



FRAZIER JELKE SCIENCE CENTER

Optimal Foraging

The following courses
will be offered next semester

Number	Course Title	Hours Offered
140	Biology II (4 sections)	MWF 9:00-9:50, 10:00-10:50, 11:00-11:50; TR 9:30-10:45
141	Biology II Lab (8 sections)	T 12:30-3:30, 4:00-7:00 W 1:00-4:00 R 12:30-3:30, 4:00-7:00
201	Mycology (Hill)	TR 9:30-10:45 T Lab 12:30-3:30
204	Animal Development (Fitz Gerald)	MWF 9:00-9:50 W Lab 1:00-4:00
260	The Science of Climate Change (Boyle)	TR 8:00-9:15
301	Microbiology (Frawley)	MWF 8:00-8:50 R Lab 12:30-3:30
304	Genetics (TBA)	TuTh 8:00-9:15 T Lab 12:30-3:30
320	Conservation Biology (Kelly)	TR 9:30-10:45 W Lab 1:00-4:00
325	Molecular Biology (Petrik)	MWF 9:00-9:50 R Lab 12:30-3:30
330	Virology/Immunology (Moore)	MWF 10:00-10:50
340	Animal Physiology (Kabelik)	MWF 10:00-10:50 M Lab 1:00-4:00
345	Ornithology (Collins)	TR 11:00-12:15 M lab 1:00-4:00
376	Molecular & Cellular Neuroscience (Dougherty)	TR 11:00-12:15 M lab 1:00-4:00
380	Topics in Biomedical Science (Miller)	TR 8:00-9:15
CHEM 414†	Biochemistry (3 sections)	MWF 11:00-11:50, TR 9:30-10:45; 11:00-12:15
CHEM 416†	Mech. of Drug Action (Jackson-Hayes)	TR 9:30-10:45
NEUR 270†	Neuroscience (Pandit)	MWF 9:00-9:50

Senior Seminar Sections

486-01	Biofuels (Petrik)	MWF 11:00-11:50
486-02	Cancer Biology (Miller)	TR 11:00-12:15

Courses for non-majors (fulfill the F7 requirement)

105	Infectious Diseases From the Past and Into the Future (Moore)	TR 8:00-9:15 R lab 12:30-3:30
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† No more than two courses taken outside the Biology Department may count for the six upper-level courses required for the Biology Major

dent Research, and get to know many of the staff and visiting scientists at Woods Hole. The SES deadline is March 20 for the Fall 2020 semester. There is an \$17,000 scholarship available for one Rhodes student to participate in the program. Students who are interested in learning more about the program should contact Dr. Boyle.

Senior Seminar News

This spring the Biology senior seminars are BIOL 486-01: Biofuel Production, MWF 11:00-11:50 AM, taught by Dr. Petrik (see brief description below) and BIOL 486-02: Cancer Biology, TR 11:00-12:15 PM, taught by Dr. Miller. Students who signed up for these senior seminars during the lottery last spring should list them on their tree under "Other Courses" when they register this fall.

BIOL 486-01 Biofuel Production: This senior seminar will teach students to read and present primary literature articles in biofuel-related research. Topics will range from cell wall and lipid biosynthesis pathways (and metabolic engineering to improve these pathways to increase biofuel production or quality), to engineering of microbes for improvement in sugar fermentation to alcohol, to the ecological considerations for the use of various plants or algae as biomass feedstocks. Students will then delve deeper by writing a review article summarizing research on a biofuel related topic of their choosing.

Juniors note that senior seminars for the '20-'21 academic year will be listed in the spring issue of BIOFEEDBACK, along with information about the lottery for enrollment.

Botanical Research in South America

Traveling across the deserts of the southwestern U.S. and northern Mexico, you might be struck by the unique collection of plants and animals. Living in harsh environments, they have evolved unique adaptations to cope with the extreme heat, aridity, and sun exposure forming a distinct community. But, would you be surprised to find many of the same plants and animals while traveling in South America? In parts of Chile and Argentina climate and rainfall patterns are very similar to parts of Mexico and the southern U.S. occurring at equivalent latitudes, and plant communities are remarkably similar as well.

This summer, Dr. Laport traveled to northern Argentina (Fig. 1) on a research trip to explore the evolutionary relationships between his primary research subject, creosote bush (*Larrea tridentata*), and its



Figure 1. A) Guanacos in Parque Nacional Los Cardones in the foothills of the Andes of northern Argentina. B) Despite being the “foothills” of the Andes, these mountains were impressive in their own right with desert plateaus covered in *L. divaricata* at over 3,100m (10,000ft)!

intercontinentally disjunct sister species, jarilla (*Larrea divaricata*). As odd as it may seem that two closely related species occur on different continents, many species occupying temperate latitudes in North America have close relatives at similar latitudes in South America, a biological phenomenon known as amphitropical disjunctions. These disjunctions have fascinated biogeographers, ecologists, and evolutionary biologists for centuries. While such disjunctions have been characterized for coastal California and coastal Chilean species, desert endemics, and even alpine specialists, many questions remain about how such disjunctions arose. For example, did they all occur at similar times in history? Do these disjunctions represent interchange from north to south, south to north, or a combination of north-south interchange? Do they all represent ancient dispersals between North and South America, or are some of them the product of convergent evolution between distantly related species?

The disjunction between *L. divaricata* and *L. tridentata* is particularly interesting as these species have historically both been used for traditional medicines by native peoples, and they were both described as belonging to the same species since being collected and described by Spanish

explorers and missionaries. While the two species are morphologically and ecologically very similar, they occur on two different continents separated by ~6,000km. How could a single plant species occupy enormous portions of two continents? Several hypotheses have been posed to explain the current distributions, including ancient land bridges and distributions that once stretched through the tropics, but current genetic divergence and biogeographic studies suggest a long-distance migratory bird (possibly an ancestor to the Golden Plover, *Pluvialis dominica*) carried seeds of the common ancestor of these species from South America to North America around 1 million years ago. In contrast, some taxa such as Mesquite (*Prosopis spp.*) occur trans-tropically, meaning they occupy arid habitats in North, Central, and South America with only modest disjunctions in their distributions through the tropics. Yet, other taxa like Saguaro Cactus (*Carnegiea gigantea*) in North America and the Argentine Saguaro or Cardon Grande (*Echinopsis terscheckii*) look amazingly similar and occupy similar habitat, but are not closely related representing an example of convergent evolution.

Dr. Laport set out to obtain *L. divaricata* leaf material (Fig. 2) from a broad swath of the species’ range for DNA analyses to clarify the relationships between the North and South American creosote bush and jarilla, estimate when they diverged using molecular clock analyses, and even the source of dispersal from South to North America using models of molecular evolution. This meant flying to Salta in northern Argentina and driving south along the foothills of the Andes through the provinces of Salta, San Miguel de Tucumán, Catamarca, La Rioja, San Juan, Mendoza, San Luis, and Cordoba, a journey of nearly 3,000km in just over a week! Of course there was the adventure of working from sunrise to sunset to collect over 100 jarilla specimens. But, there was also the joy of meeting many interesting people, seeing some incredibly beautiful landscapes, eating and drinking some amazing food and wine, and seeing many new (and some familiar) plants!

With the newly-collected specimens back at Rhodes, members of the lab are beginning the hard work this year of preparing to conduct PCR, DNA sequencing, and phylogenetic analyses. Additionally, lab members are growing some seedlings of the South American jarilla from seed collected from herbarium specimens. These newly propagated individuals will make an important contribution to the collection of research plants that will occupy the new Rhodes College Greenhouse being constructed on the south side of Robertson Hall. Although the greenhouse currently doesn’t look like much, after a late Fall 2019 opening, the new greenhouse will be home to botanical research conducted by the Biology Department!

Figure 2. Dr. Laport collecting *L. divaricata* leaves in Salta (A) and San Miguel de Tucuman, Argentina (B & C). Like its North American relative, *L. tridentata*, the South American creosote bush was found in extremely arid habitat, often dominating the landscape, but sometimes occurring mixed with mesquite trees and columnar cactus. This made for some collecting experiences that were eerily similar to working in southern Arizona!

