SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

111TH ANNUAL MEETING

MAY 4, 2018

CAL POLY POMONA
Bronco Student Center
The objectives of the Academy are to promote fellowship among scientists and those interested in science; to contribute to scientific literature through publication of pertinent manuscripts; to encourage and promote scholarship among young scientists; and to provide information to the membership, to the public, and to the public agencies on such matters as may be of joint interest to the sciences and society.

**ARTICLE II – OBJECTIVES in the By-Laws of the Southern California Academy of Sciences**

The Academy utilizes dues and contributions to promote student research, from high school students through the college graduate level with the following activities:

- **Research Training Program**: High school students conduct research with professional mentors and present their results at the Annual Meeting. Top presenters also attend the national conference of the American Junior Academy of Science held in conjunction with the American Association for the Advancement of Science.
- **Research support**: Undergraduate and graduate students receive grants to help cover their research costs.
- **Cash awards**: Undergraduate and graduate students receive awards for best presentation and best poster at the Annual Meeting.

The Academy is working toward expanding its student programs by increasing the number of student participants, as well as increasing the amount of research support and cash awards. Contributions are vital in helping the Academy achieving this goal.

The Southern California Academy of Sciences is a Federally-recognized 501(c)(3) non-profit organization

**Please join us for future meetings!**
Friends and colleagues,

Welcome to the 2018 Annual Meeting of the Southern California Academy of Sciences at Cal Poly Pomona. This is always an exciting time for SCAS as we look forward to meeting new people, catching up with old friends, and sharing new ideas. The research, scholarship, and professional development opportunities offered by the Academy can benefit students at all levels of their academic career.

We've assembled a diverse selection of symposia and speakers for this year’s meeting, which we will kick off with three symposia: Ecology, evolution and life history of parasites; Desert sciences; and Kelp aquaculture: Research advances and applications. Our plenary speaker, Dr. Greg Rouse from Scripps Institution of Oceanography at UC San Diego will discuss his research in a talk titled, “Deep Discoveries in the 2000s: Bone-Eaters, Green Bombers, Ruby Seadragons and More.” In the afternoon, contributed paper presentations will cover a variety of topics ranging from physiology and ecology to conservation biology and environmental change. And, finally, we will finish the day with an evening poster session that will once again include our Junior Academy members enrolled in the SCAS Research Training Program.

As the President of the SCAS Board of Directors, and on behalf of the Board, I would like to thank all of our members, past and present, for your contributions to the Academy. Additionally, I would like to acknowledge our Platinum (The Coastal Community Foundation) and Silver Level donors (Gloria and Harry Takahashi, Your Cause, LLC), as well as our Partners-in-kind (The Natural History Museum of Los Angeles County, Psomas, SMILODON Newsletter editors, Brad Blood and Scott Graff, American Institute of Fishery Research Biologists, and The Southern California Society of Parasitologists) for their generous support of SCAS.

If you have scientific papers to publish, remember that the SCAS Bulletin publishes papers by members without page charges. The goal of the Bulletin is to report on research activities of SCAS members, scientific research conducted in southern California, and research that is of interest to the membership. I would like to give a special thanks to the editors of the Bulletin, Dan Pondella and Larry Allen for all their hard work.

Finally, I am pleased to announce that next year’s annual meeting will be held at CSU Northridge on May 3, 2019. Thank you for your continued participation in and support of SCAS. I look forward to chatting with you soon!

Dave Ginsburg, Ph.D.
SCAS President
The academy is always seeking members who would like to become more involved in our activities by serving on our Board of Directors. The board meets once a month to plan and direct the society’s activities, which include organizing the annual meeting, publication of the *Bulletin*, offering financial support to undergraduate and graduate students, and operating a Research Training Program for high school students. Please let any Board member know if you are interested in becoming more involved.

**Officers**
David Ginsburg, *President*
Lisa Collins, *Vice-President*
Edith Read, *Recording Secretary*
Amber Brown, *Treasurer*
Kristy Forsgren, *Corresponding Secretary*
Daniel J. Pondella II and Larry G. Allen, *Editors - Bulletin*
Brad R. Blood, *Editor - Smilodon Newsletter*
Shelly Moore, *Webmaster*

**Board of Directors**
**2015-2018**: Bengt Allen, Ann Bull, Kristy Forsgren, Karina Johnston, Shelly Moore
**2016-2019**: Mia Adreani, Lisa Collins, Julianne Passarelli, Edith Read, Danny Tang
**2017-2020**: Amber Brown, David Ginsburg, Shana Goffredi, Gordon Hendler, Gloria Takahashi

**Advisory Council** (Past-Presidents)
Ralph Appy, Jonathan Baskin, Brad Blood, John Dorsey, Julianne Passarelli, John Roberts

**Junior Academy Board of Directors**
John Dorsey, David Ginsburg, Candice Groat, Gordon Hendler, Julianne Passarelli, Robert F. Phalen, Kathy Phalen, Gloria and Harry Takahashi, Danny Tang,
Graduate, undergraduate, and high school students who elect to participate are eligible for Best Student Presentation or Poster awards. The American Institute of Fishery Research Biologists (AIFRB), Southern California Society of Parasitologists (SCP) and the Southern California Junior Academy of Sciences (SCJAS) will also present awards. The program will denote students competing for an award with a § for SCAS, ‡ for AIFRB, † for SCSP, and ¥ for SCJAS.

New for 2018! The M. James Allen Award was established to recognize students that best exemplify the skills required to prepare and deliver an oral presentation at the SCAS Annual Meeting. This award is named in honor of Dr. Jim Allen, a local expert in fish ecology, mentor to many, and long-time SCAS Board member. Dr. Allen was always supportive of students, through his participation in SCAS, AIFRB, as well as serving on many Master’s and Ph.D. student thesis committees. He served as head of the Fish Biology Department at the Southern California Coastal Water Research Project (SCCWRP) and was lead scientist on the Southern California Regional Bight Survey Fish and Invertebrate Committee. Known as a “walking encyclopedia of fish,” his extensive publication record and willingness to give guest lectures for his many colleagues at local universities will never be forgotten.

Jim received his Ph.D. in Marine Biology from the Scripps Institution of Oceanography where he developed a baseline model of the functional organization of soft-bottom fish communities in southern California. For over 40 years, Jim studied the natural history and ecology of marine fishes and invertebrates in the Southern California Bight. Jim specialized in marine fish ecology and natural history, including studies of biogeography, community organization, natural and human impacts to populations, feeding habits, taxonomy, contaminant levels in fishes and fish consumption rates by anglers. He wrote life history descriptions for more than 100 species of fishes and invertebrates for the West Coast of North America, and was recognized as an expert at the taxonomic identification of coastal marine fishes in the Southern California Bight.

2017 SCAS Awards:
Best Presentation:
• **Emily Meese**, CSU Long Beach
Honorable Mentions:
• **Haley Gause**, CSU Long Beach
• **Annie Jean Rendleman**, CSU Long Beach
• **Racine Rangel**, CSU Long Beach
Best Poster:
• **Amanda Martinez**, CSU Long Beach
Honorable Mentions:
• **Zachary Travis**, Loma Linda University
• **Lorelay Mendoza**, CSU San Diego
• **Stacy Sinclair**, Loyola Marymount University

2017 SCSP Awards:
Best Presentation:
• **Haley Gause**, CSU Long Beach
Best Poster:
• **Julia DeRogatis**, Occidental College
Award for Best Student Paper in Fisheries Biology
For the past 25 years the Southern California and Baja California, Mexico District of the AIFRB has granted cash awards to honor graduate and undergraduate students of fisheries-related papers presented at the annual meeting of the Southern California Academy of Sciences. Once again, we are pleased to award the efforts of student fishery research biologists at this year’s meeting.

**Past Award Recipients**

<table>
<thead>
<tr>
<th>Year</th>
<th>Name</th>
<th>Institution</th>
<th>City</th>
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<tbody>
<tr>
<td>2017</td>
<td>Racine Rangel</td>
<td>California State University, Long Beach</td>
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<tr>
<td>2016</td>
<td>Barbara Weiser</td>
<td>California State University, Northridge</td>
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<tr>
<td>2015</td>
<td>Armand Barilotti</td>
<td>California State University, Long Beach</td>
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<tr>
<td>2014</td>
<td>Bonnie Ahr</td>
<td>California State University, Long Beach</td>
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<tr>
<td>2013</td>
<td>Michael Farris</td>
<td>California State University, Long Beach</td>
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<tr>
<td>2012</td>
<td>No Award Given</td>
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<tr>
<td>2011</td>
<td>Christopher Chabot</td>
<td>University of California, Los Angeles</td>
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<tr>
<td>2010</td>
<td>Dominique Richardson</td>
<td>University of California, Los Angeles</td>
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<td>2009</td>
<td>Kim Anthony</td>
<td>California State University, Long Beach</td>
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<td>2008</td>
<td>Chris Martin</td>
<td>California State University, Long Beach</td>
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<tr>
<td>2007</td>
<td>Christopher Mull</td>
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<td>2006</td>
<td>Julianne Kalman</td>
<td>University of California, Los Angeles</td>
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<td>2005</td>
<td>Barbara Ziegler</td>
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<td>2004</td>
<td>Kimberly Johnson</td>
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<td>2003</td>
<td>Matthew Neilson</td>
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<td>2002</td>
<td>Daniel Cartamil</td>
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<td>2001</td>
<td>Darin Topping</td>
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<td>2000</td>
<td>Kristina Louie</td>
<td>University of California, Los Angeles</td>
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<td>1999</td>
<td>Fredrick Stengard</td>
<td>University of South Florida, St. Petersburg</td>
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<tr>
<td>1998</td>
<td>Thomas Even</td>
<td>University of California, Santa Barbara</td>
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<tr>
<td>1997</td>
<td>Mason Posner</td>
<td>University of Southern California/Natural History Museum of Los Angeles County</td>
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<tr>
<td>1996</td>
<td>Ingo Gaida</td>
<td>University of California, Los Angeles</td>
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<tr>
<td>1995</td>
<td>Sabrina Drill</td>
<td>University of California, Los Angeles</td>
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<tr>
<td>1994</td>
<td>Blaise Eitner</td>
<td>University of California, Los Angeles</td>
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<tr>
<td>1993</td>
<td>Joseph Sisneros</td>
<td>California State University, Long Beach</td>
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<tr>
<td>1992</td>
<td>Refik Orhun</td>
<td>San Diego State University/Hubbs Sea World Research Institute</td>
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<tr>
<td>1991</td>
<td>Christina Swanson</td>
<td>University of California, Los Angeles</td>
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**AIFRB Goals**: The chief objective of the Institute is to foster professional development and performance of its members, and to recognize their competence and achievements. The Institute was incorporated to advance the theory and practice of fishery science and thereby to promote the conservation and wise utilization of natural resources, and to establish and maintain high professional standards through recognition of achievement and adherence to a code of ethics, known as Principles of Professional Conduct for Fishery Biologists. The Membership consists of professional scientists of proven achievement in the field of fishery biology who, by meeting certain standards of achievement, may attain the rank of Associate, Member or Fellow; AIFRB encourages student membership as well. Presently, the Institute includes approximately 1,000 fishery biologists from the United States, Canada and Mexico, as well as other nations.

The AIFRB is a 501(c)(3) tax-exempt organization (EIN 91-2145620). In planning your charitable contributions this year, please consider making a donation to our District to help build our student scholarship and award programs. Your donation check (payable to American Institute of Fishery Research Biologists) can be sent to: Heather Gliniak, Secretary-Treasurer, AIFRB Southern California & Baja California, Mexico District, California Department of Fish and Wildlife, 4665 Lampson Ave, Suite C, Los Alamitos, CA 90720.

For more information on local meetings and activities, contact the District Director, Kim Anthony, Southern California Edison, 1218 South 5th Ave., Monrovia, CA 91016, Kim.Anthony@sce.com
STUDENT GRANTS

The Southern California Academy of Sciences provides research grants to graduate and undergraduate students. The winners are required to present their research at the following year’s Annual Meeting and provide an article for the SCAS Newsletter *Smilodon*.

**2018 GRANT AWARDS**

- **Camille Brzechffa**, Occidental College
  Investigation of the endosymbiotic bacteria of deep sea *Bathymodiolus* mussels from the west coast margin of Costa Rica
- **Amanda Haas**, California State University, Long Beach
  Potential effects of ocean acidification on predator-prey dynamics in the rocky intertidal zone
- **George Jarvis**, California State University, Northridge
  Evaluating the effects of predation risk on prey fitness in the bluebanded goby *Lythrypnus dalli*

**2017 GRANT AWARDS**

- **Alyssa Clevenstine**, California State University, Long Beach
  Aggregation patterns and site fidelity of giant sea bass (*Stereolepis gigas*) on Santa Catalina Island
- **Darien Glave**, California State University, Long Beach
  Predator driven behavioral adaptation in the black surfperch, *Embiotoca jacksoni*
- **Laura Martinez Steele**, California State University, Long Beach
  Assessing *Carnobacterium maltaromaticum* infection modes in stranded sub-adult common thresher sharks (*Alopias vulpinus*)
- **Milinda Thompson**, California State University, Fullerton
  Effect of water restriction on stress in the herbivorous lizard, *Dipsosaurus dorsalis*
- **Chelsea Muñoz Williams**, California State Polytechnic University, Pomona
  Determining spatial variation in age and growth patterns of a non-fished pomacentrid, *Hypsypops rubicundus*, including validation of annual growth increments.
The Southern California Academy of Sciences wishes to acknowledge the following organizations and people for their support of the Academy (Current through April 27, 2018).

<table>
<thead>
<tr>
<th>Partners in kind</th>
<th>Platinum Level: $1000 or greater</th>
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<tr>
<td>Los Angeles County Natural History Museum</td>
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<td>American Institute of Fishery Research</td>
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<td>Biologists</td>
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<td>Southern California Society of Parasitologists</td>
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<th>Silver Level: $200 - $499</th>
<th>Bronze Level: $100 - $199</th>
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<td>Your Cause, LLC</td>
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<td>Gloria &amp; Harry Takahashi</td>
<td>John Roberts</td>
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<td>Leiber Family</td>
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<th>Contributor Level: up to $99</th>
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<tr>
<td>Caroline Huang</td>
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<td>Julia Peng</td>
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<td>Julya Elena Mestas</td>
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<td>Ann Scarborough Bull</td>
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<td>Leila Williams</td>
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</table>

Special thanks to the following people for their outstanding efforts in preparing for the 2018 Annual Meeting: Jayson Smith as Local Committee Chairperson at Cal Poly Pomona; Mia Adreani, Amber Brown, Lisa Collins, Kristy Forsgren, Shana Goffredi, Shelly Moore, Danny Tang, Juli Passarelli for coordinating abstracts, registration, student judging, awards, all the symposium organizers, the plenary speakers; and Gloria Takahashi for leading the Junior Academy.
Gloria Takahashi, La Habra High School, emeritus, Cerritos College (SCAS Board and SCJAS Board Chair/RTP Mgr.)
Robert F. Phalen, UCI (SCJAS Board and SCJAS Judging Chair)
Kathy Phalen, RN (SCJAS Board)
John Dorsey, LMU Professor Environmental Science & Engineering (SCAS and SCJAS Board)
Gordon Hendler, LA County Natural History Museum (SCAS and SCJAS Board)
Danny Tang, OCSD (SCAS and SCJAS Board)
Julianne K. Passarelli, Cabrillo Marine Aquarium (SCAS Board)
David Ginsburg, USC (SCAS and SCJAS Board)
Candice Groat, CSUDH Greenhouse (SCJAS Board and SCJAS Judge)
Harry Takahashi, Garfield High School, emeritus, photographer (SCJAS Board)
Dennis Dulyea, Educator CSUDH (SCJAS Judge)
June Kizu, LAUSD Educator emeritus (SCJAS Judge)
Nicole Chmielewski, UCI Radiation Oncology (SCJAS Judge)
David A. Herman, UCI Air Pollution and Health Effects Lab (SCJAS Judge)
Edith Read, Ballona Wetlands (SCAS Board and SCJAS Judge)
John Roberts, CSUDH, emeritus (SCAS Board and SCJAS Judge)
Mia Adreani, CSUN (SCAS Board and SCJAS Judge)
David Berube, LMU (SCJAS Judge)
Francie Barron, Nanomedical Diagnostics (SCJAS Judge)
John Tomlinson, CSUDH (SCJAS Judge)
Ben Fitzpatrick, LMU (SCJAS Judge)
Robin Liu, Jenny Lei, and Gloria Tang, Parent Support Group (SCJAS Parents)
Kimo Morris and April Morris, photographers (SCJAS Parents)
Judy Kim, SCJAS Alumna, AJAS Fellow (SCJAS Judge)
Matthew Tang, Northwood High School (SCJAS Student Group Leader)
Brad Blood, Psomas (SCAS Board and SMILODON Newsletter Editor)
Scott Graff, Psomas (SMILODON Newsletter co-Editor)
National Raisin Co., Michael Pedrosian (Raisins)
Keosha Partlow, Charles Drew University (SCJAS Judge)

Host Institutions
LMU, John Dorsey, Professor Environmental Science & Engineering
Cabrillo Marine Aquarium, Michael Schaadt, Director and Julianne Passarelli, Exhibits Curator
UCI Environmental Health Sciences Air Pollution and Health Effects Lab, Bob F Phalen, Director

Awards
Carol Cronin, Wolfram Research, Inc.

Mentors
Dr. Kristy Forsgren, CSU Fullerton
Dr. Julie Patterson, UCI Medical Center-Neuropsychiatric Center
Ms. Stacey Vigallon, Greenhouse Program, Los Angeles Audubon Society
Dr. Bo Han, USC
Dr. Ochay Otim, City of Los Angeles- Hyperion Reclamation Plant
Ms. Nora Stephanie Kawecki, Loyola Marymount University-Biology Dept.
Dr. Gene Bickers, USC
Dr. Matteo Pellegrini, UCLA
Dr. Kristen Darrow, Cabrillo Marine Aquarium, Research Curator
Dr. Nitish Nag, UCI
Dr. Justin Valliere, UCLA
Dr. Juliane K. Passarelli, Cabrillo Marine Aquarium
Dr. Yo Suzuki, J. Craig Venter Institute, La Jolla
Dr. Gang Xu, Schneider Electric
Dr. John Dorsey, LMU Environmental Science & Engineering
Dr. Misty Paig-Tran, CSU Fullerton
Dr. Dishard Wesel, UCLA
Dr. Stephen H. White, UCI
Dr. Paula Cannon, USC Keck School of Medicine
Dr. Francesca Mariani, USC Dept. Stem Cells & Respiratory Medicine
Dr. Zoe Johnson, USC Center Craniofacial Molecular Biology
Dr. Neha Garg, UCI
Dr. Hea Laird, USC Norris Cancer Center
Dr. Michelle Khine, UCI Biomedical Engineering

2018 SCAS RTP AJAS Fellows
* Attended 2018 AJAS-AAAS Meeting in Austin, TX
‡ 2017 AJAS Fellow

Delegates:
- ‡Ashley Abing, St. Lucy’s Priory High School
  Mentor: Y. Liu, Beckman Research Institute
- *Samuel Buckley-Bonanno, Harvard-Westlake School
  Mentor: W. Gekelman, UC Los Angeles
- Olivia Bornstein, Marlborough School
  Mentor: J. Dorsey, Loyola Marymount University
- *Patrick Liu, University High School
  Mentor: Z. Yu. UC Irvine
- *Jade Hiraki Morris, John A. Rowland High School
  Mentor: J.K. Passarelli, Cabrillo Marine Aquarium
- *Anushka Mukhey, Harvard-Westlake School
  Mentor: J. Dorsey, Loyola Marymount University
- ‡Jinwoo Park, UCLA Community School
  Mentor: D. Whiteson, UC Irvine
- *‡Matthew Tang, Northwood High School
  Mentor: M. Khine, UC Irvine
- Noelia Valenzuela, Francisco Bravo Medical Magnet High School
  Mentor: S. Swenson, USC
- *Michelle Xu, Arnold O. Beckman High School
  Mentor: S. White, UC Irvine

Alternate:
- Gabrielle Tulabot, Francisco Bravo Medical Magnet High School
  Mentor: S. Choi, USC
### FRIDAY, MAY 4 8:00 AM – 8:00 PM

On-site registration: Bronco Student Center, Ursa Major Suite, 8:00 AM

<table>
<thead>
<tr>
<th>Time</th>
<th>Session 1: Andromeda Suite</th>
<th>Session 2: England Evans Board Room</th>
<th>Session 3: Orion Suite A/B</th>
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<tr>
<td>9:40-10:00</td>
<td>Break</td>
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<tr>
<td>10:00-11:00</td>
<td>Symposium: Ecology, Evolution &amp; Life History of Parasites</td>
<td>Symposium: Desert Sciences</td>
<td>Symposium: Kelp Aquaculture: Research Advances &amp; Applications</td>
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<td>11:00-11:15</td>
<td>Break</td>
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<tr>
<td>11:15-1:00</td>
<td>Plenary: Dr. Greg Rouse, UC San Diego, SIO (Location: Ursa Major A)</td>
<td>Lunch</td>
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<td>1:00-2:15</td>
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<tr>
<td>3:30-3:50</td>
<td>Break</td>
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<tr>
<td>5:15-8:00</td>
<td>Poster Session (Location: Ursa Major C)</td>
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### SYMPOSIA SESSIONS*: 8:20 – 9:40 AM
Andromeda Suite, England Evans Board Room, Orion Suite A/B

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<tr>
<th>Time</th>
<th>Symposium Session 1: Andromeda Suite</th>
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<tr>
<td>8:20</td>
<td>Ecology, Evolution &amp; Life History of Parasites (Chair: Buth D)</td>
<td>Desert Sciences (Chair: Sandquist D)</td>
<td>Kelp Aquaculture: Research Advances &amp; Applications (Chair: Ginsburg D)</td>
</tr>
<tr>
<td>9:00</td>
<td><strong>1.</strong> Appy R, Cabrillo Marine Aquarium. Life cycle of <em>Dollfusiella schmidti</em> (Cestoda: Trypanorhyncha), a parasite of the round stingray, <em>Urobatis halleri</em> (Myliobatiformes: Urotrygonidae)</td>
<td><strong>8.</strong> LeBeau A, Cal Poly Pomona. Evidence of Late Cretaceous Extensional Detachment Faulting in the North Big Maria Mountains, Riverside County, California</td>
<td><strong>14.</strong> Barney B, Primary Ocean Producers. MacroSystems: Mitigating climate change in the oceans, soils and atmosphere while feeding and powering the world</td>
</tr>
</tbody>
</table>

* Full abstract text and author information is available on the SCAS website (www.scas.nhm.org).
## FRIDAY, MAY 4  10:00 AM – 1:00 PM

Symbols indicate students competing for best paper award: § for SCAS, ‡ for AIFRB, † for SCSP

<table>
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<th>Time</th>
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<tr>
<td>10:00</td>
<td>Ecology, Evolution &amp; Life History of Parasites</td>
<td>Desert Sciences</td>
<td>Kelp Aquaculture: Research Advances &amp; Applications</td>
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<td>Chair: Buth D</td>
<td>Chair: Sandquist D</td>
<td>Chair: Ginsburg D</td>
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| 11:00  | Break |
| 11:15  | President’s Address (Ursa Major A) |
| 12:00  | Plenary Speaker: Dr. Greg Rouse |
|        | *UC San Diego, Scripps Institution of Oceanography* |
|        | Deep Discoveries in the 2000’s: Bone Eaters, Green Bombers, Ruby Seadragons, and more |
|        | (Location: Ursa Major A) |
| 1:00   | Lunch Break |

* Full abstract text and author information is available on the SCAS website (www.scas.nhm.org).
**FRIDAY, MAY 4  2:15 – 3:30 PM**

Symbols indicate students competing for best paper award: § for SCAS, ‡ for AIFRB, † for SCSP

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<td></td>
<td>20. † Arroyo D, CSU Fullerton. Role of the mechanosensitive channel TcMscS in <em>T. cruzi</em> osmotic regulation, differentiation and infectivity</td>
<td>25. Zellmer A, Occidental College. Citizen science elucidates urban habitat usage by Batrachoseps salamanders</td>
<td>30. §, ‡ Clevenstine A, CSU Long Beach. Seasonal movement and aggregation behavior of the protected giant sea bass <em>Stereolepis gigas</em> off Catalina Island, CA</td>
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<td>Physiology</td>
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<td>Chair: Allen B</td>
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<td>35. § Pouv A, CSU Long Beach. Using the aerobic enzyme citrate synthase to understand biogeographic dispersal potential in echinoid larvae</td>
<td>40. § Nava E, CSU Northridge. The effects of marine protected areas on fish foraging behavior</td>
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<td>42. Bonisoli Alquati A, Cal Poly Pomona. Transcriptome analysis indicate broad response in Seaside Sparrows exposed to Deepwater Horizon oil</td>
<td>47. Torres M, Cal Poly Pomona. Analyzing morphological variation among honey bees Apis mellifera with different foraging behaviors on watermelon flowers</td>
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<td>38. § Herrera M, UC Irvine. Using the liver transcriptome to determine metabolic differences between prickleback fishes (Family Stichaeidae)</td>
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*Full abstract text and author information is available on the SCAS website (www.scas.nhm.org).
POSTER SESSION: 5:15 – 8:00 PM
Ursa Major C

POSTER TITLES*

Students competing for best poster award: § for SCAS, † for AIFRB, ‡ for SCSP, and ¥ for SCJAS
SCJAS students eligible for selection to attend 2019 AJAS meeting in Washington DC
*Full abstract text and author information is available on the SCAS website (www.scas.nhm.org)

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   THE GEOCHEMICAL EVOLUTION OF THE CENTRAL MOJAVE BATHOLITH

51. § Garcia A, CSU Los Angeles
   BATTLE OF THE SEXES: ASSESSING SEX-SPECIFIC MICROHABITAT ASSOCIATIONS IN THE
   MOJAVE DESERT MOSS SYNTRICHIA CANINERVIS (POTTIACEAE)

52. § Zuniga L, CSU Los Angeles
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   SPRINGS VALLEY, CALIFORNIA

53. § Jefferson J, CSU Los Angeles
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   HYPOLITHIC HABITATS

54. † Walsh M, Harvey Mudd College
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   INDUCE LIFE CYCLE STAGE TRANSITIONS IN THE PARASITE TRYPANOSOMA BRUCEI

55. † Murray M, UC Los Angeles
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56. † Torres V, UC Santa Barbara
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   COPPER TOXICITY AND NITROGEN INTERACTIONS IN C. WATSONII

58. Barrilleaux J, UC Irvine
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   SYSTEMS AND MUNICIPAL WASTEWATER CONCENTRATIONS

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63. § McGuire C, UC Irvine
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65. § Cairo B, UC Irvine
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66. § Katrak-Adefowora R, Occidental College
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1. LIFE CYCLE OF DOLLFUSIELLA SCHMIDTI (CESTODA: TRYPANORHYNCHA), A PARASITE OF THE ROUND STINGRAY, UROBATUS HALLERI (MYLIOBATIFORMES: UROTRYGONIDAE)


*Dollfusiella schmidti* (Heinz & Dailey, 1974) is a common parasite of the round stingray, *Urobatis halleri*, in Southern California. Larvae attributed to this species are found in the digestive gland of the mud shrimp, *Upogebia macginitieorum*, and two ghost shrimp taxa, *Neotrypea gigas* and *N. californiensis*. Eggs of *D. schmidti* were obtained from gravid proglottids taken from the spiral valve of *U. halleri* collected in Anaheim Bay. Eggs containing a hexacanth embryo were fed to the tidepool copepod, *Tigriopus californicus*, and the ostracod, *Cyprideis beaconensis*, held at 21°C. Hexacanth larvae subsequently penetrated the digestive tract and developed into inverted tentacled larvae within the hemocoel of the crustacean hosts. Infected copepods were fed to small *N. californiensis*, where larvae developed within the digestive gland. While there are numerous reports of larval stages of trypanorhynchs from various invertebrate and fish intermediate hosts, there have been few experimental trypanorhynch life cycle studies. One complete study conducted in California is that of *Lacistorhynchus tenius*, a parasite of the leopard shark, *Triakis semifasciata*. However, in *D. schmidti*, the infection of copepods is via a hexacanth larva in an egg rather than a free swimming ciliated coracidium, larvae undergo advanced development in the first intermediate host, and crustaceans instead of fish are the second intermediate host. This is the first report of a tapeworm utilizing ostracods as a first intermediate host.

2. SEA LICE (COPEPODA; CALIGIDAE): DIVERSITY, ECOLOGY, AND PATHOGENICITY

J. Passarelli¹ and D. Tang². ¹Cabrillo Marine Aquarium, ²Orange County Sanitation District.

Members of the copepod family Caligidae, commonly known as sea lice, are external parasites of predominantly marine fishes. This group is characterized by a dorsoventrally flattened, shield-like cephalothorax. This modified cephalothorax acts as a suction cup aiding in attachment to the host. Among the 30 caligid genera and nearly 500 species, *Caligus* and *Lepeophtheirus* are the two most speciose, with almost 400 valid species combined. Both *Caligus* and *Lepeophtheirus* parasitize marine teleosts worldwide, with *Lepeophtheirus* being more diverse in temperate latitudes. Along the California coast, 9 species of *Caligus* and 18 species of *Lepeophtheirus* have been reported from 13 and 16 fish families, respectively. Although caligid species are diverse and abundant, the life cycle is known for only a handful of species. In addition, new species are still being discovered both locally and worldwide. Caligids tend to be host specific, however some species have been reported from a variety of hosts. They feed primarily on the mucus, epidermal tissue, and blood of host fish. Some caligid species, such as *Caligus rogercresseyi* in the southern hemisphere and *Lepeophtheirus salmonis* in the northern hemisphere, are pathogenic on farmed salmonids. These particular ectoparasites have been attributed to an economic loss of US$480 million annually in the salmonid aquaculture industry worldwide.
3. MARINE INVERTEBRATE VAMPIRES AND THEIR BACTERIAL ACCOMPILCES
S. Goffredi¹, R. Appy², A. Urry¹, R. Hildreth¹, and J. DeRogatis¹. ¹Occidental College and ²Cabrillo Marine Aquarium.

Nearly all blood-feeding animals examined so far, from tsetse flies to vampire bats, host internal bacterial symbionts that aid in some aspect of their nutrition. Similarly hematophagous invertebrates exist in the oceans, yet symbiotic associations between them and beneficial bacteria have not been explored. This study describes the prevalence of a single bacterial genus, Vibrio, within 10 phylogenetically-diverse species of marine ‘vampires’, including leeches (both fish and elasmobranch specialists; ex. Pterobdella and Branchellion, resp.), isopods (ex. Elthusa and Nerocilla), copepods (ex. Phrixocephalus and Lernanthropus), and nematodes (ex. Vasorhabdochona and Philometra). In some cases, Vibrio was observed, based on sequencing of the 16S rRNA gene, also associated with eggs and developing hatchlings. In the fish leech Pterobdella, bacteria appear to be localized to nephridia along the body wall, a phenomenon also seen in freshwater leeches. In the other hosts, Vibrio cells were obvious, but have not yet been localized to specific region. Cultivation of 5 of these Vibrio species revealed their ability to digest red blood cells and recycle urea, perhaps hinting at a nutritional role. Finally, a folate (vitamin B9) transporter was detected via molecular analysis, indicating a possible role for vitamin provisioning by the bacteria, which would serve to balance the vitamin-deficient blood diet. Virtually nothing is known about the influence of internal bacteria on the success of marine blood-feeders, and this initial study provides evidence for their presence in several prominent marine parasites.

4. REDUCED PARASITE DIVERSITY AND ABUNDANCE IN A MARINE WHELK IN ITS EXPANDED GEOGRAPHICAL RANGE
J. Hopper¹, A. Kuris², J. Lorda³, S. Simmonds⁴, C. White⁵, and R Hechinger⁶. ¹USC Dornsife College, ²University of California, Santa Barbara, ³Universidad Autonoma de Baja California, ⁴Idaho Fish and Game, ⁵California Polytechnic State University, and ⁶Scripps Institution of Oceanography-UC San Diego.

Do recently established, expanded-range populations experience lower levels and diversity of parasites compared with historical-range populations, similar to the patterns observed in invasive species? Here, we quantified the diversity and abundance of parasites in populations of a large marine snail, Kellet’s whelk (Kelletia kelletii), throughout its historical and recently expanded range, which are separated by Point Conception, a well-known biogeographical boundary in California. We examined 199 whelks from 25 subtidal reefs throughout the expanded and historical ranges. Abiotic (temperature, latitude, distance from range limit) and biotic (host density) variables were analyzed as potential drivers of differential parasitism. Compared with historical-range whelks, expanded-range whelks experienced an 80% reduction in parasite prevalence, and those that were infected had 6% the number of individual parasites and 14% the number of parasite species. This marked decrease in species richness of parasites infecting expanded-range whelks was only partly explained by low parasite intensity. The reduced parasite abundance and diversity was not explained by the examined abiotic factors or by whelk density. This reduced parasitism resembles the enemy escape typically characterizing invasive species. One explanation is that the biogeographical boundary limits
the movements or drives the low abundance of other host species (elasmobranchs) required to complete the life cycles of the ‘missing’ parasites. Parasite escape may be important in permitting expansions into what may otherwise be marginal habitats.

5. METABOLIC THEORY OF ECOLOGY SUCCESSFULLY PREDICTS SCALING OF ECTOPARASITE LOAD AMONG HOSTS
R. Hechinger and K. Sheehan. UC San Diego, Scripps Institution of Oceanography.

Total levels of parasitism (“total parasite load”) in hosts must underlie the impacts of parasites on individuals and the role of parasitism in ecosystems. Because parasites are increasingly recognized as being important to ecosystem structure and function, a primary goal of ecology and parasitology should be to generate and test theory that can explain and predict total parasite load across broad swaths of species. Here, we enhance and test a novel prediction of such theory, recently developed, that is based on the scaling relationships between body size, temperature, and metabolic rate. We find that the theory successfully predicts the way total load of ectoparasites varies among host birds of different body sizes, and that parasite load appears to be limited - not by space - but by the supply of energy from the host.

6. SPATIAL AND TEMPORAL VARIATION IN ABUNDANCE, PREVALENCE, AND MEAN INTENSITY AMONG ISOPOD, COPEPOD AND LEECH ECTOPARASITES ON THE GIANT KELPFISH HETEROSTICHUS ROSTRATUS
D. Buth¹, B. Kim¹, and J. Passarelli². ¹University of California, Los Angeles and ²Cabrillo Marine Aquarium.

Ectoparasite infracommunities present opportunities to infer their interspecific interactions from observed distribution on their hosts. Giant kelpfish, Heterostichus rostratus, (hosts) were obtained from Cabrillo Beach, CA in June and October 2011, February, June, and October 2012, and February 2013 as part of the Inner Cabrillo Beach Survey conducted by the Cabrillo Beach Aquarium. All ectoparasites were harvested from each host. Three parasitic species were obtained: an isopod (Elthusa vulgaris), a copepod (Lepeophtheirus shaadti) and a leech (Heptacyclus cabrilloi). At the time of initial harvest, the copepod and leech were undescribed. Abundance, prevalence, and mean intensity for each parasite was calculated for each seasonal sample using the Quantitative Parasitology program. Considerable variation was revealed that may be related to the different size distributions of the hosts across seasons. Correlation tests that reveal a negative correlation between the distributions of two species may be indicating competitive exclusion. No such negative correlation was found between any pair of these parasite species, which indicates that they may be sharing the host resource without competition. In fact, a positive correlation was found between the distribution of leeches and copepods. Additional study is necessary to understand the cause of this correlation.

7. AN INTRODUCTION TO THE DESERT STUDIES CONSORTIUM
D. Sandquist. California State University Desert Studies Consortium.

The California Desert Studies Consortium (CDSC) is a collaboration among seven campuses of the California State University (CSU) system. The consortium’s mission is to advance the understanding of desert systems through education, research and outreach activities. Over the
past 40 years, the CDSC has focused most of its efforts on development and promotion of the Soda Springs Desert Studies Center (DSC) at Zzyzx, CA, in the Mojave National Preserve. In this presentation, I will review past successes of the DSC, as an educational facility, and introduce some broader goals that the consortium wishes to accomplish in the coming years. One of those goals is to convene regular meetings of like-minded educators and researchers at the Southern California Academy of Sciences annual meeting. Potential collaborators, and those simply interested in desert systems, are invited to join us at this inaugural SCAS desert session. You will learn more about the CDSC, our facility at Zzyzx, and the great science that is taking place in our local deserts.

8. EVIDENCE OF LATE CRETACEOUS EXTENSIONAL DETACHMENT FAULTING IN THE NORTH BIG MARIA MOUNTAINS, RIVERSIDE COUNTY, CALIFORNIA

§ A. LeBeau, and N. Van Buer. California State Polytechnic University Pomona.

The Paleozoic stratigraphy of the Grand Canyon has been overturned and attenuated in the Big Maria Mountains north of Blythe, California. Several structural geology studies of the range over the past 30 years have identified multiple late Jurassic to early Cretaceous deformation events. Adequately relating the geology of the range to Cordilleran Mesozoic tectonics will require determining the age of three related metamorphic units: an augen gneiss, a quartz-epidote schist, and a fine-grained quartzofeldspathic gneiss. Their ages are not well constrained, they are either Proterozoic or Mesozoic. To refine the tectonostratigraphy of the range, a geologic map based on field data and satellite imagery was created with GIS software and samples collected for analysis using X-ray fluorescence and optical petrography. LA-ICP-MS U/Pb zircon geochronology was applied to the metamorphic units. Mapping confirms the overturned limb of a syncline, and repetition of the overturned and attenuated stratigraphy suggests a detachment fault in the field area. Preliminary radiometric dating of zircons from the augen gneiss produced Mesoproterozoic ages between 1.6 and 1.0 Ga. The quartz-epidote schist and fine-grained quartzofeldspathic gneiss provided Mesozoic ages between 260 and 110 Ma. The Mesozoic units are genetically similar and differ in their fabric; the fine-grained unit being associated with a detachment-related shear zone. It will be necessary to investigate whether these trends persist within the range and regionally. Corroboration will provide a more complete geologic interpretation of the range and incorporation of its tectonic history into the mosaic of Mesozoic Cordilleran tectonics.

9. GEOLOGIC PERSPECTIVES ON PUPFISH (CYPRINODONTIDAE) DISPERSAL

J. Knott. California State University, Fullerton.

Hypotheses regarding the distribution of pupfish (Cyprinodontidae) in Death Valley and many other eastern California desert streams and ponds has been debated for decades. The original hypothesis proposed that pupfish dispersed via a system of interconnected rivers and lakes during the cooler, wetter climate of the Last Glacial Maximum (26.5-9 ka). These hypothesized waterways stretched from the Owens Valley, east of the Sierra Nevada, to the Colorado River. Genetic data purportedly indicate an overland waterway system to the Gulf of Mexico during the Last Glacial Maximum. Geologic studies that reconstruct the paleogeography and paleohydrology of the region indicate that a hydrologic connection from
Death Valley to areas outside of the Great Basin, including the Colorado River, did not exist during the Last Glacial Maximum. The Death Valley watershed probably included the Owens Valley and Panamint Valley to the west about 180-120 ka; however, the extent of the watershed remained within the Great Basin. Geologic data indicate that during the Pliocene (5-3 Ma), Death Valley remained an isolated basin within the Great Basin as well. Geologic evidence suggests that a more subdued topography existed in the western Great Basin about 11 Ma with development of extensive mountain ranges about 8 Ma. This 11-8 Ma time frame would seem to be the optimal time for extensive dispersal of small fish and other species such as spring snails.

10. LATE HOLOCENE HUMAN ECOLOGY OF THE CRONISE LAKE BASINS, CENTRAL MOJAVE DESERT, CALIFORNIA
M. Des Lauriers, California State University, Northridge.

Preliminary results of an ongoing research project and archaeological field School focused on the archaeology and human ecology of the Cronise Lake Basins. An under reported Late Holocene stable lake environment appears to have been present in at least the East Cronise Basin several times in the last 1000 years. Fish, freshwater mussel, and pond turtle remains, alongside carbonized fragments of Juncus, tule, and reed suggest a non-analogous paleoenvironmental context for human occupation of the Basin in the relatively recent past. Details from survey and excavations at several sites conducted in 2017 will be detailed.

11. STREAM CHANNEL STABILITY IN RESPONSE TO RESTORATION EFFORTS: MCGEE CREEK, EASTERN SIERRA NEVADA
A.J. Orme, California State University, Northridge.

Restoration of stream environments entails integrated strategies to stabilize channel banks, re-introduce native riparian plants, regulate or return adequate water discharge, and restrict activities contributing to channel and floodplain degradation. After nearly a century of cattle grazing along the Upper Owens River, and Mammoth, Convict, and McGee Creeks in Long Valley, eastern Sierra Nevada, agreements were reached between the regional landowner and leasees to restore these channels to a state where native vegetation could be supported. Stream cross sections were established and re-surveyed in 2005, with positive results in all channels—return of critical plant species and channel segment stabilization. Despite the return of riparian vegetation along reaches of McGee Creek, the channel continues to experience width-depth ratios suggesting instability. In 2015, a group from California State University Northridge re-surveyed 2 km of McGee Creek, using more precise techniques than had been employed by others in the past and included 46 detailed cross sections, in-stream laser-profiling, and georeferenced low altitude mapping. At this time, a third survey is in progress to determine channel geomorphic change from the “drought” period (2015) and the “above average” precipitation year (2017). Initial results suggest reaches that continue to experience incision, others demonstrating bank instability, and rapid changes in velocity and accelerated bedload transport. Explanation for this response may not be directly related to land use practices, but may reflect a fluvial landscape adjusting to variable flow and structural discontinuities found within the watershed.
Reduced water availability in arid environments is a potential source of physiological stress to animals, like desert iguanas (Dipsosaurus dorsalis). Animals must perceive events as a stressor and transduce the information into neural and hormonal responses, to facilitate necessary changes to behavior and/or physiology to minimize adverse physiological effects of the stressor(s). Corticosterone (CORT) is a hormone that helps animals mobilize energy stores and suspend unnecessary physiological processes. We predicted that at the end of a drought period, populations of D. dorsalis from “natural” sites would have higher hematocrit (an indication of dehydration) and higher baseline CORT than populations with access to supplemented water through urban irrigation. Two populations of D. dorsalis, one with and one without access to irrigation were surveyed in the Coachella Valley, CA during the driest part of their active season and after a five year drought. Hematocrit levels from the non-irrigated site were significantly higher than those from the irrigated site. CORT concentrations were not significantly different between site. Smaller lizards showed higher CORT levels than larger lizards, however the effect of size was greater in the non-irrigated site than the irrigated site. Results suggest that baseline CORT concentrations may not be elevated in response to water stress. Further work in this and other systems on effects of water availability on both baseline and post-stressor CORT, and the effects of CORT on water-conserving behavior, would shed important light on the role of CORT in facilitating water conservation.

The moss Syntrichia caninervis (Pottiaceae) is a dominant member of soil biological crust communities in the Mojave Desert. This desert species is highly desiccation tolerant, meaning it can lose virtually all cellular free water and quickly resume normal metabolism once rehydrated. Thus, S. caninervis is essentially an aquatic plant that persists in desert environments by maintaining the energetically costly trait of desiccation tolerance; however, its opportunities for acquiring energy via photosynthesis are restricted to relatively brief interludes of hydration during cooler winter months, constraining energy allocation within the life history of this species. In this context, sexual reproduction is frequently limited, and many populations appear to persist through asexual cloning, only rarely reproducing sexually. When sex expression does occur in this dioecious species, phenotypic sex ratios are typically female biased, and the expression of male sex structures is usually restricted to more mesic microsites. Here, I present genetic data from natural populations of S. caninervis to help interpret observed patterns of sex expression and sex bias in this species in light of the possible consequences of conflicting natural and sexual selective pressures.
14. MACROSYSYEMS: MITIGATING CLIMATE CHANGE IN THE OCEANS, SOILS AND ATMOSPHERE WHILE FEEDING AND POWERING THE WORLD

B. Brandon, Primary Ocean Producers.

We are working to reverse climate change in our lifetime by designing and deploying MacroSystems, an innovative automated macroalgae cultivation system incorporating seeding, farming, harvesting and processing, to be deployed on exposed open ocean sites; assessing MacroSystems’ techno-economic ability to produce economical and sustainable biomass for future processed macroalgae biomass based animal feed, fertilizer and biofuel industries at a cost competitive with terrestrial alternatives that use diminishing resources like groundwater. The final objective is ocean deployment of the prototype macroalgae cultivation system with integrated harvesting technology and a nutrient delivery system by a fossil-energy-free upwelling solution that meets the biomass production scale and cost targets set by ARPA-E MARINER. Existing terrestrial animal feeds, fertilizers, and biofuels are increasing in price in part due to groundwater shortages. MacroSystems will sustainably produce and process hundreds of millions of tons of macroalgae annually at a cost competitive with land based animal feeds, fertilizers, and biofuels that depend on groundwater. MacroSystems will reduce price increases by providing processed macroalgae substitutes that are equally or more effective that don’t require as much groundwater. This processed macroalgae biomass will be marketed initially in USA/California’s groundwater depleted regions to provide 1) a high-energy silage livestock feed to replace feeds currently grown in groundwater, nutrient, and land intensive methods and 2) as an organic liquid fertilizer to replace synthetic fertilizers currently used in California/United States agricultural production all while investing in our revolutionary ocean farming technology which as it scales will produce 3) a biofuel that doesn't use as much groundwater as existing biofuel alternatives.

15. AGRICULTURE GUIDE TO AQUACULTURE: SUITABILITY OF KELP REPRODUCTIVE SYSTEMS

S. Nuzhdin, USC Dornsife College.

Macroalgae aquaculture has grown rapidly in recent decades to an annual value of US$5.6 billion year. Kelp, a particular type of brown macroalgae, are important contributors with potential to become disruptive food, pharmaceutical, and biofuel crops. Importantly, improvements in farming techniques are being accompanied by selection-based optimization of brown algal biomass, and advances in our understanding of the genome structure and architecture of these relatively understudied crops of the future. The haplodiplontic life cycle of kelp makes them remarkably well suited for implementing such a program. The large sporophyte fronds are the generation that is harvested as a crop, but the microscopic haploid kelp gametophyte generation may be vegetatively propagated indefinitely in culture. A major hurdle in the path of economically feasible kelp farming, at the scales needed to reshape crop markets, is the environmental concerns raised by the possibility of invasive species and trans gene flow; offshore farms are often close to marine protected areas, recreational areas and shipping channels. We propose to introduce in haploid gametophytes recessive mutations (loss-of-function) in genes required for meiosis. With assurance of no undesirable settlements or gene flow, any kelp species could be farmed in all suitable areas. Furthermore, kelp sterility will spur seed companies to invest in developing new varieties of highly efficient kelp seed
stocks for sale to farmers, much as maize and sunflower have been highly improved and optimized.

16. ABUNDANT KELP GROWN IN THE OPEN OCEAN AS AN ENERGY FEEDSTOCK
S. Wilcox, Marine BioEnergy, Inc.

Marine BioEnergy, Inc. is developing an open ocean cultivation system for macroalgae, which can be converted to biocrude. Giant kelp is one of the fastest growing sources of biomass, and the open ocean is an immense, untapped region for growing kelp. However, kelp does not grow in the open ocean because it needs nutrients that are only available in deep water or near shore but not in the top layer of the open ocean. Kelp also needs to attach to a hard surface, typically less than 25 meters deep. To overcome these obstacles, the team proposes to build inexpensive underwater drones that will tow large grids, to which the kelp is attached. These autonomous drones will be capable of towing the farms from sunlit-rich surface water during the day to nutrient-rich deep water during the night, and will submerge the farms to avoid storms and passing ships. A prerequisite for this vision will be the successful demonstration of depth-cycling kelps from the surface to the deep ocean. Working with the USC Wrigley Institute for Environmental Studies, Marine BioEnergy will develop and deploy first-of-kind technology to assess and apply this unique concept of kelp depth cycling for deep water nutrient uptake to kelp production. Researchers at Pacific Northwest National Laboratory will convert the kelp to biocrude and document the quality. This technology could enable large-scale energy crop production in many regions of the open ocean, with an initial focus on the region between California and Hawaii.

17. VARIABILITY OF NITRATE UPTAKE CAPACITY IN MACROCYSTIS PYRIFERA (LAMINARIALES, PHYAEOPHYTA) WITH NITRATE AND LIGHT AVAILABILITY
C. Kopczak, California Science Center.

The nitrate uptake capacity of mature blade tissue of the giant kelp, Macrocystis pyrifera (L.) C. Ag., was examined as a function of the availability of light and nitrate. Time course measurements indicated that nitrate uptake rate, as measured by the incorporation of 15N, was significantly increased by N starvation. The response was linear over the first hour of exposure regardless of the N status of the tissue indicating that surge uptake was not responsible for the increase. The Michaelis-Menten parameters Vmax and Ks, however, were not significantly changed by either growth nitrate concentration or growth irradiance as a result of high variability among blades. Similarly, the initial slope (α) of the nitrate uptake kinetics curves was unaffected. Concentration of photosynthetic pigments increased in response to increased nitrate availability but not to increased growth irradiance. Time course and pigment data demonstrated that mature blade tissue responds to increased N availability by decreasing its capacity to take up nitrate and by increasing its investment in photosynthetic pigments, perhaps for N storage or enhanced light-harvesting capabilities and the increase in reducing power available for N assimilation. This study provides evidence for a dynamic regulatory system that responds to changes in nitrate availability in an integrated manner.
18. THE GROWTH OF A KELP RESTORATION PROJECT: INFORMING THE PHYSICAL, CHEMICAL AND BIOLOGICAL CHARACTERISTICS OF COASTAL MANAGEMENT IN SOUTHERN CALIFORNIA

T. Ford\textsuperscript{1}, K. Elsmore\textsuperscript{2}, J. Landry\textsuperscript{1}. \textsuperscript{1}Loyola Marymount University, \textsuperscript{2}Bodega Marine Laboratory

The Palos Verdes Kelp Restoration Project is an ongoing effort supported by the Montrose Settlements Restoration Program to restore kelp forests by manually culling purple sea urchins (\textit{Strongylocentrotus purpuratus}). The reduction of purple sea urchin density reduces top down forcing, restoring ecosystem structure, function and fishing opportunity. Giant kelp, (\textit{Macrocystis pyrifera}) is a brown alga that can extend from the sea floor to the ocean surface forming a canopy at the sea surface originating from a depth of 25 meters. Hundreds of individual kelps form “forests” comprising considerable biomass and biogenic structure capable of altering the physical and chemical characteristics of the water column while supporting a biotic community comprised of 750 species. The transition of this habitat presents a unique opportunity to measure wave conditions and water quality chemistry before, during and after the forest regenerates. Current efforts to quantify the changes in the nearshore environment resulting from these efforts include the following: density and biomass of kelp, fishes, invertebrates, wave energy flux, dissolved CO\textsubscript{2}, dissolved O\textsubscript{2}, pH, and metals analysis of sieve tube sap from the kelp. The results of this work can inform coastal management to the numerous benefits associated with spatially and temporally stable giant kelp forest habitat.

19. CHARACTERIZING DRIVERS OF FISH BIOMASS ON NEARSHORE ROCKY REEF IN THE SOUTHERN CALIFORNIA BIGHT

D. Pondella\textsuperscript{1}, S. Piacenza, J. Claisse\textsuperscript{2}, C.M. Williams\textsuperscript{1}, J.P. Williams\textsuperscript{1}, A. Zellmer-McCormack\textsuperscript{1}, J. Caselle. \textsuperscript{1}Occidental College, Vantuna Research Group, \textsuperscript{2}California State Polytechnic University Pomona.

Using data sets that span the Southern California Bight (SCB), we analyzed nearshore rocky reef fish biomass using generalized linear modelling within the information-theoretic approach. Fish abundance and length were visually sampled, via SCUBA, within a random stratified sampling design using line transects across depth strata in <20m depth. This data was converted to biomass using published length-weight relationships. Our spatially resolved explanatory variables included sea surface Chlorophyll a, maximum wave height, kelp biomass, urchin density, habitat relief and substrate indices, social factors, such as minimum distance to port and fishery harvest intensity index. We also ran similar models to relate the biomass of the six most abundant species to the correlates. Based on our model runs, the confidence model set (<2 ΔAIC\textsubscript{c}) for fish biomass included the variables: distance to the shelf break, SST, Chl a, reef heterogeneity, slope and kelp biomass. Different suites of the environmental variables were correlated with biomass of the most abundant fish species. Not all rocky reefs in the SCB equally support high densities of fish biomass, and our results suggest that an optimal combination of environmental and habitat conditions may support increased reef fish biomass.
20. ROLE OF THE MECHANOSENSITIVE CHANNEL TCMSCS IN T. CRUZI OSMOTIC REGULATION, DIFFERENTIATION AND INFECTIVITY
† D. Arroyo¹, N. Dave², and S. Walker¹. ¹California State University, ²Fullerton and Indiana School of Medicine.

Trypanosoma cruzi propagates from an insect vector to mammalian hosts during its life cycle. To cope with the various environments, the parasite has developed robust compensatory mechanisms; however, the sensory machinery utilized to detect variations in the extracellular and intracellular conditions remains unknown. In all cell types, mechanosensation is responsible for sensing and responding to changes in pressure, osmolarity, and tension of the membrane. In bacteria mechanosensation is associated with virulence-related traits such as biofilm formation and quorum sensing. In T. cruzi, we have identified and characterized a mechanosensitive channel (TcMscS) that shares structural and functional features with the small conductance mechanosensitive channel, MscS of E. coli. TcMscS is differentially localized in the three main life stages of the parasite. The extracellular forms express the channel in the contractile vacuole and while intracellular amastigotes show it distributed in the plasma membrane. Gene knockout by CRISPR-Cas9 methods caused severe defects in morphology, impaired growth and decreased ability to compensate osmotic challenges in epimastigotes. TcMscS knockout parasites have also shown a significant decrease in the rate of metacyclogenesis. Importantly, parasites lacking TcMscS have a defect in intracellular replication as well as a significantly lower production of trypomastigotes able to egress from the mammalian host cells, pointing to an important role of the channel in the parasites’ infectivity. Our results indicate that mechanosensitive-activated channels are part of the physiological responses that allow the parasites to differentiate and effectively infect host cells and could represent a potential drug target against T. cruzi. Funding: AHA 16GRNT30280014 and NIH R15 AI122153.

21. GLOBAL CHANGES IN GENE EXPRESSION IN TRYpanosoma cruzi EPIMASTIGOTES UPON TCMSCS KNOCKOUT
† J. Fonbuena, M. Feldman, and S. Walker. California State University, Fullerton.

Trypanosoma cruzi (T. cruzi) is an intracellular protozoan parasite, and the pathogenic agent of Chagas disease, a chronic illness that currently affects approximately 8 million people worldwide. There is only one FDA-approved drug-treatment for the disease, benznidazol, but its low efficacy and significant side effects preclude its administration to most patients. To address the limited treatment options and develop new therapeutic alternatives, we need a deeper understanding of the T. cruzi lifecycle and essential cellular processes required for parasite survival and infectivity. The mechanosensitive channel TcMscS has been identified in T. cruzi as a putative bacterial-like mechanosensitive channel and may serve as a potential therapeutic drug target, as genetic ablation of this channel induces defects in osmoregulation and reduces infectivity. Therefore, we hypothesize that elimination of the TcMscS gene will induce differential gene expression (DGE) in knock-out (KO) parasites to compensate for the absence of the channel. To investigate this hypothesis, TcMscS KO parasites were generated via CRISPR/Cas9 targeting. RNA from WT and KO parasite strains was extracted, made into a cDNA library, and analyzed by RNA sequencing. PCRs and qPCRs of WT and KO parasites were done to validate the expression levels of the TcMscS. Current analyses indicate the up
and down regulation of genes in response to TcMscS ablation. Gene candidates with the highest DGE will be validated by qPCR. We aim to identify the mechanisms of compensation developed by the parasites and the participation of signaling pathways associated with the activation of mechanosensitive channels.

22. LOCALIZATION AND ROLE OF A MECHANOSENSITIVE CHANNEL IN THE PROCYCLIC FORM OF *TRYPANOSOMA BRUCEI*
† M. Hernandez, K. Nguyen, and S. Walker. California State University, Fullerton.

*Trypanosoma brucei* (*T. brucei*) is a protozoan parasite transmitted by the tsetse fly and the causative agent of African Sleeping Sickness. Once the parasite has established infection in the host it can pass the blood brain barrier causing psychological and neurological disturbances. At this stage, the mortality rate is close to 100%. Current treatment causes severe side effects and often require prolonged intravenous administration, highlighting the need for new therapeutic options. Potential targets include mechanosensitive channels (MSCs) which have been shown to contribute to bacterial virulence. Screening of *T. brucei*’s genome revealed a putative mechanosensitive channel, TbMscS. TbMscS shares 64% identity with a recently characterized MscS-like channel in *T. cruzi* and 31% identity with *E. coli* MscS. To establish the localization of the channel, we have incorporated a myc tag at the C-terminal of the endogenous locus. Our findings indicate the channel is localized along the membrane of the parasite suggesting the channel plays a role in signaling cascades during mechanical and physiological stress conditions. Knockdown of the channel shows changes in the growth of the parasite compared to WT. Our results suggest that TbMscS is a mechanosensitive channel important for regulating physiological responses like osmotic compensation, quorum sensing and social motility in the procyclic form of *T. brucei*. Since MscS-like channels are not present in vertebrates, TbMscS could be a promising drug target against an economic and medical burdensome disease.

23. CHARACTERIZATION OF PUTATIVE CALCIUM-BINDING PROTEINS IN THE HUMAN PARASITE *TOXOPLASMA GONDII*
† I. Meepe, D. Sandoval-Olmos, J. Chetsawang and D. Pace. California State University, Long Beach.

The reliance of the Apicomplexan parasite *T. gondii* on calcium (Ca2+) for the initiation of invasion-linked traits is well established, yet many molecular mechanisms by which it regulates Ca2+ remain unknown. This study explores the roles of putative Calcium Binding Proteins (CBP1 and CBP2) in regulating Ca2+ flux during the tachyzoite lytic cycle. CBP1, which contains 2 EF hand and 4 transmembrane domains, localized throughout the cytosol of the parasite during the intracellular stage. During the extracellular stage, CBP1 localized to the membrane of the Plant-like Vacuole (PLV), a site of protein maturation and Ca2+ storage. When intracellular Ca2+ was measured, CBP1 over-expressing (OE) mutants revealed diminished Ca2+ response pathways. CBP2, a soluble protein containing 2 EF hand domains, localized in the apical cytoplasm, a critical site of invasion machinery. Invasion efficiency assays revealed divergent responses in the two OE mutants. Compared with parental strains, CBP1-OE exhibited a 53% reduction in invasion efficiency (t-test, p<0.01), whereas CBP2-OE had an invasion efficiency increase of 57% (t-test, p<0.05). Plaque assays, which measure
lytic cycle dynamics, showed no difference in plaque formation for CBP1-OE, however CBP2-OE demonstrated an 18% increase in plaque formation (t-test, p<0.01). Overall, our results suggest that these CBPs may have different Ca2+ buffering capacities and likely play distinct roles based on their localization. Full CBP characterization will elucidate their biological importance during the lytic cycle and their potential as therapeutic drug targets in combating infection.

24. DETERMINING THE RATES AND IMPORTANCE OF PROTEIN SYNTHESIS DURING THE LYTIC CYCLE OF THE INTRACELLULAR HUMAN PARASITE TOXOPLASMA GONDII

† C. Monahan, I. Salladay, and D. Pace. California State University, Long Beach.

During the lytic cycle of *Toxoplasma gondii*, the parasite cycles between two stages: extracellular (EC) tachyzoites which actively invade host cells, and intracellular (IC) tachyzoites which replicate and egress from host cells. Despite the importance of these processes, little is known regarding the physiological state of either stage. The goal of this study was to quantify rates of protein synthesis during both lytic cycle stages. Mass-specific rates of protein synthesis were quantified by tracking the transport of 14C-lysine. Rates of radioactive incorporation into protein were corrected for changes in the free amino acid pool specific activity. Preliminary results indicate that EC parasites had 1.6-fold higher rates of synthesis (ANOVA, p<0.01: 1.35x10^-3 and 8.32x10^-4 pg protein hr^-1 parasite^-1 for EC and IC parasites, respectively). When the eukaryotic protein synthetic inhibitor anisomycin was used, rates of protein synthesis decreased by 80-95% (ANOVA, p<0.01). Therefore, anisomycin was used to investigate the importance of protein metabolism during the lytic cycle. IC parasites that were exposed to 10uM anisomycin for 90min exhibited diminished invasion capability (t-test, p<0.01), indicating proteins required for invasion were undergoing rapid turnover (half-life<90min). Future experiments will assess the importance of protein turnover during EC stages as well as investigate the metabolic cost of such turnover. These experiments will be critical for assessing changes in the physiological state of *T. gondii* and its susceptibility to inhibitors of macromolecular synthesis as a treatment strategy.

25. CITIZEN SCIENCE ELUCIDATES URBAN HABITAT USAGE BY BATRACHOSEPS SALAMANDERS

A. Zellmer1 and G. Pauly2. 1Occidental College, 2Natural History Museum of Los Angeles.

Urban environments are often associated with a loss of biodiversity due to widespread habitat modifications. Yet many organisms including some amphibians and reptiles continue to make use of urban habitats, from large city parks down to even the smallest gardens and backyards. Using a combination of field surveys and data from the RASCals citizen science project, we document the presence of two slender salamander species, *Batrachoseps nigriventris* and *B. major*, in urban habitat across Los Angeles. We test the extent to which citizen science data impacts our understanding of Batrachoseps distributions in urban habitats by using fine-scale species distribution models, comparing their predicted distributions using only historical museum records versus models that incorporate citizen science data. Our results show that models that incorporate citizen science data expand the distributions of *Batrachoseps* further into urban areas, demonstrating an important difference between historical museum records
and citizen science data. The presence of these species throughout the city raises the question of whether these are understudied, isolated remnant populations of *Batrachoseps* or if urbanization has instead resulted in an expansion into newly created habitats where irrigation has led to year-round availability of moist soil in a historically seasonally dry landscape. These results highlight the utility of citizen science projects for studying urban species.

### 26. RECOVERY OF RED ALGAL TURFS AND ASSOCIATED MEIOFAUNAL COMMUNITIES IN A SOUTHERN CALIFORNIA ROCKY INTERTIDAL ECOSYSTEM

*S. Agler* and J. Smith. California State Polytechnic University, Pomona.

Rocky intertidal ecosystems are subjected to numerous disturbances that can influence community structure. The middle rocky intertidal zone of southern California is often dominated by an articulated coralline/red algal turf which serves as an important microhabitat for invertebrate meiofauna. This community can be subjected to pulse disturbances, such as by sand burial or boulder movement, which remove the turf community. The goal of this experiment is to examine the recovery rates of coralline turf, and their associated meiofauna, following a disturbance. In February 2016, plots were cleared of the turf, with the encrusting portion left behind, simulating a typical disturbance event. Recovery of algal composition, turf thickness, and associated meiofauna is being determined through comparisons with non-manipulated control plots. To date, recovery of the algal turf has been slower than expected with treatment plots still not fully recovered two years after removal. Relationships between turf and meiofaunal recovery will be examined to determine whether the recovery of meiofauna occurs concurrently with turf recovery or whether one facilitates the recovery of the other. The first phase of this experiment was initiated during the 2015-16 ENSO event. To determine whether recovery rates differ during ENSO and non-ENSO periods, a similar effort was initiated in February 2017 with recovery to be compared among sampling periods. The study will increase our knowledge about recovery of important microhabitat forming turfs and associated meiofauna following a disturbance.

### 27. A PRELIMINARY INVESTIGATION OF THE INFLUENCE OF HERBIVORY ON NATIVE SHRUB COMMUNITIES IN CALIFORNIA SAGE SCRUB

*T. Litte* and W. Meyer. Pomona College.

In the California sage scrub (CSS) ecosystem the role of herbivory is not well characterized making it difficult develop effective management and restoration strategies. To begin assessing the influence of herbivory on CSS communities, we: (1) examined the impact of herbivory on *Artemisia californica* seedling survivorship, (2) determined the susceptibility of common CSS shrubs to herbivory, (3) identified the most important herbivore species and their relative foraging preferences, and (4) determined the extent to which herbivores influence fuel loads. We found that herbivory is responsible for 70% of the mortality of *A. californica* seedlings. There was an escape from herbivory once seedling height exceeded 30 cm. Moreover, herbivory of native shrubs in CSS is highly seasonal, occurring primarily in the late summer and early fall months. *Artemisia californica* and *Eriogonum fasciculatum* were more susceptible than *Salvia apiana* and *Eriodictyon tryocahalyx*. However, shrub susceptibility depends on the composition of the herbivore community. For example, the desert cottontail...
(Sylvilagus audubonii) preferentially consumed E. fasciculatum, while the white crowned sparrow (Zonotrichia leucophrys) exclusively consumed A. californica. We found that herbivores also significantly reduce fuel loads, decreasing ignition probabilities and increasing fire return intervals supporting CSS persistence. Findings from our preliminary study suggest that herbivores reduce shrub seedling survivorship, but indirectly, herbivores reduce fuel loads. This indicates that local expatriation of herbivores may reduce CSS persistence in the long term.

28. DISTRIBUTION, LONGTERM CHANGE, AND FACTORS INFLUENCING PATCHINESS THROUGH THE GEOGRAPHIC RANGE OF THE ROCKWEED PELVETIOPSIS CALIFORNICA
§ R.J. Fales and J. Smith. California State Polytechnic University, Pomona.

Rockweeds (Phaeophyceae, Fucales) can dominate rocky intertidal habitats in temperate ecosystems and are often considered ecosystem engineers, supporting a diversity of flora and fauna that find refuge from desiccation stress underneath the rockweed canopy. The Olive Rockweed, Pelvetiopsis californica (previously Hesperophycus), is an upper rocky intertidal species ranging from Punta Eugenia (Mexico) to Monterey Bay (California, USA) yet little is known about its distribution and abundance within its range. We surveyed 47 sites along the U.S. portion of the species’ range to assess the current distribution of P. californica, with a suite of site abiotic conditions (e.g. wave exposure, slope, etc.) and biotic parameters (e.g. presence of other rockweeds, herbivore abundance, human impacts) measured to determine their role in driving distributional patterns. Additional presence and absence information was obtained from colleagues conducting long-term monitoring along the rockweeds range. Preliminary results reveal that this species exhibits a patchy distribution along the coast, particularly in southern CA where P. californica was absent along large stretches of coastline with seemingly suitable habitat. P. californica was not present at any sites surveyed in San Diego and Los Angeles counties. When P. californica was present, it always co-occurred with the mid/upper intertidal rockweed Silvetia compressa; in contrast, S. compressa was commonly found alone. Comparisons with historical records, although limited in extent, indicate a small number of local extinctions, particularly in San Diego and Los Angeles counties.

29. USING CEMENTUM ANNULI AND TOOTH WEAR TO DETERMINE THE AGE OF COYOTES IN SOUTHERN CALIFORNIA
§ A. McKenzie. California State University, Fullerton.

Although coyotes (Canis latrans) are a natural component of southern California ecosystems, they are sometimes considered a nuisance because their opportunistic habits and tolerance for urbanization brings them into conflict with people. Recent attacks on people and pets have increasingly led to lethal control of nuisance animals, yet it is unclear whether the demographic distribution of these individuals are representative of the coyote population as a whole and is information that could be used to guide coyote management. I used two methods, cementum annuli analysis and tooth wear, to estimate the age from the mandibles of 100 coyotes collected as nuisance animals and as road kills in southern California. Age estimates based on tooth wear, a non-lethal method, were broadly similar to those from cementum annuli
analysis, although tooth wear estimates produced more variation and tended to overestimate age, especially for younger individuals. The demographic structure of coyotes collected as nuisance animals was biased toward juveniles, young adults, and males, which is a pattern typical of exploited populations elsewhere. Although fewer road-killed individuals were examined, the fact that younger animals were overrepresented in the sample of nuisance individuals suggests that younger age classes (and males) may be more likely to be the target of control efforts, possibly because their behavior creates opportunities for greater conflict with people.

30. SEASONAL MOVEMENT AND AGGREGATION BEHAVIOR OF THE PROTECTED GIANT SEA BASS STERELEPIS GIGAS OFF CATALINA ISLAND, CA
§‡ A. Clevenstine and C. Lowe. California State University, Long Beach.

Due to the predictability of annual aggregations, giant sea bass (Stereolepis gigas) were fished throughout the 20th century until they were nearly extirpated from southern California, USA. Within the last decade, aggregations of 7-23 individuals were recorded at specific sites at Catalina Island, CA, indicating signs of population recovery and return of aggregation behavior. Acoustic receivers (VR2W, Vemco Ltd.) and coded acoustic transmitters (V13-1H, Vemco Ltd.) are being used to determine aggregation sites and spawning behaviors of giant sea bass as they may have changed during the last 50 years. Additionally, SCUBA surveys are being conducted to estimate aggregation size and site abundance. From June-August 2017, 34 mature giant sea bass (115-200 cm TL) were tagged along the leeward side of Catalina Island, coinciding with spawning. Giant sea bass exhibited diel movement patterns during spawning season which did not continue across seasons. Tagged individuals were detected more than twice as much at a previously unknown aggregation site (338,861) than a historic aggregation site (148,203), indicating the species may be selecting new spawning sites in light of overfishing at a historic site. All tagged fish utilized multiple aggregation sites and distance traveled varied, with movements of 12 km in 24 hr., 31 km in 24 hr., and 85 km in 96 hr. Data will continue to be collected through October 2018 to assess site fidelity and aggregation behavior.

31. DIET AND VENOM ONTOGENY IN INSULAR AND HIGH-ALTITUDE POPULATIONS OF THE SOUTHERN PACIFIC RATTLESNAKE CROTALUS HELLERI
E. Gren, Z. Travis, W. Kelln, G. Fox, and W. Hayes. Loma Linda University.

Southern Pacific Rattlesnakes (Crotalus helleri) exhibit pronounced geographic variation in venom composition. Ontogenetic variation in lethality and enzyme activities has also been documented in the taxon. Transition from more toxic, less proteolytic juvenile venom to less toxic, more proteolytic adult venom is documented with a shift from lizard to rodent prey as the snake grows. However, detailed analyses of diet and venom composition at the population level are lacking. Here, we compared diet and venom composition of juvenile and adult C. helleri from different environments with distinctive venoms. Adults from Catalina Island and Transverse Ranges express proteolytic venom typical of the species (abundant metalloproteinases and no PLA2 neurotoxins), whereas San Jacinto Mountains adults lack
metalloproteinases but possess neurotoxic PLA2s, interpreted in other species as paedomorphic because toxicity does not diminish ontogenetically. We hypothesized that 1) if diet influences venom composition, then diet ontogeny will differ substantially between the proteolytic and neurotoxic populations, and 2) that venom in the neurotoxic population will exhibit the least ontogenetic change. Diet analyses confirmed the ontogenetic shift from lizards to rodents in all populations; however, San Jacinto Mountains snakes consumed a higher proportion of lizards. Ontogenetic venom change was greater in the Catalina Island and the Transverse Mountains populations than in the San Jacinto Mountains, supporting the interpretation of paedomorphosis. Despite the diet difference in San Jacinto Mountains snakes, we argue from prey species distributions that diet is a poor explanation for venom composition within the taxon.

32. BOATS, BOATS, BOATS! AERIAL SURVEYS OF VESSEL ACTIVITY IN SOUTHERN CALIFORNIA FOR THE PAST DECADE
A. Barilotti, T. Ford, H. Burdick, P. House, I. Medel, and A. Zellmer-McCormack. The Bay Foundation and Occidental College.

Understanding how patterns of boating activity have changed since the implementation of southern California’s marine protected areas (MPAs) is an important part of evaluating their use and effectiveness in deterring fishing activity. Surveying boat activities from land can be difficult in many of the southern California MPAs because of access and visibility. To address this question, The Bay Foundation and LightHawk have conducted aerial surveys of the southern California coast to quantify and categorize boating activity on a quarterly basis since September 2008. Our data includes 3 years pre-MPA implementation and 7 years post-MPA implementation, where more than 15,000 boats have been recorded on 119 aerial surveys. These surveys are revealing where violations are most likely to occur in MPAs, where fishing and other consumptive activity has shifted due to the MPAs, and the extent of boating activities in southern California over the past decade.

33. PARADOXICAL EXCEPTION TO ISLAND TAMENESS: INCREASED DEFENSIVENESS IN AN INSULAR POPULATION OF RATTLESNAKES
W. Hayes, C. Person, G. Fox, E. Gren, and J. King. Loma Linda University and Catalina Conservancy.

Island tameness exists among diverse animal taxa on islands worldwide, and results largely from a lack of natural predators. Several insular populations of rattlesnakes lack functional rattles, which has been interpreted as the consequence of relaxed selection arising from isolation and reduced predation. We therefore hypothesized that Santa Catalina Island, California, USA, populations of the southern Pacific rattlesnake (Crotalus helleri) would exhibit a decrement in defensive behavior relative to their mainland counterparts. Contrary to our prediction, rattlesnakes from the island not only lacked tameness compared to mainland snakes, but instead exhibited measurably greater levels of defensiveness. During pinning and manual venom extraction, island snakes struck more frequently, required more time to capture, and delivered more venom (when controlling for body size) than mainland snakes. Relative head size was equal for the two populations, so differences in venom expenditure likely reflected behavioral decisions associated with risk assessment and level of defensiveness. No
34. OPERANT CONDITIONING OF GIANT SEA BASS, STEREOLEPIS GIGAS IN A KELP FOREST EXHIBIT.
C. Webber. California Science Center.

Operant conditioning is a common form of training used by many working in the animal husbandry profession. Using positive reinforcement, one is able to capture and shape a desired behavior. Documented training has occurred amongst a variety of animals; however, there is little documented success with teleost fish. Here, we discuss how positive reinforcement was used to target train a giant sea bass (Stereolepis gigas) to easily administer necessary topical medical treatments of Praziquantel, an anti-parasitic drug, during outbreaks of a common monogenean parasite (Neobenedenia sp.). Training was performed in an isolated holding tank three times a week for approximately 10 months, to achieve the desired behavior. Shortly after returning the animal to the 188,000 gallon kelp forest exhibit, we were able to continue the learned behavior. Through operant conditioning, we successfully trained our giant sea bass, and subsequently a second giant sea bass on exhibit, for voluntary applications of the Praziquantel medication, and as such, we have proactively suppressed parasite outbreaks on the eyes. This study gives evidence towards the intelligence of such a species and the ability for animal husbandry staff to perform less stressful medical applications with teleost fishes.

35. USING THE AEROBIC ENZYME CITRATE SYNTHASE TO UNDERSTAND BIOGEOGRAPHIC DISPERSAL POTENTIAL IN ECHINOID LARVAE
§ A. Pouv, A. Ohanian, and D. Pace. California State University, Long Beach.

Temperature is a primary determinant of biogeographic distribution in animals due to its influence on biochemical processes, especially aerobic metabolism. This study aimed to: 1) determine if habitat ranges of adult echinoids are linked to temperature sensitivity of critical metabolic enzymes, and 2) assess if in vitro enzyme capacity is a predictor of in vivo aerobic metabolism in echinoid larvae. The in vitro thermal performance (from 5-30°C) of the Krebs Cycle enzyme, citrate synthase (CS), was determined in 3 echinoid larvae with the following thermal habitat ranges: Dendraster excentricus (2-28°C), Strongylocentrotus purpuratus (2-24°C), and Strongylocentrotus fragilis (0-10°C). D. excentricus had Q10 values consistently greater than 3 and displayed no discrete change in activation energy (as measured by Arrhenius breakpoint analysis). S. fragilis and S. purpuratus both displayed an Arrhenius breakpoint and a peak in temperature sensitivity at 15°C. Further experiments are being conducted to address Aim 2. Preliminary results for D. excentricus show a strong correlation (r² = 0.99) between aerobic metabolism and in vitro capacity, as measured by CS total
activity; indicating CS activity may be a valuable predictor of physiological state in field-caught larvae. These results demonstrate how thermal dependence of early life-history metabolic pathways have ramifications for dispersal potential of planktotrophic larvae of benthic marine organisms. This information is important for understanding the biochemical underpinnings of biogeographic distributions and population dynamics of marine organisms.

36. THE MONKEYFACE PRICKLEBACK CEBIDICHTHYS VIOLACEUS GENOME AND TRANSCRIPTOMES AS A SOURCE FOR UNDERSTANDING DIGESTION AND METABOLISM IN A HERBIVOROUS FISH


We sequenced the genome of the herbivorous monkeyface prickleback (Cebidichthys violaceus) along with transcriptomes from nine tissues to gain insight into how this fish species thrives on an herbivorous diet in a heterogeneous intertidal habitat. The draft genome of C. violaceus was sequenced using Illumina and Pacific Biosciences sequencing technologies, with a size estimation of 656 Mb and 29,525 genes were identified via ab initio. With the nine tissue transcriptomes, we generated heat maps of differentially expressed genes (DEGs) to locate genes associated with digestion and metabolism. With the transcriptome profiles of the liver, pyloric caeca, proximal and middle intestines of C. violaceus, we identified DEGs that are associated with ketogenic metabolism, which represent the downstream pathways allowing this fish to utilize the short-chain fatty acids generated by microbial symbionts within their distal intestines. In addition, we identified four gene copies (haploid) of Bile salt-activating lipase (BAL) genes within the C. violaceus genome (most other fishes appear to only have two BAL gene copies), which coincides with elevated lipolytic activity in the guts of this fish. BAL orthologs (as well as other genes involved in digestion and metabolism) and gene copy numbers were identified in other teleost fishes to make stronger inferences about digestion and metabolism. Overall, the draft genome of C. violaceus will give us a better understanding of the evolutionary processes of dietary specialization and can lead to hypothesis formation regarding adaptations to intertidal habitats.

37. ASSESSING CARNOBACTERIUM MALTAROMATICUM PATHOGENESIS IN STRANDED SUB-ADULT COMMON THRESHER SHARKS ALOPIAS VULPINUS

§ L. Martinez Steele, CSU Long Beach.

Common thresher sharks (Alopias vulpinus) and salmon sharks (Lamna ditropis) have been periodically stranding due to a massive brain and inner ear infection caused by Carnobacterium maltaromaticum. Yet how and why these sharks are becoming infected is unknown. In this study, we aimed to better understand the pathogenesis process in stranded common thresher sharks. For that purpose, we collected and compared the gut microbial community, brain and inner ear tissue of healthy and stranded thresher sharks. The gut microbiota has recently gained attention for the role it plays in the overall health of the host, such as that, an unregulated microbial community can be sign of disease. We were able to distinguish a core microbiome common to all sharks, nonetheless the microbiome in infected sharks was characterized by a significant increase in the presence of Vibrio strains, indicating an alteration of the gut microbiome in infected sharks. The microbial presence in the areas of showed high C. maltaromaticum presence in infected sharks while no bacteria present in
healthy. To determine the health status of the shark. The presence of inflammation and infection in tissue was determined with histology, elucidating how C. maltaromaticum is potentially accessing the inner ear and brain through the endolymphatic ducts. Although there is need for more research to better understand this periodic shark stranding phenomenon, this study was able to use the microbiome as a tool to measure shark health which can aid to predicting the health status of sharks in future studies.

38. USING THE LIVER TRANSCRIPTOME TO DETERMINE METABOLIC DIFFERENCES BETWEEN PRICKLEBACK FISHES (FAMILY STICHAEIDAE) § M. Herrera, University of California, Irvine.

Prickleback fishes (Family Stichaeidae) are a unique study system in which to investigate dietary specialization because they consist of closely related species that coexist in rocky intertidal habitats, yet vary in diet choice. Diet choice can be reflected through metabolic pathways and the liver is central to many metabolic processes. My goal is to determine the metabolic differences between prickleback fishes that can be attributed to their diverse diet choices by comparing genes involved in liver metabolic pathways. We studied four species that naturally vary in diets: Xiphister mucosus (herbivore), X. atropurpureus (omnivore), Phytichthys chirus (omnivore), and Anoplarchus purpurescens (carnivore). We assigned individuals of X. mucosus and A. purpurescens to omnivore or carnivore diets in the laboratory, whereas X. atropurpureus and P. chirus individuals were fed the carnivore diet. Total RNA from the liver tissues of wild and lab-fed fish were isolated and Illumina platforms were used to examine the transcriptomic profiles. A de-novo assembly using Trinity was conducted, where one wild individual was selected to align RNA-seq reads back to the Trinity transcript. Coverages of 15-21 million reads per sample were achieved. Wild fish of X. mucosus and X. atropurpureus shared 13,124 genes, whereas the remaining pairs of wild prickleback fishes shared 4,000-5,000 genes. There were 1,882 shared genes among all four species. Ka/Ks analyses to determine selective pressures and analysis of enrichment of genes involved in metabolic pathways are underway. Overall, this study will provide crucial insight into the relationship between energy metabolism and diet in vertebrates.


The surfperches (Embiotocidae) are coastal marine fishes distributed along the eastern Pacific Ocean from Alaska to central Baja California. Surfperches are ecologically diverse and live in a variety of habitats (e.g., rocky reefs, sandy bottoms, kelp forests, eel grass beds, and estuaries). Surfperches reproduce via internal fertilization, where the males use external reproductive structures to deliver sperm into the female reproductive tract, but the structure used during copulation is currently unknown (e.g., genital papilla or flask organ). Our research goal is to observe the variation of external reproductive structures and to determine the structure used during copulation. We used macrophotography, paraffin histology and scanning electron microscopy to examine the reproductive structures in three surfperches. Walleye surfperch (Hyperprosopon argenteum), shiner (Cymatogaster aggregata) and black perch (Embiotoca jacksonii) have a genital papilla on the ventral side of the body anterior to the anal
fin. In addition to the genital papilla, shiner and black perch have flask organs, tubular structures, on both sides of the anterior portion of the anal fin and are believed to be the mode of sperm transfer. Our results showed that genital papilla shape, size and topography differed among the three surfperches, and the efferent ducts of the testes fused into a single sperm duct and directly connected to the genital papilla. Further investigation is required to determine the function of the flask organs on the anal fins. Overall, our research will contribute the little knowledge we have regarding surfperch reproduction.

40. THE EFFECTS OF MARINE PROTECTED AREAS ON FISH FORAGING BEHAVIOR
§ E. Nava. California State University, Northridge.

Marine protected areas (MPAs) are used to allow organisms and habitats to recover from anthropogenic impacts such as overfishing. MPAs have shown increased densities of fishes, which may result in resource limitation and intraspecific competition for resources among them. I evaluated whether a species known to have higher biomass in MPAs, California sheephead (Semicossyphus pulcher), is prey limited within them. I conducted foraging observations, to test whether foraging behavior of sheephead differs inside versus outside of MPAs. I studied six MPAs in southern California. Foraging observations by divers quantified fish foraging behavior (foraging rate and time spent searching). Sheephead exhibited different foraging behavior inside versus outside MPAs, with longer searching periods for food and a higher foraging rate within MPAs. These data suggest that sheephead might be resource limited within MPAs, implying that as populations of harvested species rebuild within MPAs, they may become food limited.

41. RESTORATION OF INVADED WALNUT WOODLANDS USING A TRAIT BASED COMMUNITY ASSEMBLY APPROACH
§ S. Lauman, E. Questad, and E. Bobich. California State Polytechnic University, Pomona.

Non-native plant invasions have been cited as a cause of decline of numerous plant communities, including Southern California walnut woodlands. These woodlands are dominated by Juglans californica, the California black walnut, which is a rare, endemic, allelopathic tree. Barriers to native community assembly in walnut woodlands include abiotic filters, such as light and water availability, biotic filters, including competition with invasive plant species, and allelopathy, due to the chemical juglone. Two experiments were conducted to assess how these abiotic and biotic environmental filters affect the establishment, growth, and reproduction of native and non-native annual plant species, with a focus on developing a trait-based restoration approach for this ecosystem. A laboratory experiment was used to assess species resistance to juglone at concentrations ranging from 0 to 0.5mM. A field experiment was conducted to examine native and non-native annual plant recruitment with respect to microclimate and competition. Communities containing native only, invasive only, or a mixture of both species types were assembled under J. californica canopies, and in exposed locations. In the lab assays, the germination of all but one species was negatively affected by juglone, however, biotic filtering through allelopathy is not represented in the field. The effect of competition, compared to canopy treatment, was a much stronger filter on native species establishment. Maximum leaf area, maximum plant height, and seed mass were
all positively correlated with final biomass, indicating a species’ productivity and competitive ability. Leaf traits varied across the light gradient, but were not correlated with final biomass despite being traits commonly used as indicators of plant productivity. Restoration efforts for this ecosystem should therefore focus on choosing native species that are most competitive based on functional traits that are correlated with competitive dominance.

42. TRANSCRIPTOME ANALYSIS INDICATE BROAD RESPONSE IN SEASIDE SPARROWS EXPOSED TO DEEPWATER HORIZON OIL
A.B. Alquati¹, P. Stouffer², W. Xu², and S. Taylor². ¹California State Polytechnic University, Pomona and ²Louisiana State University.

Differences in genes that mark exposure to polycyclic aromatic hydrocarbons from the Deepwater Horizon (DWH) oil spill have been shown in marine and terrestrial organisms that inhabit coastal waters and marshes of the Northern Gulf of Mexico. For terrestrial organisms little is known about their genome-wide gene expression in response to DWH oil exposure. Using a cross-species hybridization microarray approach, we investigated the transcriptomic response in the liver of seaside sparrows exposed to DWH oil compared with birds from control sites. Our analysis identified 295 differentially expressed genes (63 down-regulated and 232 up-regulated genes) between oiled and control birds. Canonical pathway analysis suggested adverse outcomes related to cellular proliferation and necrosis in the liver, liver steatosis, and cardiac enlargement and dysfunction, similar to what has previously been observed in fish species exposed to DWH oil. Our results provide novel insights into the effects of oil contamination on gene expression networks in terrestrial birds, and also indicate that organisms as taxonomically and ecologically different as fishes and terrestrial birds might share similarities in their transcriptomic responses to oil exposure.

43. THE IMPACTS OF AN INVASIVE ALGA, SARGASSUM HORNERI, ON THE FORAGING OF TEMPERATE ROCKY REEF FISHES
§ K. Scafidi. California State University, Northridge.

Invasive species can dramatically alter the physical structure of habitats and the behavior of organisms that inhabit them. Sargassum horneri, an invasive alga native to the northwestern Pacific, has spread through several subtidal regions of southern California. Despite its growing abundance, few studies have examined the effects of Sargassum horneri and associated microfauna on fish feeding behavior. This study was conducted at four sites on the leeward coast of Catalina Island and observed the foraging of CA sheephead (Semicossyphus pulcher), Garibaldi (Hypsypops rubicundus), rock wrasse (Halichoeres semicinctus) and their preference for Sargassum horneri compared to native understory algae. Fishes were observed foraging among seven species of native algae and bare substrate. Microfaunal abundance was quantified from three native algal species, Zonaria farlowii, Dictyopteris undulata, Sargassum palmeri, and compared to the invasive S. horneri. Foraging preference was illustrated using Ivlev’s Electivity Index. All fish had negative selectivity towards S. horneri despite it being the most available alga. S. horneri had the lowest abundance of microfauna and had a significantly lower abundance of amphipods than S. palmeri, an alga in the same genus. As this invasive alga spreads, these results suggest that some native fishes may have reduced foraging success, potentially negatively impacting their growth and reproduction.
44. PHYLTR: GENOMESCALE DE NOVO LTR RT PREDICTION, CLASSIFICATION, ANNOTATION, CLUSTERING, AND ANALYSIS
§ M. Simenc¹, F. Li², and J. Der¹. ¹California State University, Fullerton and ²Cornell University.

Long terminal repeat retrotransposons (LTR RTs) are retrovirus-like replicating DNA sequences that diversify within a single genome. LTR RTs constitute a major fraction of land plant DNA, and with new plant genomes being sequenced at an increasing rate, a fully automated LTR RT-specific discovery and analysis software package would help examine this important, but understudied component of genome evolution. Although many methods exist for de novo LTR RT prediction and for analyzing genomic LTR RT content, PhyLTR (Phylogenetic LTR retrotransposon discovery and analysis package) is the first to bring them together into simple genome-in, analysis-out command line tool. PhyLTR is a Python/R software pipeline for parallel UNIX environments built from open-source software. Given a genome assembly, PhyLTR will identify, classify to superfamily, annotate, and cluster putative LTR RTs. It then estimates intra-element LTR divergence using the best supported substitution model for a given cluster, scaling the divergence estimates relative to putative gene conversion tracts, and assesses inter-element gene conversion within clusters. Lastly, to provide information about transposition dynamics, PhyLTR infers cluster phylogenies and fits them to branching and speciation models, calculates diversification rates and indices of tree shape, and performs "Lineage Through Divergence (Time)" (LTD) analyses. Here we report a characterization of LTR RT content in two sequenced fern genomes using PhyLTR, providing the first genome-scale window into the diversity and dynamics of LTR RTs in ferns.

45. MOLECULAR ECOLOGY OF DIET AND VENOM COMPOSITION IN THE MOJAVE RATTLESNAKE (CROTALUS SCUTULATUS SCULATUS)
§ Z.D. Travis, W. Hayes, E. Gren, R. Williams, G. Fox, and W. Kelln. Loma Linda University.

Snake venoms exhibit remarkable geographic variation in composition and toxicity. This variation is crucial beyond ecological implications, as it becomes pertinent to the treatment of bite victims and the development of antivenom. The Mohave Rattlesnake (C. s. scutulatus), possesses a complex venom with extreme variation in venom composition, including three distinct phenotypes. Specimens with type A venom have large quantities of neurotoxic Mojave toxin. These snakes occur across most of the species’ range in North America. Snakes with type B venom lack Mojave toxin, but have large amounts of hemorrhagic snake venom metalloproteinases (SVMPs). These snakes occur in south-central Arizona and southern Mexico. Lastly, specimens with type A+B venom possess both groups of toxins, causing both neurotoxic and hemorrhagic effects, and occur in the contact zone between the A and B phenotypes. One hypothesis for extreme venom variation in C. s. scutulatus suggests that differences in prey consumption select for different venom composition. We hypothesized that type A (more toxic) and type B (more digestive) phenotypes will consume higher proportions of lizards and rodents (bulkier, more difficult to digest), respectively. We obtained dietary data (>300 samples) from preserved specimens at the Los Angeles County Museum (LACM) and Arizona State University (ASU) museum. Dietary contents revealed a weak ontogenetic shift.
in diet from reptile to mammals, but do not support the hypothesis that type A snakes feed on a higher percentage of lizards.

46. PAPUAN BLACK SNAKE (PSEUDECHIS PAPUANUS) VENOM PRE-CONDITIONING REDUCES NEUROINFLAMMATION VIA PLA2/SLOX/LTC4 SYNTHASE/LTE4 CASCADE IN A SURGICAL BRAIN INJURY RAT MODEL § Z.D. Travis and W. Hayes. Loma Linda University.

Inflammatory preconditioning is a mechanism in which exposure to small doses of inflammatory stimuli prepares the body against future massive insult by activation of endogenous protective responses. Phospholipase A2/5-lipoxygenase/leukotriene-C4 synthase/leukotriene-E4 (PLA2/SLOX/LTC4 synthase/LTE4) axis is an important inflammatory signaling pathway. Pseudechis papuanus venom contains 90.2% secretory PLA2 of its dry weight. The remaining 9.8% of the venom is composed of 3FTXs, SVMPs, CRISPs, and LAAO. Because of the protein composition, the venom causes neurotoxicity, hemolysis pulmonary inflammation, and edema. We investigated whether P. papuanus venom preconditioning (VPC) reduces surgical brain injury (SBI)-induced neurinflammation via activating the PLA2/SLOX/LTC4 synthase/LTE4 cascade using a partial frontal lobe resection SBI rat model. Sublethal doses of venom were injected subcutaneously three consecutive days prior to SBI. We observed that VPC reduced edema and improved neurological function 24 h and 72h after SBI. The VPC regime also reduced intraoperative bleeding, while the sublethal dose caused no skin inflammation at the injection site and no other toxic effects. These findings suggest that VPC reduces neurinflammation and improves outcomes after SBI by activating the PLA2/SLOX/LTC4 synthase/LTE4 cascade. VPC may beneficial to reduce post-operative neurinflammation and intraoperative hemorrhage complications from brain surgeries.

47. ANALYZING MORPHOLOGICAL VARIATION AMONG HONEY BEES APIS MELLIFERA WITH DIFFERENT FORAGING BEHAVIORS ON WATERMELON FLOWERS

M. Torres. California State Polytechnic University, Pomona.

Adult honey bees spend the last few weeks of their life span foraging on flowers for pollen and/or nectar. A typical bee’s foraging behavior at a flower is usually a single visit per individual flower, during a brief period of time (<60 s). However, there have been field observations of honey bees visiting an individual flower repeatedly during a brief period of time (revisitation). My study asks if there are morphological differences between individuals that exhibit these two different behavioral patterns on watermelon flowers. This research focuses on gathering qualitative and quantitative data from both single visiting and revisiting honeybees from two different sites to compare their wing wear. Wings are part of an insect that do not regenerate so as insects age, they accumulate wing wear. The scoring method is scoring how much wing wear a wing using an index from 0-6, six being the most wear and tear. The other measurement is quantitative distances of the upper and lower wing. The upper wing measurement is a line that starts at the angle that bisects right below the marginal cell and ends at the wing margin. The lower wing measurement is a line that goes along the lower wings vein and ends at the wing margin. For Prime Time Ranch, the results showed revisiting honeybees had more wing wear damage then single visiting honeybees. For Spadra Ranch,
some preliminary results showed that there was no difference between the revisiting and single visiting honeybees.

48. CORRELATED EVOLUTION OF ANTLERS AND TUSKS IN CERVIDS
§ N. Lopez. California State University, Long Beach.

Tusks are mostly seen on smaller ungulates and used primarily as sexual weapons in battles over territory, whereas larger ungulates lack tusks but instead possess antlers, used as a visual display of social status. Two Genera of deer have both antlers and tusks: Muntiacus and Elaphodus. In muntjacs, all fights are preceded by a “dominance display”. A gradual increase in reliance on this display may have led to the reduction in size of tusks and eventual evolution of complex, large antlers due to the rarity of actual fighting. My project will study the correlation between antlers and tusks in relation to overall body size and other ecological factors. I hypothesize that as body size increases, then relative size of tusks will decrease and the relative length of antlers will increase. Antler and tusk data on several species of cervids has been collected from museum specimens and I will collect more. I will use this data to try and support the correlation by using phylogenetic generalized least squares tests, which take species relatedness into account. Our preliminary studies suggest as the species move from closed to open habitats, from solitary to group living lifestyles, and from small to large body sizes there is a significant trend of tusk size decrease and antler size increase. I will also examine the effects of environmental and social factors, such as habitat type and fighting style, on the evolution of these traits. This study will help elucidate the selective forces that led to the transition between primitive small solitary tusked deer and the large social/polygynous antlered deer that dominate today.

49. EVALUATING THE REPEATABILITY OF BEHAVIORAL TENDENCIES OF BLACK SURFPERCH EMBIOTOCA JACKSONI
§, ‡ D. Satterfield and D. Johnson. California State University, Long Beach.

Although behaviors can be flexible, behavioral tendencies (e.g., boldness) may be heritable, and it is possible that behavioral tendencies evolve via natural selection. For example, bold and exploratory individuals may acquire food at a relatively high rate and thus have a fitness advantage in many environments. In contrast, exploratory tendencies may be selected against in high-predator environments where greater exposure may result in higher predation risk and a fitness disadvantage. Whether such behavioral tendencies can evolve will depend on the heritability of these traits. If a trait is heritable, (1) it will exhibit repeatability, and (2) offspring will resemble parents. This study seeks to evaluate whether black surfperch (Embiotoca jacksoni) exhibit heritable variation in boldness and exploratory behavior. Specifically, this study will assess these behavioral trends in reference to spatial variation in predation risk among populations. In a pilot study, we compared repeatability of responses to predatory threats in three trials. For 15 minutes, surfperch BSP were allowed to explore a tank containing a rocky shelter, and a predator (kelp bass, Paralabrax clathratus) behind a clear divider. Repeatability was found to be 77% for proportion of time spent in shelter, 71% for latency to leave shelter, and 66% for proportion of time spent nearest the predator. High repeatability may suggest heritability. Our ongoing studies use a “common-garden” experiment to test whether lab-born fish from a low-predation environment (Palos Verdes) and
a high-predation environment (Santa Catalina Island) exhibit heritable differences in behaviors.

50. THE GEOCHEMICAL EVOLUTION OF THE CENTRAL MOJAVE BATHOLITH
§ K.B. Vermillion and N. Van Buer. California State Polytechnic University, Pomona.

Here we present reconnaissance U-Pb geochronology and whole rock geochemistry on the Central Mojave Batholith, geographically defined by the Newberry, Ord, and Granite Mountains adjacent to Victorville and Barstow, CA, and the Cady, Marble, and Bristol Mountains adjacent to Ludlow, CA. In contrast to other relatively well studied large intrusive suites in the Mojave Desert generated by Mesozoic subduction (e.g. Western Mojave and Cadiz Valley Batholith), little work has been done on the Central Mojave Batholith. U-Pb ages, done at CSU-Northridge's Laser-Ablation Inductively-Coupled-Plasma Mass Spectrometer confirm that the Central Mojave Batholith records magmatism from the Proterozoic until magmatic cessation of the Mesozoic magmatic arc at ~73 Ma in the Mojave Desert. Cretaceous plutons can be divided into two groups based on geochemical correlations: (1)91 -81 Ma granitoids with about 61 - 73% SiO2 and (2) 80 - 73 Ma granites about 5% richer in SiO2 for a given Fe-Index than group 1. Cretaceous magmatism in the Central Mojave Batholith is hypothesized to have undergone three stages (1) 91 - 84 Ma, (2) 84 - 77 Ma, and (3) 77-73 Ma. Stage 1 was emplaced into little or no basement based on low lead isotope values, and consequent stages were emplaced into thicker basement to the southeast as the arc migrated in the same direction. As seen in stage 3, Ludlow and Cadiz Valley Batholith which have similar ages, whole rock geochemistry, petrographic descriptions, and lie along the same axis. The Ludlow and Cadiz Valley Batholiths also have great variability, suggesting that an anomalous magmatic source (such as a slab tear) may be responsible for generating these batholiths.

51. BATTLE OF THE SEXES: ASSESSING SEX-SPECIFIC MICROHABITAT ASSOCIATIONS IN THE MOJAVE DESERT MOSS SYNTRICHIA CANINERVIS (POTTIACEAE)
§ A. Garcia. California State University, Los Angeles.

Both a heavy reliance on asexual reproduction and the evolution of desiccation tolerance have allowed mosses to successfully inhabit arid environments worldwide. The species Syntrichia caninervis (Pottiaceae) is particularly successful in colonizing these environments. Studies on S. caninervis in the Mojave Desert, CA have observed a high female bias based upon phenotypic sex expression, and have suggested that male mosses may be restricted to shaded and moist microhabitats, because the rare expression of male gametangia is limited to these microsites. But sex expression is not necessarily a proxy for the distribution of sexes, as most ramets in a given population of S. caninervis do not express sex and could represent either males or females. Here, I use a novel genetic sex marker to test for the presence of sex-specific differences in microsite use in S. caninervis across 18 microhabitat variables in the Mojave Desert. Sex of 91 sterile samples was determined through PCR followed by restriction enzyme digestion and visualization of the digested products. Multivariate regression models applied to the microhabitat data will infer the presence or absence of sex-specific differences in microhabitat associations. The results may challenge current assumptions if they indicate that males and females are not microhabitat specific, as sex expression suggests. These findings will have important implications for
resolving the ecological and evolutionary drivers of sex ratio bias in *S. caninervis*, providing context for understanding sex evolution in other types of plants.

52. WATER QUALITY, ISOTOPE AND GEOCHEMICAL STUDY OF CALIFORNIA BLACK TOAD HABITAT IN DEEP SPRINGS VALLEY, CALIFORNIA

§ L. Zuniga, California State University, Los Angeles

This project aims to establish a long-term study of water quality and geochemistry in Deep Springs Valley, California. Data on water quality will be used to document variations in nutrients, geochemistry and other parameters in spring waters and Deep Springs Lake. One result of this study will be to better understand how water quality variations may affect the single remaining habitat of the threatened California Black Toad. The only existing water quality data for Deep Springs Valley were collected during a study from 1959-1961 with results showing anomalous concentrations of certain cations, which is suggested to be related to the geochemistry of the surrounding rock formations as well as evaporation processes. California Department of Fish and Wildlife personnel have reported small adult sizes in toads from several springs, which may be related to geochemical input from dissolution of nearby limestone formations. An additional possible stress to the toad habitat is a cattle ranch and alfalfa farm operated by Deep Springs College adjacent to the lake and springs, which will be addressed by measuring nutrients in the water. Field sampling, in-situ measurements, and laboratory analysis are being utilized to provide data about water quality and geochemistry. Water samples are tested for basic nutrients, anions (Cl, HCO3, SO4, NO3, PO4), cations (Ca, Mg, Na, K), and oxygen-hydrogen isotopes, and will be used to document seasonal changes in water quality. Rock samples will be tested for trace element concentrations to determine any local geological controls on water composition in the valley.

53. CHARACTERIZATION OF MICROBIAL COMMUNITIES IN THE MOJAVE DESERT BIOLOGICAL SOIL CRUST AND THEIR ASSOCIATION WITH *SYNTRICHIA CANINERVIS* IN HYPER- AND HYPOLITHIC HABITATS

§ J. Jefferson, California State University, Los Angeles.

The Mojave Desert is home to a variety of organisms including microbes, lichens, and mosses. Together, these organisms form a community known as the Biological Soil Crust (BSC). Microbes and mosses are major components in the BSC as well as in microhabitats underneath semi-translucent quartz rocks in the Mojave Desert. Characterization of BSC composition has been focused on individual organisms (mosses or microbes), which limits understanding how BSC organisms co-exist in various microenvironments. Our goal is to use environmental sequencing 16S rRNA to characterize microbial communities in four BSC microhabitats. Characterizing BSC microbial community composition in the presence and absence of mosses will provide insight into the process of BSC formation. This project is novel in its investigation of microbial community composition in both hyperlithic (exposed surface) and hypolithic (beneath semi-translucent quartz) desert microenvironments. The presence of moss in the BSC could potentially influence microbial composition and increase its diversity by providing additional heterogeneous habitat, altered moisture regimes, and a supplemental source of carbohydrates. We predict the composition of microbial communities will vary in hyper- and hypolithic microhabitats. With this work, we aim to better characterize how the presence of BSC
plants (moss) modulates microbial community composition and diversity, which could potentially inform decisions for conservation of BSC structure and function.

54. DEVELOPMENT OF HIGH-THROUGHPUT SCREENING METHODS TO IDENTIFY FACTORS THAT INDUCE LIFE CYCLE STAGE TRANSITIONS IN THE PARASITE TRYpanosoma brucei
† M. Walsh. Harvey Mudd College.

African Trypanosomiasis is a fatal disease that causes a severe human and economic burden in endemic regions within Sub-Saharan Africa. It is caused by infection with the parasite Trypanosoma brucei, which moves between the procyclic form in tsetse flies and the bloodstream form in mammals. Drug development is urgently needed due to toxicity of current protocols and increases in drug resistance. Instead of trying to kill the parasites directly, our lab has focused on crippling antigenic variation, which the parasites use to evade host antibody. We believe that inducing expression of an invariant protein on the surface would allow the host immune system to clear the parasite. Previous studies showed that bromodomain inhibitor IBET-151 induces a procyclic-like state in bloodstream form cells, resulting in the expression of an invariant insect-stage specific protein coded by EP1. Mice can clear infections with T. brucei if the parasites are pretreated with I-BET151. To develop an efficient, high throughput method to test additional inhibitors that induce expression of EP1, we designed a reporter strain of T. brucei that replaces one allele of EP1 with GFP. Flow cytometry of reporter bloodstream cells demonstrates an increase in GFP expression in IBET-151 treated cells and differentiating cells, indicating that our reporter strain is functional. We hope to use this reporter strain to screen for drugs that could be effective treatments against African trypanosomiasis and have begun pilot drug screens using a library of FDA approved drugs to identify compounds that induce GFP in our reporter cells.

55. TAXONOMY AND ECOLOGY OF CLAUSIDIUM VANCOUVERENSE (HADDON, 1912) ASSOCIATED WITH TWO CALLIANASSID GHOST SHRIMP TAXA FROM THE EASTERN PACIFIC
† M. Murray1, B. Passarelli1, and J. Passarelli2. 1University of California, Los Angeles and 2Cabrillo Marine Aquarium.

Clausidium vancouverense (Haddon, 1912) is redescribed based on specimens collected from two callianassid ghost shrimp (giant ghost shrimp, Neotrypaea gigas (Dana, 1852) and bay ghost shrimp, Neotrypaea californiensis (Dana, 1854)) from British Columbia (Canada), Washington, Oregon, California (United States), and Baja California (Mexico). Comparisons with copepod specimens identified by Wilson (1935) as Clausidium californiense Wilson, 1935 from N. californiensis (as Callianassa californiensis) from Newport Beach, California also revealed that they are conspecific with C. vancouverense. Interspecific variations of the labrum, postmaxillipedal sternite, anal somite, mandible, and leg 5 are discussed. Additional ghost shrimp specimens were collected from two southern California mudflats (Cabrillo Salt Marsh, San Pedro and Santa Ana River, Huntington Beach) to obtain C. vancouverense prevalence and intensity data. In total, 182 N. gigas and 67 N. californiensis were collected and 423 and 225 C. vancouverense were removed, respectively. The prevalence of C. vancouverense at Cabrillo Salt Marsh (59.6% for N. gigas and 54.8% for N. californiensis) was similar to that at Santa Ana River (52.3% for N. gigas and 52.8% for N. californiensis). By contrast, the mean intensity of C.
vancouverense at Cabrillo Salt Marsh (5.38 for N. gigas and 8.59 for N. californiensis) was higher than that at Santa Ana River (2.65 for N. gigas and 4.16 for N. californiensis). A significant positive correlation was found between host carapace length and C. vancouverense intensity (p = 0.024 for N. californiensis; p < 0.0001 for N. gigas).

56. PARASITE DIVERSITY AND BURDEN IN RELATION TO DIET IN A HERMAPHRODITIC FISH HALICHOERES SEMICINCTUS
† V. Torres and D.N. Morton, University of California, Santa Barbara

The types of parasites that an organism carries are related to its trophic level, and these parasites’ life cycles can track the organism’s relationship with others in its ecosystem. Certain types of parasites are transferred from prey to predator; therefore, an animal’s parasites are a record of what it has eaten, and they suggest what might eat it. The rock wrasse Halichoeres semicinctus undergoes a process in which it changes from female to male, which results in physiological and behavioral differences. Such differences could potentially affect how H. semicinctus interacts with other organisms in its ecosystem. We compared the parasites of male and female rock wrasses to determine if they consume different prey or otherwise behave differently. We also compared gut contents, for additional information on the diet diversity of the sexes. These comparisons revealed a trend towards greater parasite burden in female rock wrasses, which could indicate that they are eating more prey items. By eating more prey, they would be exposing themselves to more opportunities for parasitic infection, resulting in this increased burden. The data also showed a positive correlation between the diet diversity and total number and diversity of parasites. This could indicate that as fish are eating more types of prey, they are exposing themselves to both greater numbers and a greater variety of parasites.

57. COPPER TOXICITY AND NITROGEN INTERACTIONS IN C. WATSONII

Phytoplankton account for half of the world's gross photosynthesis and oxygen production. Of these globally-distributed organisms, diazotrophic (nitrogen-fixing) phytoplankton perform the vital ecological task of supplying bioavailable nitrogen - a key limiting resource in many ocean regions. The task of nitrogen-fixation, however, requires additional resources in the form of trace-metal micronutrients. Copper is one such metal that is also involved in numerous biochemical pathways, such as electron transport. The dual oxidation state of copper makes it an ideal electron transporter, but also catalyzes the production of reactive oxygen species, such as the highly damaging hydroxyl radical. There are many published reports on the positive and negative effects of copper in different phytoplankton species, but diazotrophs, being relatively newly discovered, remain uncharacterized. The N:P ratio may have an effect on the sensitivity of the cells to copper accumulation and toxicity within the cell. We conducted 96-hour incubations of the unicellular diazotroph, Crocosphaera watsonii, under different copper and nitrogen levels in chemically-defined artificial seawater media. By measuring the cellular growth rates and photosynthetic health (relative electron transport, quantum yield, absorption cross-section) of the cells under limiting and toxic conditions, we identify the threshold at which high concentrations of copper become toxic to C. Watsonii and observe the interactive effects of copper limitation and nitrogen availability.
58. CHROMATIC ADAPTATION RESPONSES IN *SYNECHOCOCCUS* TO DIFFERING WAVELENGTHS OF LIGHT


Marine *Synechococcus* sp. contribute 17% of the oceans net primary production, and can adapt quickly to changing environmental conditions. They are unique in that some strains chromatically acclimate to preferentially absorb either blue or green wavelengths of light by shifting the ratio of two light-harvesting chromophores within the phycobilisome: phycocourobilin (PUB) with maximum absorbance (Amax) of 495nm; and phycoerythrobilin (PEB) with Amax of 545nm. While chromatic adapters modify PUB:PEB ratios in response to spectral quality, it is unknown whether nutrient availability can induce this response. To test this, we first need to characterize the extent to which each strain is able to chromatically acclimate. To that end, we characterized the phenotypes of six *Synechococcus* chromatic adapters, along with two non-adapter strains that are specialists for blue and green light, when grown under blue, green, white, and red light. Chromatic adapters grown in blue light had a higher PUB:PEB ratio, whereas those grown in green light had a lower PUB:PEB ratio. Cultures grown under white and red LEDs reveal similar results as those grown in green and blue, respectively. There is a clear separation of PUB and PEB peaks in the excitation spectra of the chromatic adapters grown under different colors of light, indicating the effectiveness of this technique to induce and measure chromatic acclimation. The range of PUB:PEB ratios measured in this study will enable us to gauge to what extent nutrient availability induces chromatic acclimation in future experiments.

59. THE INFLUENCE OF INPUTS FROM SECONDARY TREATED WASTEWATER EFFLUENT ON NUTRIENT AND PHYTOPLANKTON DYNAMICS IN ORANGE COUNTY, CA

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In coastal waters, nutrient availability to phytoplankton is driven by a combination of factors including upwelling, mixing, runoff, and microbial recycling/regeneration. However, anthropogenic nutrient sources can alter nutrient supply, particularly in areas where localized point sources exist. In Orange County, off the coast of Huntington Beach, an effluent pipe managed by the Orange County Sanitation Department (OCSD) extends 7km offshore and releases treated wastewater. The goal of this study is to determine if and how nutrient concentrations differ near the wastewater outfall, and the subsequent effect on phytoplankton. Chlorophyll, nitrate, phosphate, ammonia, and colored dissolved organic matter (CDOM) measurements were taken over 15 months. Greater concentrations were typically observed in water above the effluent pipe when compared to water from a reference site, located away from discharge and coastal influence. This suggests that nutrient enrichment could be contributing to small, localized blooms of phytoplankton in the vicinity of the outfall. In addition, preliminary observations of seasonal change show that weather and hydrology alter the influence of the effluent pipe on oceanographic properties. Continued monthly monitoring of biogeochemical conditions over several years will reveal annual trends. This can help determine the extent that anthropogenic nutrients from wastewater effluent influence phytoplankton community composition.
60. **OPTIMIZING CULTIVATION OF CHLORELLA VULGARIS IN VARIOUS PHOTOBIOREACTOR SYSTEMS AND MUNICIPAL WASTEWATER CONCENTRATIONS**


Among the scientific community, there is growing agreement that microalgal photobioreactors are among the most effective systems for biomass generation and carbon capture to lower atmospheric carbon dioxide levels. Current literature mostly focuses on closed photobioreactors with carbon dioxide bubbling and, if utilizing wastewater, pure wastewater as a nutrient. This research aims to investigate the ideal type of photobioreactor and wastewater concentration to maximize microalgal growth in small-scale municipal wastewater filtration systems. *Chlorella vulgaris* was cultured in four 30-liter photobioreactors: closed and open, with and without carbon dioxide bubbling and pH monitoring. Periodically, turbidity was recorded and Guillard’s formula was added. Separately, *Chlorella vulgaris* was cultured in seven 300-milliliter samples of various concentrations of municipal wastewater and distilled water. The turbidity and pH of each sample were collected and recorded regularly. The photobioreactor system that yielded the highest biomass was the open photobioreactor with carbon dioxide bubbling and pH monitoring, generating a turbidity of 180 NTU after 21 days. The optimal wastewater concentration for culturing was the 83% concentration, with an infinite turbidity limit of 763 NTU. The data show algal growth dominance in photobioreactor systems with an additional carbon dioxide source and an installed degassing system and culturing in a concentration of around 80-85% municipal wastewater over pure wastewater or distilled water. Applying the small-scale results to larger-scale photobioreactors in municipal wastewater facilities has the potential to sequester atmospheric carbon dioxide and to purify wastewater more effectively before dumping.

61. **HARMFUL ALGAL BLOOMS: PHYTOPLANKTON MONITORING COMPARISON OF TWO LOCATIONS IN THE SOUTHERN CALIFORNIA BIGHT**

**G. Peters.** Palos Verdes High School.

This project was designed to discover the quantitative contributions of nutrient loading on marine phytoplankton. Through weekly water sample analysis from two locations, Redondo Beach’s King Harbor and Long Beach’s Rainbow Harbor near the fresh water outlet of the Los Angeles River, the main purpose of the experiment was to assign relative abundance percentages to observed phytoplankton cells. The hypothesis was that nutrients from the fresh water outlet of the LA River would create a greater prevalence of phytoplankton compared to a similar harbor without the input of these nutrients. The California Department of Public Health (CDPH) Marine Biotoxin Monitoring Program supplies volunteers with a 20 µm mesh phytoplankton net, 200 mL cod end for collection, identification field guides, data spread sheet, and microscope observation protocols. Using an OMAX digital compound LED microscope, three microscope slide plankton samples were averaged to obtain an accurate representation of relative abundance for each organism observed. The tallied data and water sample were sent to Richmond, California for verification by CDPH Environmental Management Branch experts. The samples were compared once a week from November to January and relative abundances were compared between locations. Results were achieved by combining relative abundance percentages of Long Beach and comparing those to the combined percentages of Redondo Beach. The data showed that the nutrient rich water from the LA River created optimal conditions for phytoplankton.
accumulation. The hypothesis that nutrient loading along fresh water outlets increases phytoplankton abundance was strongly supported by the results.

62. OCEANIC IRON GRADIENTS AFFECT PIGMENTATION IN MARINE SYNECHOCOCCUS

Iron is an essential micronutrient for many phytoplankton. Its source to the ocean is through sediment, notably, dust deposited by wind. Due to its terrigenous nature, an iron gradient exists in oceans, with high iron concentrations near land and low concentrations in the center of large ocean basins. Light color in the marine environment also has a gradient. High nutrients near coasts support more plankton, and the particles scatter more light in the surface ocean, resulting in green-light-dominated coastal waters. The center of oceans, with significantly less particulate matter, are often blue-light-dominated. The influence of this parallel between the light and iron gradients was tested on the chromatic acclimation response of the phytoplankton *Synechococcus*, in which light-harvesting pigments are differentially expressed in blue and green light environments within the ocean. We hypothesize that the low iron concentrations of the open ocean will trigger a blue-light response in chromatic adapters, and similarly, high iron concentrations of the coast will trigger a green light response. This response is observable by a change in the ratio of two light harvesting chromophores: blue-light-absorbing phycourobilin (PUB); and green-light-absorbing phycoerythrobilin (PEB), eliciting a color change of phytoplankton strains in culture. That nutrients can trigger a change in the PUB:PEB ratio within phytoplankton is a new finding, as typically this chromatic acclimation response has only been triggered by the color of light under which the organism is grown.

63. SEASONAL SUCCESSION OF PHYTOPLANKTON WITHIN THE SOUTHERN CALIFORNIA BIGHT

The coastline of Southern California is known as one of the most biologically rich regions throughout the world oceans. This is attributed to the fact that it lies on an eastern boundary current of the Pacific Ocean. In these areas, hydrological processes provide nutrient enrichment of surface waters. Furthermore, within the Southern California Bight, the California current drives a cyclonic flow which serves to trap water parcels in the region, preventing equatorial flow. Because of this, phytoplankton dynamics within the bight are likely to differ considerably from other areas along the California coast. Here, we investigate the community composition of phytoplankton collected offshore of Huntington Beach, CA over an annual cycle. Monthly measurements show that the community is dominated by diatoms throughout the year, with dinoflagellates representing a smaller fraction of the community. The diatom complexes *Pseudo-nitzchia seriata* and *P. delicatissima* were observed in all months, with the toxin-producing *P. seriata* showing a higher relative abundance in the summer. Picophytoplankton (<2mm) also reach their highest abundance in the warm summer months. These findings show that physical dynamics within the bight play a large role in controlling phytoplankton dynamics, resulting in a pronounced spring bloom and fewer late summer upwelling-driven blooms.
64. THE CATALINA DYNAMIC OCEAN CHEMISTRY PROJECT

Being proactive in adjusting to climate change and ocean acidification requires understanding local conditions and how they may enhance or mitigate effects that are induced by global drivers, such as anthropogenic increases in atmospheric carbon dioxide. Santa Catalina is located in the center of the Southern California Bight and exhibits singular behavior in both ocean temperature and phytoplankton dynamics, suggesting that other ocean parameters may also vary uniquely at the island. The Catalina Marine Society is measuring ocean chemistry parameters at Catalina, including pH, dissolved oxygen, chlorophyll, temperature and conductivity, with the goal of discovering how these parameters change daily and seasonally. Data from the first nine months of the current measurement campaign at Avalon (7 depth profiles) are displayed, as well as those obtained from a multi-week deployment at Two Harbors, made during 2012. The 2012 campaign data indicates that changes in pH and oxygen are associated with internal waves that advect depth gradients in these parameters.

65. SEASONAL VARIABILITY OF PROCHLOROCOCCUS ALONG SOUTHERN CALIFORNIA’S COASTAL WATERS

Prochlorococcus is the most abundant photosynthetic organism on the planet and has a known biogeographical range to the open ocean; however, a coastal population was recently found off of Newport Beach, California. The occurrence of this coastal population could be a result of a population entering with warm surface water currents when offshore winds relax (such as during an El Niño climate pattern) or it could be a native coastal population. To determine which of the competing hypothesis is correct, we measured coastal seawater nutrient concentrations, flow cytometry, and single cell genomic analysis from samples taken three times per week over a two-year period. Results from the initial nutrient samples collected during the 2015/2016 El Niño have revealed a nitrogen limited system, and increased Prochlorococcus numbers during the summer. Continued sampling through 2016/2017 neutral conditions is used as a basis of comparisons. These analyses will provide a glimpse of what may happen to organism found along California’s coastline in the future, as coastal waters come to resemble the open ocean (especially during an El Niño event) as result of anthropogenic climate warming.

66. TRAINING IMPROVES ACCURACY OF CITIZEN SCIENTIST WILDLIFE IDENTIFICATIONS FROM CAMERA TRAP PHOTOS

Citizen science can help scientists assemble much larger datasets, but the quality of these data may impact their utility. Developing practices that maximize the quality of citizen science data is therefore imperative. In this study we assess the role of training and assistance in the quality of data obtained by citizen scientists identifying wildlife from camera trap images. Participants with varying degrees of experience in biology were asked to identify photos from camera traps that were set up on an urban college campus in Los Angeles, California in order to capture photos of wildlife. Using the online citizen science website, Zooniverse, we set up two different modules: one provided minimal training, which consisted of visual and written descriptors of commonly
seen animals, and the other provided participants no training. Without assistance, citizen scientists with no biology experience had significantly lower accuracy than experienced biologists. However, when participants received some assistance, citizen scientists with no background in biology were able to identify wildlife with the same level of accuracy as the scientists with biology backgrounds. From these results, we conclude that citizen scientists, when provided with minimal assistance or training, have the ability to generate high quality data regardless of their scientific backgrounds.

67. CALIFORNIA SCRUB JAY AND EASTERN FOX SQUIRREL PRESENCE WITHIN THE BALDWIN HILLS AREA

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I focused on how vegetation type, structure, and landscape modification affected the presence and location of California Scrub-Jays (*Aphelocoma californica*) and Eastern Fox Squirrels (*Sciurus niger*) in the Baldwin Hills area within Los Angeles, CA. I created modified point count survey routes within three sites: (1) the Baldwin Hills Scenic Overlook, a recovering natural habitat; (2) Culver City Park, a manicured park designed for sports and recreation; and (3) the Culver Crest Neighborhood, a residential area adjacent to the Inglewood Oil fields. Each survey route was designed to encompass areas with varying types of vegetation and landscape modification. Each site contained four points and the vegetation of each point was classified based on structure, cover, and type using satellite imagery and on-site visual assessment. Jay and squirrel surveys were conducted October 2017- March 2018, and site characteristics were assessed in spring 2018. Jays were observed mainly at points that had complex vegetation with a variety of heights, while squirrels were tolerant of sites with less vegetative cover and more homogenous structure. In addition, jays were observed at points containing physical barriers (e.g., fences), steep terrain, and/or dense waist high vegetation, all impediments to human movement. I suspect that the driver of squirrel presence at my points were consistent anthropogenic food sources, though this would require further study for confirmation.

Understanding how common native and non-native species use urban areas is necessary in order to understand how to optimize remaining urban open space to support native wildlife populations.

68. SPECIES DISTRIBUTION MODELS OF GALAPAGOS MOCKINGBIRDS


The Galapagos Islands are host to a unique community of endemic Mockingbird species, with genetic variation across the islands. While isolation of populations on various islands has contributed to diversification, environmental variation may also play a role. Here we investigated the contribution of environmental variation relative to isolation by creating species distribution models of four endemic Mockingbird species, *Mimus melanotis*, *Mimus trifasciatus*, *Mimus macdonaldi* and *Mimus parvulus*. We assessed whether the distributions of the four species overlapped and if there was a difference in the contribution of multiple bioclimatic variables on their distributions. Our results provide insight as to the role of bioclimatic variation across islands in the speciation of this avian group. Finally, we make predictions for changes in future predicted habitat suitability under multiple climate scenarios.
69. MONITORING THE SUCCESS OF CHEMICAL AND MECHANICAL RESTORATIVE METHODS IN A SAND DUNE HABITAT

Invasive plant species may dominate their introduced habitat, threatening the existing range of native plants and animals. Habitat restoration can counter these invasions and promote the reestablishment of the native community. Due to their influx of invasive species, sand dune communities are the focus of many restorative efforts. In this study, we assess the extent to which two restoration methods - mechanical and chemical - have eradicated invasive plant species from a protected community, the LAX sand dunes. We used a quadrat and transect method to measure density of native and invasive plants across three treatment types: chemically restored, mechanically restored, and unrestored. We hypothesized that chemical restoration was more effective than mechanical restoration at eradicating invasive plants from the dunes. While mechanically and chemically restored plots both had lower cover of invasive plants than unrestored plots, these two restored areas did not differ from each other in cover of invasive plants. Differences between the methods were seen at the species level. Invasive plants varied in their response to the treatments, while native plants most often had their highest cover in mechanically restored plots. Our results suggest that future restoration efforts should implement mechanical methods of restoration. Invasive plants responded similarly to all treatments, while native plants were most abundant in plots that were mechanically restored.

70. EFFECTS OF POND, YEAR AND LIFE STAGE ON BODY CONDITION IN A HIGH ELEVATION SALAMANDER POPULATION
§ L.D. Lacasa¹, B. Ripley¹, A. Lackey², C. Mott³, and H. Whiteman⁴. ¹Grossmont College, ²Binghamton University, ³Eastern Kentucky University, and ⁴Murray State University.

Polyphenism is the phenomenon of multiple phenotypes expressed from a single genotype. One species that exhibits this trait is the Arizona tiger salamander (Ambystoma mavortium nebulosum). It can either experience metamorphosis to leave the pond or remain as a sexually mature paedomorphic adult. A population of the Mexican Cut Nature Preserve (Colorado, USA) has been studied for 27 years to assess their physiological attributes based on intra-specific and environmental factors. This project aimed to identify a covariate that represents individual "health" to evaluate its potential to predict survival in population models. We explored three metrics: standard body condition index (BCI), residuals of regression of scaled mass on scaled snout-vent-length (SVL), and a scaled mass index (M). We identified regression residuals as the most suitable because they met good metric criteria and are easy to interpret. For 2006 and 2010, we tested for differences in regression residuals of salamanders by year, pond, pond type (permanent versus semi-permanent) and salamander life stage. In permanent ponds, there was a significant difference in body condition between years and ponds. There was also a significant difference between body condition of morph types in permanent ponds, with metamorphs having a much lower condition. These results suggest that salamander fitness may depend strongly on abiotic and/or biotic characteristics of ponds which change from year to year. The relative fitness of the morphs may shift due to a variety of environmental factors, which will be investigated in future studies.
71. SYSTEMATIC CHARACTERIZATION OF GENES OF UNKNOWN FUNCTION IN A MINIMAL BACTERIAL CELL (SYNTHETIC BACTERIUM JCWI-SYN 3.0) USING DEEP LEARNING

¥ A. Moturi¹ and Y. Suzuki², ¹Torrey Pines High School, ²J. Craig Venter Institute

The Synthetic Biology group at the J. Craig Venter Institute constructed a free-living bacterial cell that operates with only 473 genes, JCWI-syn3.0. This simple cell makes the complete understanding of a cellular system a realistic goal. A major challenge for achieving this is that the functions of the proteins encoded by 149 of the cell’s genes are either completely unknown or can only be predicted with very low confidence. Conventional transposon bombardment and gene knockout approaches often fail to reveal functions of genes that are essential for viability, where lethality precludes phenotypic characterization. Conditional inactivation of genes is effective for characterizing functions central to cell growth and division. Recently, a system for inducible repression of gene expression based on clustered regularly interspaced short palindromic repeats-mediated interference (CRISPRi) was established in the minimal cell for this purpose. Using CRISPRi, our goal is to examine various molecular signatures in the knockdown strains using microscopy with vital dyes that stain specific cellular systems. When a large dataset of micrographs is generated, the data will be analyzed using machine learning to categorize some of the uncharacterized genes into phenotypic groups with known functions. A deep convolutional neural network (DeepLoc) has been created to analyze protein localization in yeast cell images, and we wish to implement a similar approach. We have collected images of minimal cells, however, because JCWI-syn3.0 cells are roughly 1000 times smaller than the yeast cells used in DeepLoc, the information available from micrographs of the minimal cells is limited. We are considering whether transfer learning gives us the ability to tune the neural network with the yeast data for application to the minimal cell, or if a new model will have to be built to take into account the image quality. This systematic characterization of knockdown strains is expected to reveal previously unknown mechanisms at the core of cellular life.

72. BEE DIVERSITY AND ABUNDANCE WITHIN THE CALIFORNIA SAGE SCRUB OF THE SAN JOSE HILLS

§ C. Tabush and J. Leong, California State Polytechnic University, Pomona.

California sage scrub (CSS) is a native plant community of conservation concern and includes deciduous shrubs like California sagebrush (Artemisia californica), black sage (Salvia mellifera) and California buckwheat (Eriogonum fasciculatum). Due to agricultural and suburban development, the CSS has declined by 85% and has become fragmented across the state. CSS occurs along the coast of California, and inland regions, like the San Jose Hills. While much of the vertebrate fauna is reasonably well known, not much is known about the bee fauna associated with inland CSS fragments. To determine how inland fragments of CSS differ in their bee assemblages and how bee diversity and abundance relate to plant species assemblages, bees were collected and identified from three CSS habitats (Voorhis Ecological Reserve (VER), Frank G. Bonelli Park (BP), and Galster Park (GP)) of the San Jose Hills via the use of pan traps in August 2016. Transect sampling was used to determine plant species assemblages in each site. The difference in the bee abundances between VER and BP proved to be statistically significant, with VER yielding a bee sample twice the size of the BP bee sample. The most abundant bee genus caught at VER was Ceratina (Apidae), whereas Lasioglossum (Halictidae) was most abundant at
BP. The dominant plant species was California sagebrush at VER, and California buckwheat at BP. Although, bee and plant assemblage data for GP have not yet been analyzed, data from VER and BP suggest that there is a relationship between plant assemblages and bee fauna.

73. ALLELOPATHIC IMPACTS OF SCHINUS MOLLE ON EXOTIC AND NATIVE PLANT COMMUNITIES IN SOUTHERN CALIFORNIA
§ D. Banuelas. California State Polytechnic University, Pomona.

Schinus molle (California pepper tree) was first introduced to California in 1840. Since then it has naturalized throughout the state, with its impact on native plant communities still largely unknown. However, in South Africa and other regions the species has severely impacted native plant communities. The pepper tree is also allelopathic, producing chemicals that inhibit the growth of competing plant species. To understand how chemical inhibition might impact plant communities in southern California, three native and three exotic species were sown in soil collected beneath the canopies of male and female pepper trees. The species may potentially alter the soil microbiota and can impact restoration efforts when specimens are removed or cutback. Additionally, an allelopathic mulch from female and male trees was applied to test species in potting soil to determine the impacts of allelopathic mulch. Previous research has shown staminate flowers have the most potent allelopathy. The results of this study will be the first step in elucidating how pepper trees impact both native and exotic plant communities. If native species can withstand soil effects and allelopathic mulch, while exotic species cannot, allelopathy may serve as a viable restoration technique.

74. ASSESSING THE DIVERSITY OF FECAL INDICATOR AND RELATED BACTERIA IN THE BALLONA WETLANDS TIDAL SALT MARSH

Fecal Indicator Bacteria (FIB) are used in the monitoring of marine and fresh waters to indicate the probability of the presence of pathogens. The Ballona Wetlands Ecological Reserve is a tidal salt marsh where estuarine water mixed with runoff contaminated by FIB enters the marsh system daily during flood tides. The goal of this project was to assess the diversity of fecal indicator and other kinds of bacteria in the marsh during flood tides and ebb flows. During two sampling events, six grab samples were collected at the east tide gate: three replicate grab samples during the flood flow from the estuary into the wetlands, and three replicates of the ebb flow from the wetlands back into the estuary. Three replicate samples of runoff were collected upstream from Ballona Creek for comparison. Densities of total coliforms, E. coli, and enterococci were determined by the substrate-enzyme test using Idexx materials (Colilert-18 and Enterolert media, Quantitray-2000 testing trays). After the bacteria were incubated and grown, the Vitek 2 Compact microbial identification system identified the bacterial colonies. Preliminary data show that there is a reduction E. coli and Enterococci from flood to ebb tides. The diversity of species was greatest in samples of water flooding into the wetlands from the adjacent estuary, representing a mix of marine and freshwater/runoff. There were species unique in the estuarine flood samples that are all known pathogens. Overall, FIB density and diversity of species identified from the Quantitrays were less in water flowing from the wetland, suggesting that wetland processes had reduced these bacteria.
75. SUSTAINABILITY AND WATER MANAGEMENT IN THE URBAN ENVIRONMENT: INVESTIGATING THE WATER SOURCE OF TREES AT CALIFORNIA STATE UNIVERSITY, FULLERTON VIA STABLE HYDROGEN AND OXYGEN ISO TOPES

**G. Rodriguez** and M. Ybarra. California State University, Fullerton.

Two different water sources are found on the California State University, Fullerton campus: local rainwater and imported irrigation water from the Colorado River. In efforts to be more water-use conscious, we aim to identify campus trees that best utilize local rain and groundwater. The Campus Wide Irrigation Project uses a stable isotope approach to determine water sources of on-campus trees. Stable isotopes serve as natural tracers that can distinguish different water sources due to their distinct isotopic signatures. Once a month, we sample: 12 key tree species and soil surrounding the trees and extract the water from them. We also sample free water (ground and irrigation). Water samples are sent to the University of Wyoming Stable Isotope Facility and are analyzed by TC/EA- IRMS. Results for tree species sampled to date suggest that all have moderate-to-heavy use of shallow water. Root development in the shallow soil layers may have been the result of past watering practices whereby shallow soil was constantly irrigated. Few species, like Jacaranda and Cebia trees, seem to use some groundwater. Our results also suggest that Platanus, Fraxinus, and Cebia may have stem-water storage indicated by isotopic enrichment during deciduous periods. We encourage the CSUF campus to adjust watering practices to encourage deeper rooting patterns, which will lessen dependence on imported irrigation water. Focusing on planting more water-friendly and known deeply-rooted species (including California native), will also reduce dependence on imported irrigation water.

76. PALEOGEOGRAPHIC INTERPRETATION OF THE FISH LAKE VALLEY/HORSE THIEF HILLS AREA USING GEOCHEMISTRY OF VOLCANIC ROCKS

**§ S. Avila**, J. Knott¹, N. Mueller², B. Lutz³, and J. Lackey⁴. ¹California State University, Fullerton, ²UT Dallas, ³New Mexico Tech, and ⁴Pomona College.

Volcanic rocks collected from Willow Wash in Fish Lake Valley and the Horse Thief hills, California were classified as Tertiary basalt. We dated with 40Ar/39Ar and geochemically characterized these rocks by X-Ray Fluorescence (XRF) to determine if these are the same or different basalt flows. In Willow Wash, several 11.5-11.7 Ma basalt flows that underlie a thick sequence of Pliocene-Quaternary sediments were basalt (47-52% SiO2). The Zr/Ba and Ce/Y ratios for these basalts were similar to each other as well as to basalt outcrops in the White Mountains. Based on the decreasing thickness, age and geochemical data we infer that the basalt found in Willow Wash originated in the White Mountains and flowed 32 km east prior to Basin and Range extension that formed the intervening 1000 m of relief. The Horse Thief hills samples were from a volcanic breccia that is part of a tilted sedimentary-volcanic sequence exposed on the south side. XRF data show that the volcanic matrix of the breccia is andesite and the volcanic clasts are trachyandesite (56-60% SiO2). A previous whole-rock, K-Ar date of 6.3 ± 0.2 Ma on showed that this sequence represents a remnant Miocene basin now uplifted. Our data confirms that at 11.5-11.7 Ma a basalt flowed 32 km east from the White Mountains to Willow Wash before Basin and Range extension began. The andesitic breccia interbedded with basin deposits shows that a small basin formed south of the Horse Thief hills at 6.3 Ma.
77. GEOCHEMISTRY OF BASALTS IN THE WHITE MOUTAINS AND SILVER PEAK RANGE, CALIFORNIA AND NEVADA
E. Jimenez¹, J. Knott¹, and J. Lackey². ¹California State University, Fullerton and ²Pomona College.

Basalt flows are found as isolated outcrops atop mountains and ridges in both the White Mountains and Silver Peak Range on either side of Fish Lake Valley, CA/NV. Earlier studies mapped these rocks at Tertiary basalt (Tb) with whole-rock ages ranging from 11.5 Ma (40 Ar/39 Ar) to 4.8 Ma (K-Ar), but there is no nearby, apparent volcanic source and their position on topographic highs is confusing. Previous studies showed that basalts older than 5 Ma had a Zr/Ba ratio less than 0.2 indicating a lithospheric source dominance whereas basalts less than 5 Ma had a Zr/Ba ratio greater than 0.2 from asthenosphere source. In this study, we collected basalt rock from locations in both ranges and determined their geochemical composition using x-ray fluorescence to determine if these basalts have the same magmatic source. Our Zr/Ba and Ce/Y ratio plots were not consistent with the hypothesized magmatic system. The Zr/Ba ratio of the 4.8 Ma basalt near Fish Lake was 0.15 whereas the 11.5 Ma basalt in the eastern White Mountains was 0.21. Outcrops in the Silver Peak Range varied from 0.14 to 0.22. Explanations of these inconsistencies are poor age control, xenocrystic contamination or that the Zr/Ba ratio is not as precise a measure as previously thought.

78. SEASONAL VARIATION IN SOUTHERN CALIFORNIA AEROSOL COMPOSITION IS DRIVEN BY LOCAL CLIMATE VARIABILITY
§ K. Mackey¹, S. Stragier¹, L.A. Cat¹, X. Xu¹, S. Capps², K. Treseder¹, C. Czimczik¹, L. Robledo¹, ¹UC Irvine, ²Atmospheric Data Solutions, LLC.

Southern California is an urban metropolis bordered by mountains to the north and east and the Pacific Ocean to the west. Its unique geography and climatological features lead to annual patterns in atmospheric aerosol content from natural and anthropogenic sources. Here we sought to determine the nitrogen (N, including nitrate, ammonium, and total N) content of Southern California aerosols collected in Orange County, CA., and to identify relevant sources and processes that affect aerosol abundance and chemistry in different seasons. Aerosol carbon (C) and N isotopic compositions (d13C and d15N, respectively) suggested that the C content of the aerosols derived mainly from the marine layer that occurs in the months of May through July. The resulting inversion layer traps anthropogenic aerosols generated within the basin, and the high N content and d15N values of aerosols collected in summer reflect this source. In contrast, winter aerosols had lower N content, and d13C values indicated a greater terrestrial signal, consistent with winds originating in the east. This trend was particularly evident in samples collected during high velocity Santa Ana wind events, which bring terrestrial material from the Great Basin and mountainous regions located to the east of Southern California. Based on these observations, we suggest that atmospheric deposition of N is more likely to affect terrestrial Southern CA ecosystems in the summer, when N content is high and aerosols are trapped by the inversion layer, whereas marine ecosystems are more likely to be affected in the winter when westward winds are more common.
79. INVESTIGATING THE LIMITS OF DNA EDITING AND REPAIR TO IMPROVE GENE THERAPY

D. Miranda and P. Cannon, USC Keck School of Medicine.

Gene editing provides a potential pathway in a cure for severe combined immune-deficiencies by altering the patient’s DNA. If we are able to increase homologous recombination (HR) in hematopoietic stem cells (HSCs), then we will see the efficiency of editing at different distances from the nuclease cut site. After nucleofecting cells with zinc-finger nucleases and plasmid donors, the cells are incubated and assayed after 4-5 days. Overall, we lean towards the conclusion that inhibiting non-homologous end joining (NHEJ) prior to inducing homologous recombination (HR) yield to better results. These results can assist in the determination of how to induce HR without the complete elimination of NHEJ.

80. ASSESSMENT OF THERMODYNAMIC PROPERTIES OF CARBON NANOTUBES (CNTS) AND HYDRATED C60 FULLERENES (C60HYFN) AS POTENTIAL AGENTS TO SUPPRESS REACTIVE OXYGEN SPECIES

C. Yoon.

Oxidation of the neural tissues in human brain causes neurodegenerative disease; however, information on the sub-cellular localization of oxidative molecules is not provided in detail thus far. It is highly desirable to visualize the activities of Reactive Oxygen Species (ROS) in living cells on a microscopic level for the proper mechanism of the role of peroxidation. Multiple pathways through oxidative stress can produce cell injury; and thus, the oxidative reactions in biomembranes are particularly important. It can result in the impairment of lipid–protein interation and modification and fragmentation of membrane proteins as well, thereby leading to the cell injury and aging. A free-radical chain reaction capable of propagating in space is the major oxidative reaction in biomembranes. In this paper, the functionalized Carbon Nanotubes(CNTs) and hydrated C60 Fullerenes(C60HyFn) molecules were thermodynamically studied to determine whether the molecules stabilize or destabilize the molecules. The Auto Optimize Tool in the computational software was used for each Carbon Nanotubes(CNTs) and hydrated C60 Fullerenes(C60HyFn) derivatives modeled in this project to determine its optimization energy. The Universal Force Field (UFF) option was selected for all the molecules modeled.

81. N100 AND P50 SUPPRESSION IN SCHIZOPHRENIA AND BIPOLAR DISORDER: EFFECTS OF TIME BLOCKS

M. Yun and J. Patterson. University High School.

Sensory gating, the process in which the brain filters out irrelevant stimuli, was assessed by paired auditory stimulus paradigms of N100 and P50, two evoked auditory potential waves appearing approximately 100 and 50 milliseconds, respectively, after the administration of the stimulus. Schizophrenic and bipolar patients tend to demonstrate difficulty with processes of sensory gating. This study was undertaken to evaluate whether or not the sensory gating paradigm diminishes during successive trial blocks in normal, schizoaffective, paranoid schizophrenic and bipolar disorder patients. N100 and P50 potentials were collected from individuals diagnosed with schizoaffective disorder (n = 34), paranoid schizophrenia (n = 31),
bipolar I disorder (n = 31) and controls (n = 30) using DSM-IV criteria and the Structured Clinical Interview for DSM-IV. N100 gating ratio, the amplitude of the evoked potential at 100 milliseconds to the second of two paired clicks divided by the response to the first, demonstrated a significant main effect for trial block (F = 5.25, p = 0.0237). P50 gating ratios had a significant group by channel interaction (F = 2.68, p = 0.0156). Peak difference, a peak-to-peak analysis between N100 and P50, demonstrated a significant block by click interaction (F = 7.58, p = 0.00681). Peak difference between S1 and S2 was only significantly different during the first half of trials and not during the second half of trials. The gating ratios and peak differences could provide significant new contributions to the sensory gating literature by providing a biological marker for schizophrenia and bipolar disorder.

82. EFFICIENT BINOMIAL CHANNEL CAPACITY COMPUTATION WITH AN APPLICATION TO MOLECULAR COMMUNICATION

E. Wesel¹, R. Wesel², L. Vandenberghé², C. Komninakis³, and M. Medard⁴. ¹Harvard-Westlake School, ²University of California, Los Angeles, ³Qualcomm, ⁴Massachusetts Institute of Technology.

This paper develops an efficient method to compute the binomial channel capacity and applies it to the molecular channel. The binomial channel (with parameter n) takes the success probability for a Bernoulli trial as input and produces the number of successes in n trials as output. The input alphabet is the unit interval and the output alphabet is the set of integers from zero to n. Despite the fact that the input alphabet is uncountably infinite the capacity-achieving input distributions turn out to have a small finite support that evolves gracefully as n increases. The ellipsoid algorithm was previously used to compute the binomial channel capacity, but convergence is rather slow even with a well-chosen initial condition. The Dynamic Assignment Blahut-Arimoto (DAB) algorithm starts with the capacity-achieving mass point locations for the n−1 case and exploits Csiszar’s Min-Max Capacity Theorem to check convergence and adjust mass point locations to achieve a much faster convergence rate, unlocking the potential for the capacity and corresponding input distribution to be computed for larger values of n.

83. STRATEGY TO DEFINE THE IMMUNO-MODULATORY ROLE OF DEC-205 DCS IN LIMITING INFLAMMATION DURING WNV ENCEPHALITIS

S. Noori, J. Rezendes and D. Durrant. California State Polytechnic University, Pomona.

West Nile virus (WNV) is an emerging mosquito-borne flavivirus that continues to cause infection and disease. Although WNV is usually controlled in the periphery, it can spread to the central nervous system (CNS), where infection of neurons and induction of inflammation can lead to encephalitis and death. While the recruitment and function of antiviral T lymphocytes are necessary for limiting WNV pathogenesis, inflammation must be tightly controlled to prevent inflammation-mediated damage of neurological tissue. We recently identified a subset of dendritic cells (DCs) within the CNS that express the DEC-205 endocytic receptor during WNV encephalitis. These cells had a key role in restricting viral entry and replication in the CNS. However, how these cells establish protection without creating neuronal destruction is unknown. Here we aim to define the immuno-regulatory role of these cells during WNV neuro-invasive disease by utilizing a murine model of WNV encephalitis. The animals used in this study will have the DEC-205 receptor gene deleted from all relevant tissues which will be accomplished
through breeding strategies. Once we have an established colony deficient for the DEC-205 gene (DEC-205 KO), we will induce WNV encephalitis and then assay WNV infection, replication, and neuronal injury from their CNS tissues. These data will clarify the immunomodulatory role of DEC-205 DCs during WNV encephalitis. Strategies to exploit these cells in the activation of host defense programs should lead to further investigations as novel therapeutic approaches against neuro-invasive viral disease.

84. CONSEQUENCES OF NICKEL EXPOSURE ON GENE EXPRESSION IN CULTURED CELLS

Lung cancer is the leading cause of cancer deaths. Although smoking increases an individual’s chance at developing lung cancer, 40% of lung cancers are not smoking-related; they are instead driven by genetic and epigenetic factors. By understanding the genetics and epigenetics impacting cancer risk and progression, we may allow for more accurate prediction and progress towards personalized medicine. Nickel is a common environmental contaminant known to contribute to the development of lung and other cancers. Nickel affects epigenetic regulation. However, the exact mechanism is not yet known. By treating established cell lines with nickel, I have concluded that cells treated at high nickel concentrations exhibit growth and metabolic inhibition. Furthermore, exposing Beas 2B bronchial epithelial airway cells to 150µM nickel for 24 hours has revealed changes in gene expression possibly involved in increased lung cancer risk.

85. GARLIC'S (ALLIUM SATIVUM) IMMUNOMODULATORY EFFECTS ON CYTOKINE SECRETION FROM LPS AND CANDIDA ALBICANS INDUCED MACROPHAGES
§ B. Soto and N. Buckley. California State Polytechnic University, Pomona.

Historical documents from ancient societies mention the usage of garlic (Allium sativum) as a medicinal agent; some modern cultures continue to use garlic for medicinal purposes. The century spanning usage of garlic as a medicinal agent suggests that garlic may have biological effects, including effects on immunity. Macrophages perform several key functions in the first-response of the immune system including release of cytokines. Cytokines are signaling molecules secreted by immune cells to direct the response of neighboring cells to the challenge. Such cytokines include the proinflammatory tumor necrosis factor-alpha (TNF-α), interleukin (IL)-1 , and IL-6. This study characterizes the effects of an aqueous garlic extract on cytokine production in J774A.1 (J7), RAW 264.7 (RAW), and murine thioglycollate-induced primary (TG) macrophages when challenged with lipopolysaccharide (LPS) and Candida albicans. LPS is a component of the outer membrane of gram negative bacteria. Candida albicans is an opportunistic yeast pathogen responsible for many hospital borne illnesses in immunocompromised individuals. Enzyme linked immunosorbent assay (ELISA) analysis shows that garlic increases LPS induced TNF-α secretion in J7 and male and female TG macrophages, but not in RAW macrophages. Additionally, garlic decreases C. albicans induced TNF-α secretion in J7, RAW, and male and female TG macrophages. These results suggest that garlic’s effects on TNF-α secretion in macrophages is cell line dependent and challenge dependent. Preliminary quantitative reverse-transcriptase polymerase chain reaction (RT-qPCR) data
suggests that garlic does alter TNF-α, IL-1, and IL-6 mRNA levels, but more results are incoming.

86. ANALYZING THE ROLE OF GLI1+ CELLS IN SUTURE REGENERATION


Craniosynostosis is a condition in which a suture on the calvaria fuses during early development, causing abnormal skull growth. Currently, surgeons alleviate these conditions by excising the calvarial bone to adjust the shape of the skull. Stem cell technology has great potential in helping patients with craniosynostosis: ideally, transplanting a population of stem cells in the calvaria would create a suture in patients who otherwise could not form their own. Previously in our lab, it was determined that Gli1+ stem cells regulate the regeneration factor of the calvarial bone. To understand the limits of sagittal regeneration, we removed the entire suture and discovered that it mostly regenerated after 3 weeks, which shows the potential of being able to apply stem cells to a host so they can develop a suture.

87. SCREEN PRINTED FLEXIBLE CARBON NANOTUBE THIN-FILM TRANSISTORS


The characteristics of semiconducting single-wall carbon nanotubes proves to be the ideal materials to be used in printed electronics because they have superb printability, suitable electrical and mechanical properties. Thus, semiconducting single-wall carbon nanotubes have a prospective role for flexible electronics. Despite these beneficial features, it proves to be difficult to cultivate cost-efficient and scalable methods for producing thoroughly printed, superior quality single-wall carbon nanotube thin-film transistors. One method, screen printing, is uncomplicated, inexpensive, and scalable. This technique can produce both inelastic and bendable single-wall carbon nanotubes. The printed nanotube thin-film transistors display adequate performance on flexible and firm substrates. Due to the ability of the fully screen-printed single-wall carbon nanotube thin-film transistors to exhibit high quality performances, it is reasonable to believe that screen printing will be an affordable, dependable, and scalable technique to producing outstanding nanotube thin-film transistors. The nanotube thin-film transistors produced via screen printing may be used in display electronics. In addition, this procedure may also be used to construct thin-film transistors from other materials for other types of display electronics and flexible macroelectronics.

88. A CLINICAL AND GENOMIC INVESTIGATION OF STRESS AND DEPRESSION IN YOUNG ADULTS

¥ T. Han, J. Patterson. Walnut High School.

Depression is a serious mental illness that is often associated with stress and suicide. It is a mood disorder that is regularly said to cause a loss of interest and a persistent and overwhelming feeling of constant sadness. Past findings have proposed multiple factors that may be related to depression. In this study, these proposed factors, specifically gene expression and environmental stress, were explored to determine their association with depression. This study expands on current knowledge of specific genes being associated with depression, as well as environmental
and personal stressors that can alter gene expression and predict depression. We investigated the expression of the FK506 binding protein 5 (FKBP5) gene, which has been associated with depression, treatment response and early childhood adversity. The participants were administered rating scales assessing levels of stress, childhood trauma, anxiety, hopelessness, and severity of depression in order to study their association with gene expression and diagnosis. Participants included 25 healthy controls and 27 subjects diagnosed with major depressive disorder; including 19 males and 33 females. Significantly higher scores were found for the MDD compared to the control group for the scales measuring depression, childhood trauma and adverse events, anxiety and stress, and hopelessness. The correlation between FKBP5 and total Adverse Child Events (ACE) score approached significances (p=0.09) for the MDD group. There were no significant correlations between FKBP5 and the clinical scales in the control group. These findings indicate that adverse child events can be an important predictor of future depression.

89. COMPARATIVE ANALYSIS OF ALZHEIMER'S GENE DATA UTILIZING NONNEGATIVE MATRIX FACTORIZATION

The purpose of this study was to evaluate urchin abundances and compare abundances to historical data from past studies. Populations of the two common Southern California sea urchins (the purple sea urchin, Strongylocentrotus purpuratus and the red sea urchin, Strongylocentrotus franciscanus) were studied. Both of these species have been well characterized in past studies. However there have been recent reports suggesting a decline in abundances of these two ecologically important species. Sea urchins are important because they control the abundance of macroalgae, so a change in abundances could shift the ecosystem. A hypothesis was tested that the average size and abundance of urchins will be similar between these two study sites and comparable to historical abundances. Transect surveys were used on multiple dates to evaluate urchin abundance and size distribution at two locations: Abalone Cove and Whites Point. Counts were made for all urchin species present using a transect line and quadrat grid placed every 2m. The average sizes of the sea urchins were similar at both Whites Point and Abalone Cove, but there was a higher density of urchins in the lower tidal zone with primarily juveniles in the higher tidal zone. At both sites urchins were significantly more abundant in lower tidal zones. Although these two sites are very geographically close, population structure of urchins differed. The abundances were also significantly lower that historical records would suggest. This has potential significant effects for macroalgal community structure in the intertidal zone.

90. ICORDISX: SMARTPHONE-BASED PERSONALIZED CARDIAC MONITORING USING COMPUTER VISION AND BLUETOOTH LOW ENERGY

Heart disease is a prevalent issue in the modern world, with 84 million people in the US alone that require regular checkups with clinicians. iCordisX aims to provide a personalized and data-driven supplement for cardiac anomalies that acts as a dependable healthcare interface for wireless ECG monitors. Compatible with both iOS and Android mobile operating systems, iCordisX is accessible to 77% of adults. By operating through the Bluetooth Low Energy platform (iOS) and all sectors of Bluetooth (Android), iCordisX can connect to a common variety of wireless cardiac monitors, and receive electrocardiogram data directly from the
wireless link. Through a personalized account system, users will be able to keep track of their heart health data from day to day via personalized features, and monitor trends over time as stored on a web server. The app also provides options for a monitoring and a diagnosis mode, the former of which will recognize anomalies in real time, and the latter which is meant to acquire detailed statistics from the received data. The monitoring model was verified via a MATLAB program, and the MIT-BIH database for normal sinus rhythms was used as the baseline comparison data.

91. NEUTRAL RED AND CRESYL VIOLET AS COUNTERSTAINS FOR THE NADPH-DIAPHORASE HISTOCHEMICAL REACTION

§ Z. Khan, J. Wong, A. Mardia, and G. Kageyama. California State Polytechnic University, Pomona.

Nicotinamide adenine dinucleotide phosphate diaphorase (NADPH-d) histochemistry is used to study nitric oxide (NO) synthesizing nitrergic neurons. The NADPH-d histochemical technique beautifully stains the entire neuron, including the dendrites, soma and extensive axon arborizations. Because other neuronal or supporting cell types are not stained by this technique, it is not possible to know exactly where these neurons and axon arbors are located relative to other neurons. It would be desirable to find a counterstain that provides a clear visualization between the stained nitrergic neurons and the other cell types located in the same area. The NADPH-d histochemical technique involves the formation of a dark blue formazan reaction product from nitro-blue tetrazolium (NBT). Unfortunately, formazan tends to be lost during standard procedures for Nissl counterstaining. By minimizing the exposure of the formazan reaction product to lower grades of ethanol, we have developed two Nissl counterstaining protocols that are suitable to use with the NADPH-d reaction. The first protocol allows the visualization of dark blue NADPH-d stained neurons in relation to lighter blue Cresyl Violet (Nissl) stained cells. The second protocol shows more contrast between dark blue stained NADPH-d neurons and Neutral Red stained neurons. The new staining protocols will enable one to quantitate the percent of NADPH-d stained neurons in a given area, and determine how the NADPH-d nitrergic axons relate to different neuronal nuclei, layers and blood vessels.

92. A MICROFLUIDIC DEVICE FOR PLASMA SEPARATION FROM WHOLE BLOOD SAMPLES USING ACOUSTIC MICROVORTEX

¥ S. Liu. Arcadia High School.

Human blood plasma has shed light on better diagnostics and treatment towards hundreds of diseases. However, separation of plasma from blood is crucial as hemolysis occurs (the rupture of blood cells and release of hemoglobin) leading to the release of different analytes which will throw off plasma tests and skew results. The current benchtop standard for blood plasma separation includes centrifugation. However, centrifugation suffers from its bulky and expensive design, and inability to be integrated with downstream detection. In my project, a novel microfluidic technology (acoustic microvortex) for plasma separation from whole blood solution was successfully developed. It relies on the principle of air bubble induced acoustic microstreaming to capture and filter out the blood cells from the blood sample, resulting in pure plasma at the outlet of the microchannel. The device was fabricated using soft lithography and has channels with lateral cavities that store air bubbles. When the air bubbles were acoustically...
agitated at 16 kHz, it created acoustic microstreaming. The swirling fluidic vortices generated by acoustic microstreaming created a spinning effect, similar to conventional centrifugation. By utilizing different physical and hydrodynamic properties of blood cells and plasma, I was able to successfully separate plasma from the rest of the blood components. Experiments demonstrated this device able to successfully separate plasma from a whole blood solution with a 31.8% yield and 99.9% efficiency, comparable with a centrifuge but significantly higher than the other microfluidic technologies for blood plasma separation. This device has many advantages over the current plasma separation technologies: high separation yield and efficiency, no channel clogging, no moving part, inexpensive, small, easy to integrate with downstream detection, no blood dilution required, etc.

93. CROSS TRANSPLANTATION OF PERICHONDRIAL SKELETAL PROGENITOR CELLS INTO A RIB BONE RESECTION USING THE MOUSE MODEL

¥ A. Garcia. Francisco Bravo Medical Magnet High School.

The perichondrium, a thin layer of connective tissue surrounding the costal cartilage, houses skeletal progenitor cells that can proliferate and form cartilage cells. The bone portion of the rib heals fractures by first generating a cartilage callus, which is later remodeled to bone. We hypothesize that cartilage progenitor cells in the perichondrium can help the bony rib generate a cartilage callus in response to injury. We tested this by conducting cross-transplantation surgeries in mice, where we transplanted the perichondrium of an RFP-labeled mouse into the bone injury of a GFP-labeled mouse. To analyze tissue, we used techniques such as cryosectioning, immunofluorescence microscopy, and H&E staining. We found that there was little to no participation of transplanted cells in the bone repair, suggesting that perichondral progenitor cells do not enhance bone regeneration.

94. PREDICTING PROTEIN STRUCTURES THROUGH ENERGY MINIMIZATION BY VECTOR OPERATIONS FOR PEPTIDE DRUG DESIGN

¥ M.C. Xu¹, S. White². ¹Arnold O. Beckman High School; ²Department of Physiology and Biophysics, University of California Irvine.

Proteins regulate a wide array of cellular processes that make up the basis of life. In order for a protein to function, its tertiary and quaternary structures must interact with each other at the molecular level. To gain a deeper understanding of the protein’s many functions, the structure of the protein must first be thoroughly studied. Experimental methods such as nuclear magnetic resonance (NMR) and X-ray crystallography can reveal the complex protein structure, though these methods are labor-intensive. This research provides a computational method for predicting a protein’s three-dimensional structure from just its amino acid sequence by studying the stability of a folded conformation. Using the Ising model to characterize the protein folding energy, this research solved the α-carbon backbone conformation on the lattice grid through ant colony optimization. The specific amino acids with their side chains were then placed on their respective α-carbon backbone positions and adjusted to minimize the overall energy. The computational predictions were compared with the experimentally-determined structures of the same proteins obtained from the Protein Data Bank in order to validate structural homology. Results show that the computationally-determined structures were in close agreement with the experimental structures. This method can be applied to the drug design industry, predicting and
facilitating the arrangement of amino acids so that the most effective drug can be created based on stability.

95. LET'S TAKE A WALK IN OUR INFAUNAL ‘WOODS’ AND LOOK AT THEIR ‘TREES’
D.C. Lees, Littoral Ecological & Environmental Services.

Research in the mid-1900s transformed infaunal ecology from a discipline focused primarily on longeuous megafauna, likely the most productive and influential inhabitants in most sedimentary ecosystems, to a field concentrating on ephemeral macrofauna. In 1974, we conducted a study in so. California that compared megafaunal and macrofaunal species composition, density, biomass, etc., at depths between 14m and 55m. It evaluates the validity of conventional approaches. The study reveals fundamental differences between megafaunal and macrofaunal assemblages in this study area and demonstrates our lack of knowledge regarding a diverse range of infaunal variables. Only four of >520 macrofaunal taxa identified were observed among >150 megafaunal taxa. Macrofaunal organisms were ≈80 times more common than megafaunal organisms, but estimates for megafaunal biomass and secondary production indicate that megafauna contributed substantially more to higher trophic levels. Average life spans for megafaunal organisms were nearly eight times longer than for macrofauna, implying greater stability. Megafaunal assemblages had greater numbers of “ecosystem engineers”. The study indicates that infaunal resources are severely undervalued in studies limited to macrofauna. Some claim: ‘The soft-sediment seafloor of the open continental shelf is among the least-known biomes on Earth…’ Differences observed in this study suggest that megafaunal studies should provide greater insight into dynamics and conditions in these poorly known biomes, and have greater power to predict or assess recovery or responses to environmental change or degradation.

96. SPATIAL VARIATION IN LIFE-HISTORY CHARACTERISTICS OF A NON-FISHED POMACENTRID, HYPSYPOPS RUBICUNDUS, IN THE SOUTHERN CALIFORNIA BIGHT
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Recent studies conclude that varying ecological and environmental processes (e.g., temperature, habitat, productivity, fishing pressure, predation, and density-dependent interactions) introduce spatial variation in marine fish life-history characteristics. The Southern California Bight (SCB), has a unique current circulation pattern which, when coupled with the complex bathymetry, results in strong abiotic gradients and diverse microhabitats. In addition, a variety of man-made structures (i.e., breakwalls, jetties, artificial reefs, and oil platforms) around the area also provide an artificial source of hard-substrate habitats for many reef-associated fishes. Prior studies of spatial differences in life-history parameters for fishes in the SCB have concentrated on fished species. The Garibaldi (Hypsypops rubicundus), is a marine damselfish native to the shallow kelp forests and rocky reefs of California and Baja Mexico. As the State Marine Fish of California, this species has been fully protected since 1995. By focusing on a historically protected species, we can determine how spatially explicit environmental and ecological factors are shaping patterns in growth and longevity, without the impact of fishing. Garibaldi were collected from each of seven ecologically and environmentally distinct locations in the SCB,
where they are known to be abundant. Paired natural and man-made habitats within each location were sampled, if available. Otolith-based ageing is used to assess if Garibaldi age, growth, and mortality patterns vary by location, mean annual sea surface temperature, reef type (natural/man-made), and/or sex within the SCB.

97. LONG TERM TRENDS OF NEARSHORE ICHTHYOPLANKTON OF KING HARBOR, REDONDO BEACH 1974-2017
§ S. Hardisty, M. Robart, C.M. Williams, J.P. Williams, and D.J. Pondella. Occidental College.

The Vantuna Research Group at Occidental College has conducted monthly ichthyoplankton tows in King Harbor, Redondo Beach from 1974 to present as part of an ongoing 100-year project. Sampling was performed using a 333-µm mesh standard conical meter net at five locations during daylight, twilight, and night in King Harbor. Eggs and larvae were sorted from the sample and were identified to the lowest possible taxonomic order. The most common larval taxa identified include Hypsoblennius sp., Paralichthys/Xystreurys sp., Hypsypops rubicundus, Genyonemus lineatus, Engraulis mordax, Lythrypnus sp., and Seriphus politus. Egg and larval abundance in ichthyoplankton are indicators of shifts in adult populations and response to oceanographic indices. These indices involve oceanographic fluctuations such as the 1976-77 regime shift, El Niño/Southern Oscillation cycling, Pacific Decadal Oscillation, and North Pacific Gyre Oscillation that induce variability in recruitment strength and subsequently ichthyoplankton production. The Multivariate ENSO Index (MEI) merges oceanographic metrics to describe ENSO fluctuations, and the Cumulative Upwelling Index (CUI) is a measure of the volume of upwelling that occurs. These data suggest that historical rise in sea surface temperatures may contribute to the overall decline in ichthyoplankton abundance, and shift in biodiversity (S), over the last four decades.

98. PRELIMINARY STUDY OF FERTILITY AND JUVENILE SURVIVAL IN ARMADILLIDIIUM VULGARE, A TERRESTRIAL ISOPOD
§ S. Tran and B. Ripley. Grossmont College.

The terrestrial isopod Armadillidium vulgare is commonly observed dispersing between landscaping areas on the Grossmont College campus. We were interested in investigating the metapopulation dynamics of this species, such as which habitat patches on campus are sources (high population growth rate) versus sinks (low population growth rate). We made preliminary estimates of the demographic parameters of clutch size, growth and juvenile survival rates for a small sample of females. We collected pregnant females and kept them in isolation where they were observed until parturition then we counted the mancae weekly for 12 weeks in summer and fall 2017. The average clutch size was 40.30 mancae (±14.77 standard deviation). The summer experiment had a 100% mortality rate by the second week. We concluded that soil was necessary for survival of offspring and with different culture methods, the average juvenile survival rate in fall was 72.15%. The presence of the mothers seems to contribute to manca survival as well. There was also an observable difference in the growth rate between the isolated clutches and in bulk cultures, which we are investigating further. With successful methods for rearing mancae determined, we can now compare clutch size and survival of offspring from different habitat areas to determine their quality.
99. METAZOAN PARASITES OF CALIFORNIA GRUNION LEURESTHES TENUIS IN SOUTHERN CALIFORNIA
B. Passarelli. University of California, Los Angeles.

The California grunion *Leuresthes tenuis* is a beach-spawning fish endemic to California, U.S.A., and Baja California, Mexico. *Leuresthes tenuis* is an iconic marine fish of California due to its reproductive habits. During spring and summer months, thousands of people go to the beach late at night to watch these fish reproduce. These events are called grunion runs. The core of the geographic range of *L. tenuis* is southern California, between Santa Barbara and San Diego. In this highly urbanized area, coastal construction, beach grooming, and pollution negatively impact the sandy beaches where grunion spawn. Metazoan parasites can be important indicators of the health of their hosts and ecosystem. While broad patterns of the relationship of *L. tenuis* with their parasites are known, important details still need to be investigated. Parasites have been reported infecting *L. tenuis* but these reports are from over forty years ago and need to be reviewed and updated. Previously reported parasites include monogeneans, digeneans, and crustaceans. Six crustaceans have been reported to infect *L. tenuis*: a branchiuran *Argulus melanostictus*, three copepods *Bomolochus cuneatus*, *Caligus olsoni*, and *Clavellopsis* sp., and two isopods *Elthusa (=Lironeca) californica* and *Nerocila acuminata (=californica)*. At least two of the copepods, *C. olsoni* and *B. cuneatus* need to be re-described to meet today's description standards. This project will identify, review, and determine quantitative descriptors (prevalence, mean intensity, and abundance) of metazoan parasites infecting *L. tenuis* at five localities in southern California.

100. A NEW SPECIES OF LEPEOPHTHEIRUS (COPEPODA; CALIGIDAE) INFECTING THREE KELPFISH SPECIES (CLINIDAE) FROM SOUTHERN CALIFORNIA

A new copepod species, *Lepeophtheirus schaadti* n. sp., is established based on female and male specimens removed from the body surface of the Giant Kelpfish, *Heterostichus rostratus*, and Striped Kelpfish, *Gibbonsia metzi*, captured at Inner Cabrillo Beach in southern California, USA. In addition, examination of copepod specimens previously identified by Wilson (1935) as *L. parviventris* from the Spotted Kelpfish, *Gibbonsia elegans*, in Newport Bay, California, revealed they are conspecific with *L. schaadti* n. sp. The new species differs from its congeners by a combination of characters that include: female with a genital complex that is more than half the length of the cephalothoracic shield and with posterolateral lobes, an abdomen that is composed of one somite and is less than one-quarter the length of the genital complex, a maxillulary dentiform process bearing a thin ridge on the inner tine and lacking a basal knob, no myxal process on the maxilliped, apically rounded tines on the sternal furca, the spine on the first exopodal segment of leg 3 inserted distally on the basal swelling, a 3-segmented leg 4 exopod, and a broad inner lobe of leg 5 that does not extend beyond the posterior margin of the genital complex; and male with three accessory claws on the antennal endopod and no myxal process on the maxilliped. *Lepeophtheirus schaadti* n. sp. is the fourth ectoparasitic species reported from the Giant Kelpfish as well as the first ectoparasitic species reported from the Striped Kelpfish and Spotted Kelpfish.
101. PREVALENCE AND INTENSITY OF PORCELLIDIID COPEPODS ASSOCIATED WITH BLUEBAND HERMIT CRAB (*PAGURUS SAMUELIS*) AT SIX SOUTHERN CALIFORNIA LOCATIONS, AND THEIR POTENTIAL RELATIONSHIP TO THE CO-SYMBIONT LIMPET (*CREPIDULA WILLIAMSI*). J. Morris¹ and J. Passarelli². ¹Rowland High School and ²Cabrillo Marine Aquarium.

The symbiotic relationship between copepods belonging to the family Porcellidiidae and their hermit crab hosts in the eastern Pacific remains poorly known. The present study marks a two-year investigation into the prevalence and intensity of an unidentified species of porcellidiid copepod associated with the bluebanded hermit crab (*Pagurus samuelis*). Three sites along the Palos Verdes Peninsula were studied in Year 1 (Malaga Cove, Pt. Fermin, and Cabrillo Outer Beach). In Year 2, three additional localities were added (Golden Cove, Founders Park, and White Point). From October 2016 to February 2018, we sampled 800 hermit crabs dwelling in a variety of gastropod shells. The number of symbiotic copepods was recorded along with the presence of an additional symbiont, the limpet *Crepidula williamsi*, living inside the host shell. The overall prevalence and mean intensity of copepods remains significantly higher at Pt. Fermin (71.7%, 9.0) compared to Cabrillo Outer Beach (16.2%, 6.0), Golden Cove (13.0%, 4.2), Founders Park (13.0%, 11.5), White Point (6.0%, 1.2), or Malaga Cove (0%, 0) (Fishers Exact, p<0.0001). The copepod prevalence and mean intensity varied seasonally throughout the sampling period at Pt. Fermin (Fishers Exact, p<0.0001). Further, a significant relationship was observed between the intensity of copepods and the presence of limpets (Pearson Correlation = 0.543, p<0.001). The results of this two-year study reveal greater insight into the ecology of porcellidiid copepods on hermit crab hosts in the eastern Pacific.

102. RESPONSE OF VERTEBRATES TO FIRE IN NATIVE SAGE SCRUB HABITAT E. Harris. Pomona College.

Fire is a critical component of Southern California ecosystems. Regularly occurring fires recycle nutrients, increase biodiversity, and reduce fuel loads. They also influence vegetation structure that may lead to secondary effects on vertebrates. In this study, I examined the response of vertebrates to two fires at the Bernard Field Station (BFS) in Claremont, CA. Using camera trapping, I monitored species at the BFS starting in June, 2015, continuing for 29 months. I compared species abundance and community structure in unburned habitats and burned habitats as well as examined specific habitat preferences of each species captured during the study. In the first year following the fire, communities in burned and unburned habitats were significantly different (p<0.05). Most bird species and woodrats were captured significantly more frequently at unburned sites than burned sites throughout the entire study period. However, Mourning Doves were captured more frequently at burned sites than unburned sites throughout the entire study period. Other species showed less consistent patterns across time. Desert cottontails were initially captured more frequently at burned sites until one year after the first fire. They were then captured more frequently at unburned sites until the second fire, when they were again captured more frequently at burned sites. Coyotes were also more frequently captured at burned sites and continued to be captured more frequently at burned sites for many months of the study period. This research has important implications for management strategies, as it provides essential information about how different species respond to fire.
103. UNDERSTANDING FLOWER DEVELOPMENT AND FLORAL ORGAN ABSCISSION IN *AQUILEGIA* AND *DELPHINIUM*

§ B. Sharma and T. Batz, Cal Poly Pomona

*Aquilegia* and *Delphinium* are genera of the basal eudicot family Ranunculaceae with a diversity of 60 and 300 species respectively. Species of both these genera have acquired diverse habitats. The resulting adaptations include variations in inflorescence architecture, floral organ morphology, and timing of organ abscission. Both these genera have horticultural species, either grown for pot flower (*Aquilegia* species) or cut flower (*Delphinium* species) markets. For the business of floriculture, timing is the key, sales are largely focused on holidays, and any delay or unexpected decrease in production can pose heavy financial losses. A second risk is related to shelf life of flowers post-harvest as the petals and sepals dehisce especially if the flowers travel far to market. In our current study, using *Aquilegia coerulea* as a model system we are tracking developmental and genetic changes in shoot apical meristem as it transitions from a vegetative meristem to a floral meristem. Results from developmental and genetic studies in Aquilegia can help shorten and manage the time to flower in popular horticultural plants. To address the second issue, we are investigating formation of abscission zone in *Delphinium* flowers. *Delphinium* flowers experience organ shattering within a few days of flower opening. Organ shedding in cut flowers makes them unattractive to buyers. The results from the developmental studies in *Delphinium* are geared to better understand the timing of organ abscission. Studies in both these systems can help understand and address two critical problems in floriculture industry.

104. AMPHIBIAN MICROBIAL DIVERSITY ACROSS AN URBAN-RURAL GRADIENT

§ M. Basam, S. Goffredi, and A. Zellmer. Occidental College.

Amphibians are hosts to cutaneous symbiotic bacteria and other microbial species that play a crucial role in the health and ability of amphibians to defend themselves against life-threatening pathogens, such as chytrid fungal pathogens. Previous research has demonstrated that the environment in which amphibian populations are present is associated with the microbial diversity found on their skin, possibly by providing a reservoir for microbial species. As a result, the environment may play an important role in mediating susceptibility to skin pathogens. Here we test whether environmental differences can be detected across an urban to rural gradient in Los Angeles. Compared to rural populations, urban amphibian populations may be more isolated, have higher exposure to pesticides, and be exposed to more pathogens due to urban run-off and proximity to the pet trade. Therefore, we expect amphibians in more urban environments to have distinct skin microbiomes, with potentially reduced microbial diversity and increased prevalence of pathogenic microbes relative to more rural populations. To test this hypothesis, we collected skin microbial samples and soil samples across the different habitats from multiple amphibian species and test for differences in skin microbial communities across this environmental gradient. Our results demonstrate that microbial community composition is associated with both the amphibian species sampled and environmental differences across sampling sites, with variation in microbial composition along the urban to rural gradient. We discuss the implications of these results in the context of emergent global amphibian pathogens.
105. FROM VENOME TO SYNDROME, AND SYNDROME TO VENOME: CORRESPONDENCE OF RATTLESNAKE VENOM COMPOSITION AND CLINICAL SYMPTOMS OF SNAKEBITE

W. Hayes1, A. Corbit2, E. Gren1, A. Cooper1, C. Cochran1, G. Fox1, C. Person1, W. Kelln1, K. Kim, M. Lee, Z. Travis1, B. Gardner, and A. Ruha1. 1Loma Linda University, 2Southern Adventist University, and 3Banner Good Samaritan Medical Center.

Rattlesnakes possess highly variable venoms that cause severe systemic and local tissue effects in human snakebite victims. We sought to determine the degree to which different clinical symptoms could be attributed to variation in snake venom composition. To characterize venom variation, we subjected the crude venoms of seven southern California rattlesnake taxa to high-pressure liquid chromatography (HPLC) fractionation, which allowed us to identify the relative composition of major toxin families. We also assigned snakebite severity subscores (SSsS), including local wound, cardiovascular, respiratory, gastrointestinal, hematological, and neurological symptoms, to 166 envenomated patients presenting at the LLU Medical Center with bites from identified snake species. Analyses demonstrated a high correspondence between venom composition and clinical symptoms, indicating that venom composition could be inferred from clinically symptoms. We applied reverse inference to two unusual envenomation cases for which clinical symptoms were highly unexpected for the confirmed species that bit the patients. Because neither of the two offending snakes was available to examine venom composition, we sampled other snakes from the same populations. For the case of neurotoxic envenomation by a Sidewinder (Crotalus cerastes) in Arizona, no snakes from the vicinity possessed Mojave toxin, a presynaptic neurotoxin, in their venom. Similarly, for the case of proteolytic envenomation by a Mojave Rattlesnake (Crotalus scutulatus) in California, no snakes from the vicinity possessed snake venom metalloproteinases. These findings offer valuable insights on the treatment of envenomation and limitations to inferences regarding the correspondence of venom composition and clinical symptoms of snakebite.

106. EFFECTS OF INVASIVE ANNUALS ON SOIL CARBON AND NITROGEN STORAGE IN SOUTHERN CALIFORNIA LOWLAND AREAS ALONG SPATIAL AND TEMPORAL GRADIENTS

§ T. Caspi and W. Meyer. Claremont McKenna College and Pomona College.

While non-native plant invasions are considered threats to biodiversity, the impact of invasions on nutrient cycling processes, particularly in soil, are often overlooked. In southern California, California sage scrub (CSS), the native shrub-dominated habitat type in lowland areas, has decreased to under 10% of its original distribution largely due to type-conversion to non-native annual grasslands. Preliminary studies suggest that this negatively impacts C and N storage, but our ability to predict the consequences of largescale type-conversion on regional nutrient budgets remains limited. We identified key factors controlling regional soil C and N storage by assessing how composition of the invading plant community, microbial abundance, and soil conditions impact storage capacity in surface soils of adjacent native and invasive habitat types at nine sites along a coast to inland gradient. We found that the impact of type-conversion on nutrient storage was contingent upon the identity of the invader. CSS stored more C and N than adjacent non-native grassland habitats, but sites with non-native habitats dominated by Brassica spp. had similar nutrient concentrations to CSS. Across the gradient, we found that total C and N
increased in sites with high cation exchange capacities and bacterial concentrations and decreased with pH, which was higher in invasive habitats. We calculate that > 925 tons of C and > 60 tons of N per km² are lost when CSS converts to grass-dominated habitat, indicating that non-native grass invasions are a significant regional contributor to greenhouse gas emissions.

107. THE EFFECTIVENESS OF CHRYSEOBACTERIUM INDOLOGENES ON BATRACHOCHYTRIUM DENDROBATIDIS IN VITRO
D. Wheeler. California State Polytechnic University, Pomona.

Approximately thirty percent of amphibians are affected by chytridiomycosis (chytrid). Chytrid is an infectious disease, caused by the parasitic fungus Batrachochytrium dendrobatidis (Bd). Bd is a serious risk to amphibians globally, as over a hundred amphibian species are extinct due to Bd. One of the most successful lab treatments for Bd was a solution of the bacteria Janthinobacterium lividum. However, J. lividum does not thrive in certain habitats. An alternative treatment is needed. The bacteria Chryseobacterium indologenes shares many characteristics with J. lividum. It is known to survive in a wider variety of habitats relative to J. lividum. The validation of C. indologenes as a prospective treatment option for Bd could lead to the bacteria saving amphibians in natural habitats. The goal of the pilot study was to evaluate the relative effectiveness of C. indologenes and J. lividum in the treatment of Bd. The experiment involved growing Bd on several culture plates and testing the inhibition capabilities of the following treatment groups: C. indologenes, J. lividum and E. coli (control). Areas where Bd growth was inhibited were defined as "zones of inhibition. Bd had greater growth around the control in comparison with C. indologenes. This suggests that C. indologenes is able to inhibit Bd growth. However, there was no established pattern of inhibition in regard to J. lividum versus the control. Since J. lividum is known to inhibit Bd, no definitive conclusions can be drawn. Further research is needed to determine the effectiveness of C. indologenes.

108. HUMMINGBIRD FEEDING HABITS AND INTERSPECIES TERRITORIALITY

Despite their small size, hummingbirds are known to exhibit extreme aggressive behavior, especially when defending a food source. Highly aggressive birds are often more successful in feeding, giving them a selective advantage over less aggressive birds. The purpose of this project is to measure the degree of interspecies aggression in local Allen’s and Anna’s Hummingbirds. As a secondary objective, this project will determine the effect that rising temperatures may have on each species’ aggressiveness. An array of hummingbird feeders was designed to include three dishes: one with an Anna’s hummingbird decoy fixed to it, another with an Allen’s decoy, and a third with no decoy present. A motion-activated game camera was placed in front of the array to capture footage of visits to each feeder. When the footage was reviewed, the species of the hummingbird visiting, the feeder being used, and the temperature were all recorded. Data collection took place in Malaga Cove from July 26 to September 29, 2018. Anna’s Hummingbirds were less aggressive than Allen’s Hummingbirds, as only 6.2% of visits were to the Allen’s decoyed feeder. Allen’s Hummingbirds, on the other hand, showed little preference between the decoyed feeders. Both species, however, preferred the feeder with no decoy present. Furthermore, when temperatures were cross referenced with interspecies feeder visits, it was found that both Allen’s and Anna’s hummingbirds were more likely to visit feeders of the
opposite species’ decoy when temperatures were higher. Because Allen’s Hummingbirds were
found to be more aggressive around food sources than Anna’s Hummingbirds, it follows that as
their ranges overlap due to habitat destruction, Allen’s Hummingbirds will be more
reproductively successful. This raises concern for Anna’s Hummingbirds, especially as
temperatures continue to become more unstable due to climate change.

109. APPLYING THE LOTKA–VOLTERRA MODEL TO THE DYNAMICS OF
CHEMICAL SPECIES WITHIN COMPLEX REACTION NETWORKS

A distinguishing feature of complex systems is the non-linear dynamics relating microstates
within a systems phase space. At thermodynamic equilibrium, the probability of a system
occupying a particular state may be derived from its partition function. However, for complex
systems continuously driven from equilibrium by an external, low-entropy force, it is unlikely
the system settles into a definite probability distribution. Their trajectory through phase space
approaches a dynamical attractor, which is modeled with differential equations rather than
statistical ensembles. The complex systems explored in this paper are chemical reaction
networks, in which the relative frequency of each chemical species is determined by the current
frequencies of the others. We investigate an alternative method to representing this behavior
based on the Lotka-Volterra equations used in ecology to model population. Living species are
replaced with chemical species, and environmental competition is replaced with competition
between parallel chemical processes for common reagents. We show this models connection to
the partition function, illustrating entropys role in both representations. Lastly, we apply this
novel method to chemical networks independently analyzed using traditional methods of
kinematics, and compare the results. In particular, we consider systems with unusual fine-tuning
to their environment, such that they occupy a low-entropy state whose dissipation of free energy
is exceptionally greater than a more typical high-entropy configuration. These low-entropy
systems avoid settling into static equilibria so long as there is a source of free energy, and enable
analysis of the physics governing the emergence of self-sustaining processes found in biology.

110. VASCULARIZATION OF MALE BLUE ROCKFISH (SEBASTES MYSTINUS)
URINARY BLADDERS
A. Cover and H. Jamal. California State University, Fullerton.

Rockfish support one of the largest fisheries in California. Due to overharvesting, the California
Department of Fish and Wildlife began closing the fishery from January to February in 2002 to
protect females giving birth. Many male species of rockfish including blue rockfish (Sebastes
mystinus) display courtship behavior prior to copulation. It has been hypothesized that
pheromones may be released in the urine during courtship, thus playing a role in mate selection.
In another scorpaeniform, pheromone release from the urinary bladder is associated with arterial
vascularization. We hypothesized that male blue rockfish urinary bladders would be larger and
have more vascularization than females. Male blue rockfish (21.23 ± 0.89 cm SL; mean ± SEM;
n = 6) had urinary bladders that were 1.87 ± 0.53 cm in length, whereas females (24.33 ± 1.41
cm SL; n = 6) had urinary bladders that were 0.70 ± 0.15 cm in length. Male urinary bladder
somatic index (urinary bladder weight/body weight; UBI) was significantly (p = 0.004) greater
than female UBI (male 0.162 ± 0.019%, female of 0.022 ± 0.005%). Additionally, erythrocyte
clusters (i.e., blood cells within arteries) were counted within the urinary bladder lumen. Males had significantly (p < 0.0001) greater vascularization within the urinary bladder (males 109.33 ± 4.72 clusters in cross section of the bladder, females 25.17 ± 1.66 clusters). This study increases our understanding of rockfish reproduction and provides a novel approach in investigating pheromone release in teleost fish.

111. GONADAL DEVELOPMENT OF THE BLACK-BELLY DRAGONFISH (STOMIAS ATRIVENTER)
§ S. Zulueta and K. Forsgren. California State University, Fullerton.

The black-belly dragonfish (Stomias atriventer) is a mesopelagic species that has a geographic range in the eastern Pacific Ocean. Aspects of dragonfish life history have been described including general morphology and behavior, biomechanics, and larval development. However, little is known about the reproductive biology of this mesopelagic fish. We sampled gonadal tissues from black-belly dragonfish to describe gamete development. Museum specimens were examined, and fish were caught via mid-water trawls onboard the R/V Yellowfin. The ovaries and testes were dissected, preserved in Bouin's fixative, and histologically processed using paraffin wax. We determined the volume of ovarian follicles of various stages of development: primary ovarian follicles were 0.1193 ± 0.008 mm³, secondary ovarian follicles were 1.1 ± 0.08 mm³, and tertiary ovarian follicles were 5.9 ± 0.4 mm³. The ovary consisted of 62.8 ± 5.4% primary ovarian follicles, 26.3 ± 2.5% secondary ovarian follicles, and 10.9 ± 4.6% tertiary ovarian follicles. The testes contained primary and secondary spermatocytes that were 21.7 ± 2.8 µm³, spermatids were 3.49 ± 0.45 µm³, and spermatozoa were 3.57 ± 0.46 µm³. Most of the testes were composed of spermatids (76.9 ± 4.3%), but also contained spermatocytes (13.5 ± 3%), and mature sperm (9.65 ± 2.5%). The presence of multiple stages of ovarian follicles and sperm development indicates the black-belly dragonfish are batch spawning fish and have an asynchronous ovarian development pattern. Supplemental fish and seasonal data are needed to understand the gonadal development of mesopelagic fish.

112. PRESENCE OF ROCKS IN THE G.I. TRACT OF MONKEYFACE PRICKLEBACKS (CEBIDICHTYS VIOLACEUS)
¥ W. Wan and E. Paig-Tran. Walnut High School and California State University, Fullerton.

The monkeyface prickleback (Cebidichthys violaceus) is an herbivorous stichaeid that lives in rocky, shallow waters. C. violaceus typically feed on macrophytes. We discovered rocks ranging in diameter from 0.1 to 2.1 mm in the G.I. tract of the C. violaceus extracted from the San Simeon low tide zone in 2000. Nine fish (12.7 to 23.2 cm in total length, TL) were examined and 89% of the fish contained rocks. Unlike most species that make use of gastroliths for digestion, there was no correlation between size of the fish (TL) and rock size in the gut. All fish that had food inside the gut also had rocks present, while fish without food also did not contain rocks in the gut. It is possible that C. violaceus are purposefully swallowing rocks to aid in digestion or it may simply be a byproduct of feeding in a rocky environment. We caution that these findings were from a single collection and more samples are necessary before concluding that they are behaviorally targeting rocks rather than ingesting them by accident. The occurrence of gastroliths is unusual in fish and most reported species use fine gravel as a digestion aid rather than true
gastroliths. The presence of G.I. rocks is especially interesting in *C. violaceus*, as its intestinal walls are relatively thin.

113. SHORT PHOTOPERIOD EXPOSURE INDUCES DECREASES IN TESTICULAR METTL3 MRNA IN SIBERIAN HAMSTERS (*PHODOPUS SUNGORUS*)

O. Jaime, M.A. Rader, and K.A. Young. California State University, Long Beach.

Seasonal reproduction is mediated via hypothalamic sensitivity to changes in photoperiod. Long photoperiods are stimulatory to the testicular function of Siberian Hamsters (*Phodopus sungorus*) while short photoperiods inhibit reproduction. The neuroendocrine mechanisms that regulate seasonal reproduction are well known; however, less is known about the genetic factors that control testicular recrudescence. N6-methyladenosine (m6A) is one of the most common mRNA modifications in eukaryotes and plays a critical role in testis function in mammals, with alterations in m6a mRNA negatively affecting fertility. As a result, we hypothesized that the genes that control the (m6A) mark, such as the METTL3, which is part of a larger methyl-transferase complex that carries out methylation, may be differentially regulated by photoperiod. Male adult hamsters were exposed to long photoperiod (LD, control) or inhibitory short photoperiod for 14 weeks (SD, regressed), or short day for 14 weeks followed by transfer to LD for 1, 2, 4 or 8 weeks (post transfer, recrudescing, PT). SD exposure significantly reduced body, paired testis, and epididymal masses as compared to all other groups. Seminiferous tubule diameters and spermatogenic activity levels significantly decreased with SD as compared to LD exposure, and returned to levels no different than LD after PTwk2. SD exposure significantly decreased Mettl3 mRNA expression as compared to LD, with values restored in PT groups to LD levels. These results indicate that testicular recovery after exposure to a stimulatory photoperiod is relatively rapid and Mettl3 may be important in the active and recrudescing testis in photoperiodic Siberian hamsters.

114. SWITCHING OFF SPERM’S POWER: THE EFFECTS OF JELLY FISH TOXINS ON SEA URCHIN SPERM FERTILITY

¥ M. De La Cruz. Downey High School.

Previous studies have found that jellyfish, *Aurelia aurita* populations are rising at a high rate, so I wanted to learn more about its toxins and whether it too can be an environmental factor that can disturb the normal fertilization processes of purple sea urchins, *Strongylocentrotus purpuratus*. The purpose of my experiment is to make different concentrations of the jellyfish toxins (0.25mL, 0.50mL, 0.75mL, and 1.00mL) to test these on the sperm of sea urchins and observe if the sperm can fertilize sea urchin eggs. I predicted that the toxins would cause problems on the sperm which would lead to poor binding and breaking into the sea urchin eggs membrane causing little to no fertilization, in other words the sperms power would be turned off. It was observed that the number of eggs fertilized was decreased by 24-35% during the increase in concentration of the jellyfish toxin. The significance of these results is that there is an inhibitory response from the jellyfish toxin on the sea urchin sperm membrane. My future focus will be on learning more about the interaction between the sperm cells membrane receptors on a structural level. Proof of this interaction between the toxin and the sperms membrane receptors holds future information and understanding of sexual reproduction and development that applies to many marine organisms.
115. ACUTE EXPOSURE TO AROCLOR-1254 DOES NOT INDUCE INCREASES IN TESTICULAR APOPTOSIS IN MALE ROUND STINGRAYS (UROBATIS HALLERI)
A. Damian, D.E. Frantz, and K.A. Young. California State University, Long Beach.

Polychlorinated biphenyls (PCBs) negatively affect reproduction in many species; although how PCBs influence elasmobranch physiology is not well known. Recent studies in our laboratory have determined that exposure of newly mature male round stingrays (Urobatis halleri) to Aroclor-1254 decreases both steroidogenic enzyme testicular gene expression and spermatozoa motility and viability. Because the mechanism of these declines was unknown, we hypothesized that in vivo exposure of round rays to Aroclor-1254 would induce an upregulation of testicular apoptosis in the testis. To address this hypothesis, male stingrays were injected with either Aroclor-1254 or vehicle (sesame-oil) and held for 24 hrs prior to testis tissue collection. The number of positive apoptotic cells was assessed using the Terminal deoxynucleotidyl transferase (TdT) dUTP Nick-End Labeling (TUNEL) assay on histological sections of ray testis tissue. When staining was quantified, no significant differences were noted between males treated with Aroclor-1254 as compared to those treated with sesame oil (p=0.24). In addition, a key apoptotic regulator gene, caspase-3, was evaluated and exposure to Aroclor-1254 did not significantly increase testicular Caspase-3 mRNA expression (p=0.25). No changes were noted between the Aroclor-dosed group and controls in average spermatocyst diameter of the primary lobule (p=0.15) or the secondary lobule (p=0.19). Although acute exposure to Aroclor-1254 induced declines in steroidogenesis in round stingrays, no changes were noted in the testicular apoptotic response. This suggests that Aroclor-1254 may not have rapid effects on the survival of testicular cells; however, it does appear to affect the steroidogenic process in the testis of round rays.

116. EFFECT OF TEMPERATURE FLUCTUATION ON SPINE REGENERATION RATE OF PURPLE SEA URCHINS, STRONGYLOCENTROTUS PURPURATUS

This study investigated the effect of temperature fluctuation on spine regeneration rate of purple sea urchins, Strongylocentrotus purpuratus. With the rise in ocean temperature over the years, it is important to learn how climate change will affect the spine regenerative abilities of purple sea urchins, since their spines are used for sensing, locomotion, and protection. If spines of two urchins are cut in half and placed in settings with temperature fluctuation and without, then the spine regeneration time for the urchin in the temperature fluctuating setting will be longer (lower growth rate), because the urchins will expend more energy to survive in a temperature fluctuating setting, leaving less energy to be used to regenerate the spines. The urchins were placed in two settings: one in 12.5-13 °C water with no temperature fluctuation and the other in 12.5-13 °C water with the temperature fluctuating to 19-22 °C twice a day. The spines of the urchins were cut in half and their growth was measured every week for three weeks using a computer software, Image J. The results showed that the average growth rate of the heat treated group was around 0.1524 mm per week, while the average growth rate of the control group was around 0.0945 mm per wk. The hypothesis was rejected because the spines of the urchins in the temperature fluctuating setting had a higher growth rate compared to the urchins in the controlled setting. The results from this experiment can be used to continue to investigate the effects of
further rise in temperatures for a longer period of time on the spine regeneration abilities of *S. purpuratus* to find their limit.

**117. INVESTIGATING ALLELOPATHY AND SOIL MOISTURE AS FACTORS DETERMINING COMMUNITY COMPOSITION OF AN INVADEN SOUTHERN CALIFORNIA BLACK WALNUT WOODLAND**

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Soil moisture and allelopathy can both affect plant germination and establishment. Understanding their interaction can help explain the distribution of native and invasive plant species and provide methods for cultural control of invasive plants. *Juglans californica* (Juglandaceae), a Southern California endemic tree, produces juglone. Juglone’s allelopathic effects have been studied on agriculturally significant crops but not on how it could affect invasive and native species occurring under the canopy of *J. californica*. *Brassica nigra* (Brassicaceae) is an invasive forb that produces allelopathic mustard oils and is a dominant member of some walnut woodland communities. Since these allelochemicals are abundant during times of high soil moisture, it is likely both species’ allelopathic potentials are most influential in winter than in summer. Invasive dominance in walnut woodlands may be due to invasive species’ higher tolerance of allelopathy than native species. Our ongoing greenhouse experiment tests the tolerance of three invasive and three native species to allelochemicals from *J. californica* and *B. nigra*. Each species is being treated with one of the following: *J. californica* mulch, *B. nigra* mulch, coconut coir, allyl isothiocyanate, juglone, or water. To examine how soil moisture and allelopathy interact, each plant is also given a moisture regime: dry or wet. Each treatment combination is replicated four times. By studying the tolerance of these species to allelopathy, we can better understand why invasive species are more abundant in this ecosystem and determine if mulch derived from walnut litter can be useful in the management of invaded areas.

**118. EFFECTS OF SHORT FIRE RETURN INTERVALS ON CHAPARRAL ECOSYSTEMS**


Fire return intervals (FRIs) are a key environmental factor in chaparral ecosystems. With increasing drought and anthropogenic fire ignition particularly in the past decades, dangers with short FRIs are increasing. I examine the impacts of short FRIs on diversity, coverage, and flammability several decades afterwards. 10 pairs of nearby quadrats with differing FRIs were selected and transects were taken recording presence of individual species in either canopy or understory. I found significant decreases in shrub canopy coverage and net canopy coverage in short FRI sites. Short FRIs also increased the spread potentials of fires while decreasing the intensities of fires. These changes suggest that short FRIs form a positive feedback loop increasing flammability which then increases the probability of further short FRIs. The decreased intensity may cause greater invasive species dominance and could further increase fire risk. These findings suggest that fire management should place a greater premium on controlling fires in areas with recent burns or previous short FRIs in order to reduce future fire risk and further ecological degradation. Implementation of these practices could help reduce risk to property and lives from fires and the landslides, floods, and air pollution that follow.
119. SHORELINE STABILIZATION THROUGH EELGRASS AND OYSTERBED LIVING SHORELINE RESTORATION IN NEWPORT BACK BAY, CA
§ C. Knapp, USC Dornsife College

120. CONNECTIVITY OF HYPSYOPS RUBICUNDUS POPULATIONS ACROSS THE SOUTHERN CALIFORNIA BIGHT

The Garibaldi, *Hypsypops rubicundus*, is a marine fish common to rocky reefs and kelp forests in the Southern California Bight (SCB). The Vantuna Research Group at Occidental has collected Garibaldi from several locations in southern California and Baja California, Mexico in order to study the life history of this historically understudied fish. The primary goal of this project was to determine the connectivity of Garibaldi populations throughout southern California and Baja California by looking at gene flow between populations, and to understand how this is influenced by the currents of the SCB. DNA has been extracted from over 300 Garibaldi fin tissue samples. It was determined that fin tissue samples provided higher quality and higher concentration DNA extractions than both gill raker and muscle tissues samples. It was also found that fin clips from adult Garibaldi provided higher quality and concentration DNA samples than juvenile and young of the year fishes for most locations. Of all samples extracted, 36% were of poor quality, preventing them from being sent out for sequencing. Once sequencing is complete, we will use analytical programs that estimate gene flow and divergence from the DNA data to assess the population connectivity of Garibaldi populations. This information will be important in future conservation decisions relating to Garibaldi and other fish with larval dispersal phases, as well as in the development and monitoring of Marine Protected Areas in the SCB.

121. EFFECTS OF MORPH, YEAR AND POND ON VARIATION IN SURVIVAL AND STAGE TRANSITION IN POLYPHENIC SALAMANDERS
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Polyphenism is a case where one genotype may produce multiple phenotypes based on environmental factors. One species that exhibits polyphenism is the tiger salamander (*Ambystoma mavortium nebulosum*), whose offspring remain larval for several years, then either metamorphose into a typical adult phenotype (metamorph), or retain larval characteristics and instead become a sexually mature paedomorph. We studied a metapopulation of these salamanders in a subalpine region of central Colorado, using capture-mark-recapture methods. We used MARK software to evaluate the effect of larval density, pond type, and year as explanatory variables on survival, recapture, and stage transition rates of each ontogenetic stage in females. Different linear models were fit to our data to identify variables that, when included, decreased the Akaike information criterion. The best-fit model overall included all the explanatory variables, suggesting that survival and transition have meaningful variation between years and depend on pond type and larval density. On average, metamorphs had the highest survival, then paedomorphs, then larvae, though larval survival over time is highly variable. Larvae had a higher average probability of transitioning to paedomorphs in permanent ponds and to metamorphs in non-permanent ponds, but transition probabilities are also variable between
years. These estimates will be used to parameterize stochastic matrix population models to investigate relative fitness of metamorphic and paedomorphic life history pathways under environmental conditions that differ in space and time, perhaps explaining why both morphs exist.

122. ASSESSMENT OF BIOFILM FORMATION ON METAL ALLOYS USED FOR PROSTHETICS
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As the world population grows larger, so does the need for prosthetics used to replace body parts lost to injury or illness. In recent years, an increase in infection during prosthetic implantation has led to more formation of biofilm on human prosthetics. The development of modern biomaterials has resulted in more biocompatible implants, but prosthetics are still susceptible to microbial colonization on their surface. The goal of this project is to test new metal alloys against colonization by Staphylococcus epidermidis (strain 35984) and Pseudomonas aeruginosa (strain PA01), and identify the new metal that is least susceptible to biofilm formation. In our lab, experimental metal alloys such as commercially pure titanium (CpTi), dental-grade titanium (Ty), titanium based alloy Ti-6V-Al (Ti64), and stainless steel (SS316L) are exposed to the two bacteria. Our first goal was to quantify biofilm propagation on the surface of each metal using a Biofilm reactor, a crystal violet staining protocol, and fluorescent microscopy. Metal alloys were placed in the biofilm reactor, with 3.5 mL of overnight bacterial culture added. The biofilm reactor ran at 37°C for 72 hours. Once in the reactor, bacteria were exposed to a constant media flow for 24 hours to better simulate the conditions in the human body. Preliminary data shows that the Ty alloy is less susceptible to biofilm formation. This indicates that Ty may be a better choice than the traditional metals, stainless steel and pure titanium. Next, we plan to use metals with different boron concentration and expose them to the bacteria using the same method. Boron has showed to increase the durability of metals thereby making it an important area to study as we hope to increase the longevity of prosthetics.

123. STEREOCHEMICAL AND THERMODYNAMIC ANALYSIS OF FULLERENE DERIVATIVES AND CARBON NANO TUBES AS POTENTIAL AGENTS TO SUPPRESS REACTIVE OXYGEN SPECIES

Recent studies show that oxidative stress, caused by an excess of the Reactive Oxygen Species (ROS) such as superoxide anion, hydrogen peroxide, and hydroxyl radical in the brain, is involved in the pathogenesis of neurological disease. It is highly desirable to visualize the activities of ROS in living cells on a microscopic level to observe the mechanism of peroxidation, since most of the cells affected by Alzheimer’s disease are caused by ROS. In this project, the thermodynamic stabilities of hydrated Single Walled Carbon Nanotubes (SW-CNTs) and Fullerene Derivatives were studied in the light of their promising role in treating neurological disease. In order to effectively demonstrate current research to analyze the CNTs, conventional contrasting agents, such as iodinated agent and gadolinium, which are synthesized fullerene derivatives, computational program Avogadro and Gaussian were used. By making efficient use of these programs, it was possible to study the computational and empirical aspects of the CNTs and functionalized fullerene molecules and determine whether they are safe and
stable agents. First, the molecules were modeled and the safety and stability were primarily deduced quantitatively by analyzing the optimized energies of the molecules. The analysis of thermodynamic stability and electron properties of functionalized fullerenes, PC61BA-(Gd-D03A), iodinated fullerenes, and CNTs were used in assessing the efficiencies of the drugs for Alzheimer’s disease.

124. A STUDY ON THE FUNCTIONALIZED CANCER SCANNING CONTRAST AGENTS IN THE POSITRON EMISSION TOMOGRAPHY (PET)

In medical imaging, contrast agents play an important role in refining the clarity and contrast of a body part. Higher clarity and contrast allows the physician to clearly differentiate between the body structure and nearby tissue. This allows for accurate examination and diagnosis of any abnormality in the body part. Contrast agents are used for medical scans such as the Positron Emission Tomography (PET) scan, a frequently used diagnostic method in modern clinical practice that does not use damaging ionizing radiation. Through electrochemical techniques, researchers have studied the possibility of using aqueous nanoparticles as contrast agents. This paper uses theoretical and computational simulations to examine nanomaterials such as fluorescent functionalized particles and to evaluate the potential of nano-scaled contrast agents to detect tumor cells. The potential of using nano-scaled contrast agents is determined by molecular stability and safety. This paper compares and analyzes the thermodynamic stability of various contrast agents, such as derivatives of lanthanide element and metal oxides. The thermodynamic stability is determined by the molecule’s optimized energy, which can be computed through chemical programs. In addition, the Density Functional Theory (DFT) and Universal Force Field (UFF) methods, which employ physical and chemical methods, are used to assess the electron properties of contrast agents.

125. STABILITY ANALYSIS OF WHEELCHAIR USING COMPUTATIONAL AND MECHANICAL SIMULATIONS

To examine the mathematical, computational and physical relationship between the body position (center of gravity) and the dimensions (geometry) of wheelchair, assessments of the stability by using the force equilibrium equations and moment equilibrium equations are needed. The study provides solutions of the stability by calculating the tipping angles as the total weight of the system changes. When the restoring moments acting on the system become smaller, a wheelchair will tip over. The wheelchair becomes unstable, when it tips to a point where the Center of Gravity(CG) of the person seated on the wheelchair is vertically aligned with the point where the wheel contacts the ground. The tipping angle is the angle that wheelchair makes with the horizontal plane at this point. As the tipping angle decreases, it will fall over because the magnitude of the restoring moment is smaller than the moment generated by the center of gravity. Center of gravity is important factor to adjust the stability or the wheelchair. The performance of the system is maximized by modifying the location after the exact location of the center of gravity is mathematically and computationally calculated. In this study, when the center of gravity is modified, the mass of the chair and the mass of the person is considered together since movement towards the front or back of the chair depends on the location of the center of
gravity. The center of gravity can be different by individual, depending on their weight and arm or limb length.