EXAM #2

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Grading: There will be two non-cumulative exams (9/20 and 10/13) and weekly homework assignments. Scores from my section of the class are averaged with those from Professor Imlay's section of the class, prior to assignment of a final course grade.

Office hours: Please email for appointment. I am happy to meet via Zoom or In-Person. Please email for appointment.