Berkeley
UNIVERSITY OF CALIFORNIA

INTEGRATIVE BIOLOGY

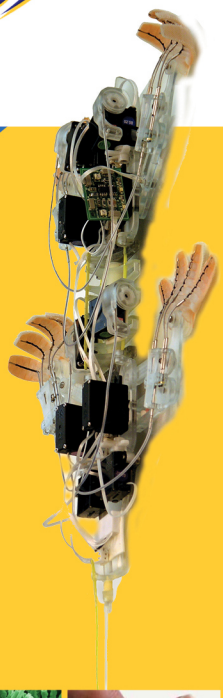
BIOINSPIRED DESIGN

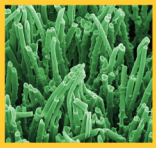
INTEGRATIVE BIOLOGY 32 - SPRING 2016

NEW COURSE!

Control Number: 42148 | Units: 3
Instructor: Prof. Robert Full
Location: MW 12-1P, 2060 VLSB
F Discussion, 220 Jacobs Hall







All Fields and Levels Welcome
Engineering, Biology, Medicine, Art, Architecture and Business

Learn from Nature
Design New Technologies for Health, the Environment and Safety

Use Design Innovation Institute - Jacobs Hall
Diverse Teams Create Design Projects

Discuss Bioinspired Design Case Studies
Gecko-inspired Adhesives, Robots that Run, Fly and Swim, Artificial Muscles, Computer Animation, Medical Devices and Prosthetics

Contact: Robert Full, rjfull@berkeley.edu



Integrative Biology 32
3 UNITS
Lower Division

BIO-INSPIRED DESIGN

Spring 2016

Instructor

Professor Robert Full
5128 VLSB
Office hours**:** Monday & Wednesday 1:00-2:00 PM
Phone: 510-642-9896; e-mail: rjfull@berkeley.edu

GSIs
TBA

Prerequisites: None. Open to all students.

Textbook: None: On Reserve, Vogel, Steven. *Cats' paws and catapults: Mechanical worlds of nature and people*. WW Norton & Company, 2000.

bCourses Site:
We will use the IB 32 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 32

Meeting time and place: Monday & Wednesday. 2060 VLSB. 12:00PM - 1:00PM

Discussion sections:
One hour per week
INTEGRATIVE BIOLOGY 32 S 101 DIS; 42151; Fr 11-12P, 220 Jacobs Hall
INTEGRATIVE BIOLOGY 32 S 101 DIS; 42154; Fr 12-1P, 220 Jacobs Hall
INTEGRATIVE BIOLOGY 32 S 101 DIS; 42157; Fr 1-2P, 220 Jacobs Hall
INTEGRATIVE BIOLOGY 32 S 101 DIS; 42160; Fr 2-3P, 220 Jacobs Hall

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. Diverse teams of students will collaborate on, create, and present original bioinspired design projects in our new **Design Innovation Institute in Jacobs Hall**. Lectures will address the biomimicry design process from original scientific breakthroughs to entrepreneurial start-ups using cases studies that include gecko-inspired adhesives, robots that run, fly and swim, artificial muscles, computer animation, medical devices and prosthetics while highlighting health, the environment, and safety.

Connections: Before every class, design teams will add a ***Connection Link*** to the Discussion Board in bCourses to share Bioinspired Design connections. These URLs can include relevant design or biology courses on campus; links to campus organizations, clubs, institutes and competitions interested in design; biological discoveries and bioinspired designs from news and journals, and; global research, centers, and institutes.

Bioinspired Design Projects: Three bioinspired design opportunities will be offered.

1. Create a Gecko-inspired adhesive. In the first session, teams will manufacture a gecko inspired adhesive and analyze the adhesive. In the second design session, teams will use their gecko-inspired adhesive as a design tool to propose a new product.

2. Build a Legged Robot. In the first session, teams will construct a legged robot provided by DASH Robotics. In the second design session, teams will use their robot as a design tool to propose a new product.

3. Novel Bioinspired Design. The final exam will be a 5 min video of a bioinspired design of your team's choice. Team 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). Resources from Jacobs Hall will be available. The video must be posted to the assignment page in bCourses by 5PM on May 1. (You will NOT have a written exam during the May 11 slot.)

Grading

Your grade will be determined by:

10%: *Connection* links submitted by teams (Points for web surfing!)
25%: Midterm (In-class multiple choice based on lecture and readings)
5%: Discussion Section Assignments (Decompose two research papers)
15%: Design Project #1 Gecko-inspired adhesive design
15%: Design Project #2 Design legged robot (DASH)
30%: Final Project (5 min team video)

Disabled Students

Disabled students please get a letter from the Disabled Students Program and present this letter to the instructors at least 2 weeks in advance of the exam so that appropriate accommodations can be made. See http://dsp.berkeley.edu

Integrative Biology 32

TENTATIVE COURSE SCHEDULE, Spring 2016

Date	Lecture (2060 VLSB)	Discussion (220 Jacobs Hall)
20 January	1. Introduction	
22 January		Introduction & orientation; Literature searching; Assign Gecko paper #1
25 January	2. BioDiscovery - How to discover Nature's principles?	
27 January	3. BioDesign - How do I design from Nature?	
29 January		Understanding scientific publications; Assign Gecko paper #2
1 February	4. BioConstraints - How are Nature's designs compromised?	
3 February	5. BioScaling - How do I consider size?	
5 February		Understanding experimental design and statistics
8 February	6. BioSelection - How do I select the best inspiration?	
10 February	7. BioComplexity - How to simplify extract principles?	
12 February		Discovery decomposition
15 February	Holiday	
17 February	8. BioAdhesion	
19 February		Analogy check exercise

22 February	9. BioAdhesion - Gecko	
24 February	10. BioMotion-Walk	
26 February		Gecko adhesive design project 1
29 February	11. BioMotion-Running	
2 March	12. BioControl	
4 March		Gecko adhesive design project 2
7 March	**13. Midterm**	
9 March	14. BioSensing	
11 March		DASH robot design project 1
14 March	15. BioPower	
16 March	16. BioPower-Artificial Devices	
18 March		DASH robot design project 2
21 March	Spring Vacation	
23 March	Spring Vacation	
		No discussion
28 March	17. BioMaterials	
30 March	18. BioSupport - Skeletons	
1 April		Paper selection for final project
4 April	19. BioTransport - Pumps	
6 April	20. BioMotion-Swim	
8 April		Work on final project
11 April	21. BioMotion-Fly	
13 April	22. BioAnimation	
15 April		Work on final project
18 April	23. BioEnergy	
20 April	24. BioEntrepreneurship	
22 April		Work on final project
25 April	25. Team Project Preparation	
27 April	26. Summary	
1 May		Submit final video project