

**Integrative Biology C32 33127
L&S Discovery Course C30Z 33107
3 UNITS**

**Course may be used to satisfy the Biological Science breadth requirement in Letters and Science
Lower Division**

BIOINSPIRED DESIGN

Spring 2017

Website: http://polypedal.berkeley.edu/?page_id=691

Instructor

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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 C32 or L&S C30Z

Meeting time and place: Monday & Wednesday. 145 Dwinelle. 12:00PM - 1:00PM

Discussion sections:

One hour per week

INTEGRATIVE BIOLOGY C32 S 101 DIS; 33129; Fr 9-10A, 220 Jacobs Hall
INTEGRATIVE BIOLOGY C32 S 102 DIS; 33151; Fr 10-11A, 220 Jacobs Hall
INTEGRATIVE BIOLOGY C32 S 103 DIS; 33152; Fr 11-12P, 220 Jacobs Hall
INTEGRATIVE BIOLOGY C32 S 104 DIS; 33153; Fr 12-1P, 220 Jacobs Hall
INTEGRATIVE BIOLOGY C32 S 105 DIS; 33154; Fr 1-2P, 220 Jacobs Hall
INTEGRATIVE BIOLOGY C32 S 106 DIS; 33155; Fr 2-3P, 220 Jacobs Hall

LETTERS & SCIENCE C30Z S 101 DIS; 33108; Fr 9-10A, 220 Jacobs Hall
LETTERS & SCIENCE C30Z S 102 DIS; 33109; Fr 10-11A, 220 Jacobs Hall
LETTERS & SCIENCE C30Z S 103 DIS; 33110; Fr 11-12P, 220 Jacobs Hall
LETTERS & SCIENCE C30Z S 104 DIS; 33111; Fr 12-1P, 220 Jacobs Hall
LETTERS & SCIENCE C30Z S 105 DIS; 33112; Fr 1-2P, 220 Jacobs Hall
LETTERS & SCIENCE C30Z S 106 DIS; 33113; 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**. Project teams will have opportunities to learn about team dynamics and how to make a successful team. 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 a Google form 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. 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). Resources from Jacobs Hall will be available. The video must be posted to the assignment page in bCourses by 5PM on April 28. (You will NOT have a written exam during the May 10 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 C32; L&S Discovery Course C30Z

TENTATIVE COURSE SCHEDULE, Spring 2017

Date	Lecture (145 Dwinelle)	Discussion (220 Jacobs Hall)
18 January	1. Introduction	
20 January		Introduction & orientation; Literature searching; Assign Gecko paper #1
23 January	2. BioDiscovery - How to discover Nature's principles?	Publish Teaming Survey
25 January	3. BioDesign - How do I design from Nature?	
27 January		Understanding scientific publications; Assign Gecko paper #2; Form Teams
30 January	4. BioConstraints - How are Nature's designs compromised?	
1 February	5. BioScaling - How do I consider size?	
3 February		Review Assignment #2. Discovery Decomposition & Analogy Check. Assignment #3 Select own publication and do Decomposition and Check
6 February	6. BioSelection - How do I select the best inspiration?	
8 February	7. BioComplexity - How to simplify & extract principles?	
10 February		Assist with Assignment #3. Discuss teaming tools
13 February	8. BioAdhesion	
15 February	9. BioAdhesion - Gecko	
17 February		Review Assignment #3; Help for Midterm
20 February	Holiday	
22 February	10. Midterm Exam	
24 February		Gecko adhesive design project Part 1
27 February	11. BioMotion-Walk	
1 March	12. BioMotion-Running	
3 March		Gecko adhesive design project Part 2
6 March	13. BioControl	
8 March	14. BioSensing	
10 March		DASH robot design project Part 1
13 March	15. BioPower - Nature	
15 March	16. BioPower - Technology	
17 March		DASH robot design project Part 2
20 March	17. BioMaterials	
22 March	18. BioProsthetics	
24 March		Final Design Project. Suggest bio paper for final project.
27 March	Spring Vacation	
29 March	Spring Vacation	
March 31		No discussion
3 April	19. BioMotion-Swim	
5 April	20. BioMotion-Fly	

7 April		Work on final project
10 April	21. BioAnimation	
12 April	22. BioGreenChem	
14 April		Work on final project
17 April	23. BioArchitecture	
19 April	24. BioEntrepreneurship	
21 April		Work on final project
24 April	25. Team Project Preparation	
26 April	26. Summary	
28 April		Submit final video project