

BioE C217/IB C217/ME C217

Engineering Biomimetics or Engineering from Biology

3 UNITS
Fall 2017

Instructors

Professor Robert Full

5128 VLSB

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Prerequisites: Open to all graduate students or consent of instructor.

Textbook: None: On Reserve, Vogel, Steven. *Cats' paws and catapaults: Mechanical worlds of nature and people*. WW Norton & Company, 2000; Vogel, S. (1988). *Life's devices: the physical world of animals and plants*. Princeton University Press; *Life in Moving Fluids*, Second Edition, by S. Vogel, Princeton University Press (1996); *Mechanical Design in Organisms*, by S. Wainwright, W. Biggs, J. Currey, and J. Gosline, Princeton University Press (1982)

bCourses Site:

We will use the IB 217 bCourses site for the syllabus, reading assignments, announcements, presentations, and lecture material. You may access the site by going to: <https://bcourses.berkeley.edu>, login through CalNet and then to Integbi, ME or BioE C217.

Meeting time and place: Monday, Wednesday. 5053 VLSB. 9:00AM - 10:30AM

Rationale: Bioinspired design views the process of how we learn from Nature as an innovation strategy translating principles of function, performance and aesthetics from biology to human technology. The creative design process is driven by interdisciplinary exchange among engineering, biology, medicine, art, architecture, and business. Lectures will introduce the biomimicry design process from original scientific breakthroughs to devices using cases studies. Each lecture will be followed by a second period in which small teams or pairs of students select a paper of interest for more in-depth discussion. Teams will collaborate on, create, and present an original bioinspired design project.

Bioinspired Design Project

Teams will select a journal publication with a biological discovery and extract the principle. Teams will then create a mock-up, prototype, and/or computer simulation/animation in combination with the setting in which your design is to be used. Designs should include possible societal impacts (health, fitness, environment, safety, security, education, connections to others or community, assisting underserved, disabled populations or underdeveloped countries, sports and entertainment).

Grading

Your grade will be determined by:

30%: Leading one discussion of publication(s)

20%: In class participation
50%: Final team project presentation

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TENTATIVE COURSE SCHEDULE, Fall 2017

Date	Lecture (5053 VL5B)	Assignment
23 August	1. Course Introduction	
28 August	2. Biomimetics Introduction	
30 August	Popular Presentation Videos	
4 September	Holiday	
6 September	3. BioDiscovery - How to discover Nature's principles?	Read Literature
11 September	Team Presentation & Discussion	1. Select an Example of a Bioinspired Design. What Makes It a Good Example?
13 September	4. BioDesign - How do I design from Nature?	Read Literature
18 September	Team Presentation & Discussion	2. Select a Biological Discovery. Do a Discovery Decomposition.
20 September	5. BioConstraints - How are Nature's designs compromised?	Read Literature
25 September	Team Presentation & Discussion	3. Use Biological Discovery to Propose a Design. Do an Analogy Check.
27 September	6. BioSelection - How do I select the best inspiration?	Read Literature
2 October	Team Presentation & Discussion	4. Design a Research Program Necessary to Translate the Discovery.
4 October	7. BioScaling - How do I consider size?	Read Literature
9 October	8. BioComplexity - How to simplify & extract principles?	Read Literature
11 October	9. BioControl	Read Literature
16 October	10. BioSensing	Read Literature; Form Final Groups 4-5; Create Collaborative Plan
18 October	11. BioPower	Read Literature
23 October	12. BioMaterials	Read Literature; Submit 3 Possible Discoveries Final Project
25 October	13. BioAdhesion	Read Literature
30 October	14. BioMotion - Swim	Read Literature
1 November	15. BioMotion - Fly	Read Literature
6 November	16. BioMotion - Walk	Read Literature; Select Discovery for Final Project
8 November	17. BioMotion - Run	Read Literature
13 November	18. BioProsthetics	Read Literature
15 November	19. BioAnimation	Read Literature
20 November	Presentation Assistance	
22 November	Holiday	
27 November	Final Presentations	
29 November	Final Presentations	