SOUTHERN CALIFORNIA ACADEMY OF SCIENCES

109TH ANNUAL MEETING

MAY 6-7, 2016

UNIVERSITY OF SOUTHERN CALIFORNIA
LOS ANGELES, CALIFORNIA
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*
*revised and adopted December 2009*

The Academy utilizes dues and contributions to promote student research, from high school students through the college graduate level through these 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 Association of the Academies of Science annual conference.
- **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 participating students and increasing the size of the student research support and cash awards. Contributions are vital in helping the Academy achieving this goal.

Southern California Academy of Sciences is a Federally-recognized 501(c)(3) non-profit organization
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## FUTURE SCAS MEETINGS

- **2017** California State University, Northridge (CSUN)
- **2018** TBD
- **2019** TBD
- **2020** California State University, Fullerton (CSUF)
Dear Colleagues,

On behalf of the Board of Directors, I welcome you to the 2016 Annual Meeting of the Southern California Academy of Sciences at the University of Southern California (USC).

SCAS is celebrating 125 years! For over a hundred years, the Southern California Academy of Sciences has been an important part of the scientific community of southern California. On 6 November 1891, a group of people interested in science gathered in Los Angeles to organize an association to promote all types of natural history. By the end of the year, the purpose of the Southern California Academy of Sciences was delineated "...to secure a more frequent interchange of thoughts and opinions among those who devote themselves to Scientific and Natural History studies; to elicit and diffuse a taste for such studies where it is yet unformed; and to afford increased facilities for its extension where it already exists." One hundred and twenty-five years later I believe the Academy is doing just that. We strive to promote fellowship among scientists and we encourage and promote scholarship among young scientists at our Annual Meeting. We contribute to scientific literature through publication of pertinent manuscripts in the Bulletin of the Southern California Academy of Sciences. I am proud to have been a member of SCAS for almost 20 years and am honored to have served as president of the Board of Directors for the last four years. I now report to you in my final letter as president…

We have assembled a diverse selection of symposia and speakers at this year’s Annual Meeting. In addition, Contributed Paper sessions are scheduled for both days. Friday’s symposia include: 50 years of research at the USC Wrigley Institute, Parasite Diversity, and Climate Change in California. Dr. Larry Allen from CSU Northridge will be the plenary speaker on Friday. The title of his talk is “The Return of the Kelp Forest King, Giant Sea Bass (Stereolepis gigas), off California.” On Friday evening from 5:00 to 7:00pm, please join us for the poster session along with a wine and cheese reception in Ronald Tutor Campus Center, Ballroom B. We will have a special gift for attendees and will be celebrating SCAS’ 125th anniversary!

Saturday’s symposium is: Marine Mammals. The plenary speaker on Saturday is Dr. Virginia Naples from Northern Illinois University. The title of her talk is “The gaping truth: Adaptations for a sabertooth lifestyle.” Presentations by high school students in the Junior Academy Research Training Program (RTP) will also take place on Saturday. You will be impressed by the high quality of research and presentations from these students.

Please visit our website http://scas.nhm.org for all information pertaining to SCAS. On our website you can register for future annual meetings, renew your membership, apply for grants, and submit a manuscript to the Bulletin. The Academy Bulletin is open to high quality papers on research worldwide, particularly from SCAS members. I would like to thank the editors of the Bulletin, Dan Pondella and Larry Allen for all their hard work. Our website is hosted under the Natural History Museum of Los Angeles County and we are grateful to the Museum and hope to
continue our long-standing relationship. I would like to thank our Board of Directors webmaster Shelly Moore for making our website so amazing!

As the President of the SCAS Board of Directors, and on behalf of the Board, I would like to take this opportunity to thank all of the members for your support of the Academy. The Academy is working toward expanding its student programs by increasing the number of participating students and increasing the size of the student research grants and cash awards. Your contribution is vital in helping the Academy achieving this goal.

I would like to thank the following people for their outstanding efforts preparing for our 2016 Annual Meeting at USC — David Ginsburg as Local Committee Chairperson, Lisa Collins, Shelly Moore, Ann Dalkey, all the symposium organizers, the SCAS Board of Directors, and Gloria Takahashi for leading the Junior Academy. I would also like to acknowledge the USC Dornsife College and the USC Wrigley Institute for Environmental Studies for significantly supporting the cost of this annual meeting.

Congratulations and welcome to our newly appointed and elected Board members, Shana Goffredi from Occidental College and Mia Adreani from CSU Northridge. The following Board members have agreed to serve as officers beginning the 2016-2017 term; David Ginsburg as President, Edith Read as Recording Secretary, Kristy Forsgren as Corresponding Secretary, Karina Johnston as Treasurer, Daniel Pondella and Larry Allen as Editors of the Bulletin, Brad Blood as Editor of the Smilodon, and Shelly Moore as Webmaster.

I would like to thank Ann Dalkey for her seven years of service on the Board as both Treasurer and Corresponding Secretary. Since 2009, her hard work to organize the treasury has really helped SCAS grow as an institution. She will be missed!

And finally, I would like to announce next year’s annual meeting will be at California State University, Northridge.

So, in my final words to you as president, I would like everyone to know how much I have enjoyed being president of SCAS! The last four years have been a great learning experience for me, and I am grateful for the opportunity. I love this society, and will continue to serve on the Board. I also plan to continue to attend the annual meetings and will participate as much as possible. I hope I have served you well!

You can stay current with the Academy by visiting our website and also liking us on Facebook and Instagram (scas_nhm). I hope you enjoy the meeting!

Sincerely,

Julianne Kalman Passarelli, PhD
SCAS President

Go Bruins!
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**

Julianne Kalman Passarelli, *President*
David Ginsburg, *Vice-President*
Edith Read, *Recording Secretary*
Ann Dalkey, *Treasurer, Corresponding Secretary*
Daniel J. Pondella II and Larry G. Allen, *Editors - Bulletin*
Brad R. Blood, *Editor - Smilodon Newsletter*
Shelly Moore, *Webmaster*

**Board of Directors**


**Advisory Council** (Past-Presidents)

Ralph Appy, John Dorsey, John Roberts, Jonathan Baskin, Brad Blood

**Junior Academy Board of Directors**

Gloria Takahashi, Ralph Appy, Jonathan Baskin, John Dorsey, Gordon Hendler, Julianne Passarelli, Danny Tang, Robert F. Phalen, Kathy Phalen, Harry Takahashi
Graduate or undergraduate students working towards a degree who elect to participate are eligible for Best Student Presentation or Poster awards. The American Institute of Fishery Research Biologists (AIFRB) and Southern California Parasitologists (SCP) will also present awards. The program will denote students competing for an award with a “*” for SCAS; “F” for AIFRB; “P” for SCP. Junior Academy judges room is Tutor Campus Center (TCC) 350. Awards will be allocated at the judges’ discretion based upon quality and number of presentations.

2015 STUDENT AWARD WINNERS

BEST STUDENT PRESENTATION
Michelle Barton, California State University, Long Beach
Nest site selection of the light-footed ridgway rail (Rallus longirostris levipes) in two southern California salt marshes.

BEST STUDENT PRESENTATION - HONORABLE MENTIONS
Stephanie Benseman, California State University, Northridge
Distribution and growth estimates of young-of-the-year of giant sea bass, Stereolepis gigas, off southern California.

Christopher DeMarco, California State University, Los Angeles
Conservation of the western gray squirrel in Griffith Park through non-invasive genetic sampling with mtDNA and microsatellite analysis.

Emily Meese, California State University, Long Beach
Spatial distribution, habitat selection, and effects of temperature on resting benthic elasmobranchs at Big Fisherman's Cove, Santa Catalina Island.

Fernando Salgado, California State University, Long Beach
Assessing the functional overlap of ion homeostasis, pH regulation, and survival and infectivity in the human parasite Toxoplasma gondii.

BEST STUDENT POSTER
Joshua McKinley, California State University, Fullerton
Feeding behavior of Anthopleura elegantissima after low tide exposure.

BEST STUDENT POSTERS - HONORABLE MENTIONS
Alexander Lepicier and Juan Julian (JJ) Baraja, California State University, Dominguez Hills
Do coyotes (Canis latrans) residing on the Palos Verdes Peninsula select different prey as a result of residing in a wild land-urban interface?

Arthur Barraza, California State University, Fullerton
The reproductive morphology of male black perch Embiotoca jacksoni.

Morgan Brown, California State University, Long Beach
Relationship of Sphaeroma quoyanum to native invertebrate community and sediment dynamics in a southern California salt marsh.
**Award for Best Student Paper in Fisheries Biology**

For the past 24 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:**

1. **2008**  
   **Armand Barilotti**, California State University, Long Beach
2. **2007**  
   **Bonnie Ahir**, California State University, Long Beach
3. **2006**  
   **Christopher Mull**, California State University, Long Beach
4. **2005**  
   **Barbara Ziegler**, California State University, Long Beach
5. **2004**  
   **Julianne Kalman**, University of California, Los Angeles
6. **2003**  
   **Matthew Neilson**, California State University, Long Beach
7. **2002**  
   **Daniel Cartamil**, California State University, Long Beach
8. **2001**  
   **Darin Topping**, California State University, Long Beach
9. **2000**  
   **Kristina Louie**, University of California, Los Angeles
10. **1999**  
    **Fredrick Stengard**, University of South Florida, St. Petersburg
11. **1998**  
    **Thomas Even**, University of California, Santa Barbara
12. **1997**  
    **Mason Posner**, University of Southern California/Natural History Museum of Los Angeles County
13. **1996**  
    **Ingo Gaida**, University of California, Los Angeles
14. **1995**  
    **Sabrina Drill**, University of California, Los Angeles
15. **1994**  
    **Blaise Eitner**, University of California, Los Angeles
16. **1993**  
    **Joseph Sisneros**, California State University, Long Beach
17. **1992**  
    **Refik Orhun**, San Diego State University/Hubbs Sea World Research Institute
18. **1991**  
    **Christina Swanson**, University of California, Los Angeles

**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.

**Southern California District Activities:** The Southern California & Baja California, Mexico District of the AIFRB conducts two to four dinner business meetings per year that includes a presentation of a topic of interest to the members. The student winner of this AIFRB award may be invited to present his or her talk to the District membership. The District sponsors awards for excellence in fisheries work at both the student and professional level, hosts an annual BBQ and silent auction to raise District funds and promote membership, occasionally sponsors fisheries symposia and workshops, and attends the National Board of Control meetings.

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 Glinia, 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.
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*.

2016 GRANT AWARD WINNERS

**Graduate**

**Ellie Wenger**, California State University, Long Beach  
The impacts of sea level rise on decomposer communities in California salt marshes.

**Homam Jamal**, California State University, Fullerton  
The Seasonal Reproductive Biology of Blue Rockfish (*Sebastes mystinus*).

**Emily Meese**, California State University, Long Beach  
Thermal energetics and activity rates of horn sharks, *Heterodontus francisci*.

**Alyssa Braciszewski**, University of California, Irvine  
Relatedness and differential disease resistance in abalone (genus *Haliotis*).

**Undergraduate**

**Haley Gause**, California State University, Long Beach  
Assessing the dissemination potential of tachyzoite stages of *Toxoplasma gondii* parasites during exposure to coastal California seawater conditions: exploring a new pathway to marine mammal infections.

2015 GRANT AWARD WINNERS

**Molly Burdick-Whipp**, California State University, Long Beach  
Understanding fish habitat in a tidally restricted urban lagoon.

**Nick Jensen**, Claremont Graduate University/Rancho Santa Ana Botanic Garden  
Southern California *Streptanthus* as a model system for understanding historical biogeography and regional patterns of edaphic specialization.

**Caitlin McGarigal**, California State University, Long Beach  
Behavioral and physiological effects of angling stress, and post-release mortality, of two important game fish in southern California, kelp bass (*Paralabrax clathratus*) and barred sand bass (*P. nebulifer*).

**Magalie Valere-Rivet**, Loma Linda University  
Lactate production in the hermit crab, *Pagurus samuelis*, subjected to temperature and burial stresses.

**Thomas Kroupa**, California State University, Long Beach  
Thermal defense strategy determines limpet response to acute temperature stress on rocky shores.
ACKNOWLEDGEMENTS

The Southern California Academy of Sciences wishes to acknowledge the following organizations and people for their support of the Academy.

***current through April 20, 2016***

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<thead>
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<th>Partners in kind</th>
<th>Platinum Level $1000 or greater</th>
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<tr>
<td>Natural History Museum of Los Angeles County</td>
<td>MBC Applied Environmental Sciences</td>
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<td>Psomas</td>
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<tr>
<td>American Institute of Fishery Research Biologists</td>
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<tr>
<td>Southern California Parasitologists</td>
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<tr>
<td>Donald J. Reish</td>
<td>Gloria and Harry Takahashi</td>
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<td>Michael Horn</td>
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<th>Bronze Level $100 - $199</th>
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<td>Ann Dalkey</td>
<td>Caroline Huang</td>
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<td>John Roberts</td>
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<td>Ken Gobalet</td>
<td>Kirschbaum Family</td>
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<td>Barry Snyder</td>
<td>John Dorsey</td>
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<td>Katherine Dickson</td>
<td>Leila Williams</td>
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<td>June Siva</td>
<td>Robert F Phalen</td>
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<td>Camm Swift</td>
<td>Florence McAlary</td>
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<td>Edward Kormondy</td>
<td>Harry Fierstine</td>
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<td>Margaret Neighbors</td>
<td>Ann Bull</td>
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<td>Charles Collins</td>
<td>Shelly Johnson</td>
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<td>E Read and Associates, Inc.</td>
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This meeting is proudly sponsored by:

The Southern California Academy of Sciences wishes to acknowledge David Ginsburg and Lisa Collins from USC Dornsife College for organizing the 2016 Annual Meeting.

Special thanks to the SCAS 2016 Annual Meeting Committee: Ann Bull, Lisa Collins, Ann Dalkey, David Ginsburg, Shelly Moore, Julianne Kalman Passarelli, and Danny Tang, all the symposium organizers, the plenary speakers, and Gloria Takahashi for leading the Junior Academy.
ACKNOWLEDGEMENTS

Southern California Junior Academy of Sciences (SCJAS)

Gloria Takahashi, La Habra High School, emeritus, Cerritos College (SCJAS Board Chair)
Kathy Phalen, RN (SCJAS Board)
Robert F. Phalen, UCI (SCJAS Judging Chair and SCJAS Board)
June Kizu, CSUDH (SCJAS Judge)
Candice Groat, CSUDH (SCJAS Judge)
Edith Read, Ballona Wetlands (SCAS Board)
John Roberts, CSUDH, emeritus (SCAS Board)
John Dorsey, LMU (SCAS Board and SCJAS Board)
Ralph Appy, Cabrillo Marine Aquarium (SCAS Board and SCJAS Board)
Jonathan Baskin, Cal Poly Pomona, emeritus (SCAS Board and SCJAS Board)
Gordon Hendler, LA County Natural History Museum (SCAS Board and SCJAS Board)
Julianne Kalman Passarelli, Cabrillo Marine Aquarium (SCAS Board and SCJAS Board)
Harry Takahashi, Garfield High School, emeritus, photographer (SCJAS Board)
Danny Tang, OCSD (SCAS Board and SCJAS Board)
Dennis Dulyea, CSUDH (SCJAS Judge)
Theodore Stankowich, CSULB (SCJAS Judge)
John Boyle, Cerritos College (SCJAS Judge)
Nicole Chmielewski, UCI (SCJAS Judge)
David Herman, UCI (SCJAS Judge)
Carol Cronin, Wolfram Research, Inc.

MENTORS
Dr. John Burnett, City of Hope
Dr. James Hicks, University of California, Irvine
Dr. Sebastien Fuchs, Western University School of Medical Sciences
Dr. Matteo Pelligrini, UCLA
Dr. Yilun Liu, City of Hope
Dr. Michelle Khine, University of California, Irvine
Dr. Anshu Agrawal, University of California, Irvine
Dr. Kathy Flynn, College of the Canyons
Dr. Chee Wei Wong, UCLA
Dr. Dan Weisenberger, University of Southern California
Dr. Sanza Kazadi, Jisan Research Institute
Ms. Elyse van Spyk, University of California, Irvine
Dr. Daniel Whiteson, University of California, Irvine
Dr. Namita Schoff, University of Southern California
Dr. Camelia Danilov, University of Southern California
Dr. Leslie Thompson, University of California, Irvine
Dr. Gizem Karaali, Pomona College
Dr. Julie V. Patterson, University of California, Irvine
Dr. Jason Li, Asylum Research, Santa Barbara
Dr. Stephen White, University of California, Irvine
Dr. Robin Liu, Beckman Coulter
Dr. Rohan Dharmakumar, Cedars Sinai Hospital
Dr. Robert Boyd, Lockheed Martin ADP
# MEETING SCHEDULE

All sessions are in the Ronald Tutor Campus Center

## Friday, May 6, 2016  University of Southern California

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<th>End Time</th>
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<td>Ballroom A</td>
<td>1-15</td>
<td>8:00 AM</td>
<td>4:20 PM</td>
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<tr>
<td>Parasite Diversity</td>
<td>Ballroom C</td>
<td>16-28</td>
<td>8:00 AM</td>
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</tr>
<tr>
<td>Contributed Papers, Marine</td>
<td>Ballroom C</td>
<td>29-34</td>
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<tr>
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<tr>
<td>California Climate Policy</td>
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## Saturday, May 7, 2016  University of Southern California

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<tr>
<th>Session Topic</th>
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<th>Papers</th>
<th>Start Time</th>
<th>End Time</th>
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<tbody>
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<td>Marine Mammals</td>
<td>Ballroom A</td>
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<td>Contributed Papers, Terrestrial</td>
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<td>8:00 AM</td>
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<td>Contributed Papers, Marine</td>
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<td>128-135</td>
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<td>Junior Academy - Research Training Program I</td>
<td>TCC 350</td>
<td>136-146</td>
<td>8:20 AM</td>
<td>3:00 PM</td>
</tr>
<tr>
<td>Junior Academy - Research Training Program II</td>
<td>TCC 351</td>
<td>147-156</td>
<td>8:20 AM</td>
<td>2:40 PM</td>
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</tbody>
</table>

Session Breaks 10:40 AM and 3 PM; refreshments and snacks
Lunch 12:30 PM – 1:20 PM

## Plenary Sessions (both days)  Ronald Tutor Campus Center, Ballroom B  11:00 AM

**Friday Plenary Speaker**

**Dr. Larry G. Allen**, California State University, Northridge  
The Return of the Kelp Forest King, Giant Sea Bass (*Stereolepis gigas*), off California

**Saturday Plenary Speaker**

**Dr. Virginia Naples**, Northern Illinois University  
The gaping truth: Adaptations for a sabertooth lifestyle
# SCHEDULE AT A GLANCE

## FRIDAY
May 6, 2016

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<th>Time</th>
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<td>8:00 - 10:40</td>
<td>Wrigley Institute</td>
<td>Parasite Diversity</td>
<td>Marine Contributed Papers</td>
</tr>
<tr>
<td>10:40 - 11:00</td>
<td>Break</td>
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<tr>
<td>11:00 - 12:30</td>
<td>Plenary: Dr. Larry G. Allen</td>
<td>Ronald Tutor Campus Center, Ballroom B</td>
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<tr>
<td>12:30 - 1:20</td>
<td>Lunch</td>
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<tr>
<td>1:20 - 3:00</td>
<td>Wrigley Institute</td>
<td>Parasite Diversity</td>
<td>California Climate Policy</td>
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<tr>
<td>3:00 - 3:20</td>
<td>Break</td>
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<tr>
<td>3:20 - 5:00</td>
<td>Wrigley Institute</td>
<td>Marine Contributed Papers</td>
<td>California Climate Policy</td>
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<tr>
<td>5:00 - 7:00</td>
<td>Poster Session: Ronald Tutor Campus Center, Ballroom B</td>
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## SATURDAY
May 7, 2016

<table>
<thead>
<tr>
<th>Time</th>
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<th>Session 2</th>
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<th>Session 4 &amp; 5</th>
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<tbody>
<tr>
<td>8:00 - 10:40</td>
<td>Marine Mammals</td>
<td>Terrestrial Contributed Papers</td>
<td>Marine Contributed Papers</td>
<td>Junior Academy</td>
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<tr>
<td>10:40 - 11:00</td>
<td>Break</td>
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<td>11:00 - 12:30</td>
<td>Plenary: Dr. Virginia Naples</td>
<td>Ronald Tutor Campus Center, Ballroom B</td>
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<td>12:30 - 1:20</td>
<td>Lunch</td>
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<td>1:20 - 3:00</td>
<td>Marine Mammals</td>
<td>Terrestrial Contributed Papers</td>
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<td>Junior Academy</td>
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<td>3:00 - 3:20</td>
<td>Break</td>
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<td>3:20 - 5:00</td>
<td>Marine Mammals</td>
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Friday, May 6, 2016 Plenary Speaker

THE RETURN OF THE KELP FOREST KING, GIANT SEA BASS (*STEROLEPIS GIGAS*), OFF CALIFORNIA

Dr. Larry G. Allen, California State University, Northridge

The Giant Sea Bass, *Stereolepis gigas*, is the largest reef associated bony fish off California reaching over 2.5 m in length and 250 kg in weight. During the early 20th century they were heavily fished and their population crashed in 1935. Giants were protected both recreationally and commercially in 1982 and listed as critically endangered by IUCN in 1994. Evidence is now mounting that the population of giants off California is in recovery affording an opportunity to finally study them. Although Giant Sea Bass have been protected for over 30 years very little was known about their basic biology and life history. Among other things, our recent studies have determined how old they get, how fast they grow, and how genetically diverse their current populations are. Field studies over the last two summers were aimed at describing spawning behavior and establishing the Giant Sea Bass population size and biomass densities for Santa Catalina Island, CA. Our results show that they show sexual dimorphism, mate in pairs, spawn after dusk, and the majority of individuals and biomass occurred at 3 of the 8 sites during mid-late July in both 2014 and 2015. Currently, about 45 adult giant sea bass occur around Catalina Island in the summer months. Long-term surveys now show that giant sea bass are definitely returning to the southern California kelp forests from which they were absent for almost 70 years. All of this new information is critical to the future management and sustainability of this megacarnivore in our coastal waters.

Saturday, May 7, 2016 Plenary Speaker

THE GAPING TRUTH: ADAPTATIONS FOR A SABERTOOTH LIFESTYLE

Dr. Virginia Naples, Northern Illinois University

Sabertooth cats have fascinated vertebrate paleontologists as well as the public, for more than 150 years. They typify all of the usual features of being a cat; large claws, powerful builds, stealthy stalking habits and successful predatory behavior. The main thing that sets these animals apart, however, and which accounts for much of the fascination with them, is the presence of highly elongated, recurved and serrated canine teeth. There are no living analogues to show how the animals used their spectacular teeth, but speculations range from reasonable to highly unlikely to bizarre. When picturing a sabertooth, most enthusiasts envision *Smilodon*, the famous felid from the Rancho La Brea tarpits. *Smilodon* is a true felid, and a dirk-tooth type of sabertooth. This cat was among the top predators of its time. There are also other dirk-teeths, equally striking in body form and dentition, but that are less well known. Additionally, there are many other animals, both cats and catlike carnivores which show a different form of the sabertooth adaptation. They are the scimitar tooth cats. These animals range in size from housecats that could probably prey on animals as large as small deer, to robust lion-sized predators such as *Xenosmilus*, an animal built like the equivalent of a human sumo wrestler. Although these latter cats were also sabertooths, their canines are relatively shorter, more robust and coarsely serrated, as were their incisors. They are named cookie cutter cats because they could remove a bite, as would a cookie cutter, from their chosen prey. A wide variety of research approaches have been used to study sabertooths, and paleontologists have learned much about their feeding habits, habitat preferences and locomotor capabilities. Nevertheless, much yet remains to be discovered. I will discuss some of these results, and present a picture of where research on sabertooths is at present, and the directions in which it might progress in the future.
Southern California Academy of Sciences 2016 Session Schedule

Friday, May 6, 2016

Session 1: USC Wrigley Institute Celebrates 50 Years of Research
Location: Ballroom A (Ronald Tutor Campus Center)

Chairs: David Ginsburg and Lisa Collins, USC Environmental Studies Program

8:00 Welcoming remarks: Roberta Marinelli, Director, USC Wrigley Institute of Environmental Studies

1 8:20 50 YEARS OF DEVELOPING ENVIRONMENTAL SCIENTISTS, EDUCATORS AND STEWARDS
A.M. Muscat, Catalina Island Conservancy

2 8:40 DIVERSITY, SEASONALITY, AND PRIMARY PRODUCTIVITY OF A ROCKY INTERTIDAL COMMUNITY NEAR THE WRIGLEY INSTITUTE FOR ENVIRONMENTAL STUDIES ON LEEWARD SANTA CATALINA ISLAND
S.N. Murray, Department of Biological Science, California State University Fullerton

3 9:00 LIFE HISTORY OF THE INVASIVE SEAWEED SARGASSUM HORNERI AT SANTA CATALINA ISLAND
L.M. Marks, D.C. Reed, S.J. Holbrook. Marine Science Institute, University of California Santa Barbara

4 9:20 GRAIN TRAPPING BY FILAMENTOUS CYANOBACTERIAL AND ALGAL MATS: IMPLICATIONS FOR STROMATOLITES – SOME OF THE OLDEST FOSSILS ON EARTH
F. Corsetti¹, C. Frantz¹, V. Petryshyn². ¹Department of Earth Sciences, University of Southern California; ²University of California Los Angeles

5 9:40 AN END TO THE MYTILUS-PANULIRUS STORY: COLLAPSE OF MUSSEL BEDS ON CATALINA AND ELSEWHERE IN THE REGION
C.D. Robles, Department of Biological Sciences, California State University Los Angeles

6 10:00 SCALE DEPENDENT DRIVERS OF MPA PERFORMANCE: A CASE STUDY OF THE SPINY LOBSTER (PANULIRUS INTERRUPTUS) ON SANTA CATALINA ISLAND
C.D. Garza¹, S.W. Windell¹, M. McCormick¹, S. Litvin². ¹Division of Science and Environmental Policy, California State University Monterey Bay; ²Hopkins Marine Station of Stanford University

7 10:20 EVALUATING THE JUVENILE KELP BASS FISHERY PRODUCTION IN EELGRASS BEDS IN A SOUTHERN CALIFORNIA MARINE PROTECTED AREA
R.L. Tanner¹, A.K. Obaza², D.W. Ginsburg³. ¹Department of Integrative Biology, University of California Berkeley; ²NOAA Fisheries, Protected Resource Division, Long Beach, CA; ³Environmental Studies Program, University of Southern California

10:40 – 11:00 BREAK
11:00 – 12:30  Plenary Session: Ballroom B (Ronald Tutor Campus Center)
Dr. Larry Allen, Department of Biology, California State University Northridge
“The Return of the Kelp Forest King, Giant Sea Bass Stereolepis gigas off California”

12:30 – 1:20  LUNCH BREAK

8  1:20  SHIFTS IN ATTACK BEHAVIOR OF AN IMPORTANT KELP FOREST PREDATOR WITHIN MARINE RESERVES
J.S. Berriman¹, M.C. Kay², D.C. Reed³, A. Rassweiler⁴, D.A. Goldstein¹, W.G. Wright¹. ¹Department of Biological Sciences, Chapman University; ²Department of Biological Sciences, California State University Los Angeles; ³Department of Biological Sciences, Santa Barbara City College; ⁴Marine Science Institute, University of California Santa Barbara

9  1:40  OCTOPUS ECOLOGY THROUGH THE AGES: CONTINUING INVESTIGATIONS OF OCTOPUS BIMACULATUS AROUND CATALINA ISLAND
J. Hofmeister. Scripps Institution of Oceanography, University of California San Diego

10  2:00  FORTY YEARS OF STUDYING FISH AND SHARK MOVEMENTS AT CATALINA ISLAND: WHAT HAVE WE LEARNED?
C.G. Lowe. Department of Biological Sciences, California State University Long Beach

11  2:20  ASSESSING RESILIENCE TO STRESSORS IN THE CHANGING OCEAN: UNIQUE INFRASTRUCTURE AT THE USC WRIGLEY MARINE SCIENCE CENTER FOR THE STUDY OF DEVELOPMENTAL PHYSIOLOGY
S.L. Applebaum, T-C.F. Pan, C.A. Frieder, D. Hedgecock and D.T. Manahan. Department of Biological Sciences, University of Southern California

12  2:40  LARGE DATASET PORTALS AND PLACE-BASED EDUCATION OF UNDERGRADUATE STUDENTS: DON’T TELL THEM – SHOW THEM APPROACHES
K.B. Heidelberg¹, D.Y. Kim². ¹Environmental Studies Program and ²Wrigley Institute for Environmental Studies, University of Southern California

3:00 – 3:20  BREAK

13  3:20  DRIVERS OF ABUNDANCE OF TWO COMMON REEF FISHES: INTERSPECIFIC COMPETITION OR SOMETHING ELSE?
M.A. Steele. Department of Biology, California State University Northridge

14  3:40  REPRODUCTIVE ECOLOGY OF SOUTHERN CALIFORNIA KELP FOREST FISHES AROUND SANTA CATALINA ISLAND
M.S. Adreani. Department of Biology, California State University Northridge

15  4:00  INFLUENCE OF THE STRUCTURE OF AN INVASIVE ALGA ON THE DISTRIBUTION OF FISHES
G. Srednick. M.A. Steele. Department of Biology, California State University Northridge

4:20  END OF SESSION

5:00 – 7:00 POSTER SESSION     Location: Ballroom B (Ronald Tutor Campus Center)
Friday, May 6, 2016

Session 2: Parasite Diversity

Location: Ballroom C (Ronald Tutor Campus Center)

Chair: Ralph Appy, Cabrillo Marine Aquarium

16* 8:00  TeMcS JUST MAKES SENSE: ROLE OF A MECHANOSENSITIVE CHANNEL IN *TRYPANOSOMA CRUZI*

N. Dave, A. Maru, B. Wong, V. Jimenez Ortiz. Center for Applied Biotechnology Studies and Department of Biological Sciences, California State University Fullerton

17*P 8:20  CHARACTERIZATION OF PUTATIVE CALCIUM BINDING PROTEINS IN *TOXOPLASMA GONDII*

I.N. Meepe, D. Tran, V. Valencia, C. Monahan, D.A. Pace. Department of Biological Sciences, California State University Long Beach

18*P 8:40  BIOCHEMICAL ELUCIDATION OF A K+/H+ EXCHANGE PATHWAY THAT REGULATES PARASITE BEHAVIOR DURING THE LYDIC CYCLE OF THE HUMAN PARASITE *TOXOPLASMA GONDII*

E. Galbreath, V. Valencia, H.E. Gause, C. Monahan, J. Chetsawang, D.A. Pace. Department of Biological Sciences, California State University Long Beach

19*P 9:00  ASSESSING THE VIRULENCE POTENTIAL OF THE TACHYZOITE STAGE OF THE Apicomplexan PARASITE, *TOXOPLASMA GONDII*, WHILE EXPOSED TO SEAWATER CONDITIONS

H.E. Gause, D.A. Pace, V. Valencia. Department of Biological Sciences, California State University Long Beach

20 9:20  INFECTION OF GHOST SHRIMP (*NEOTRYPAEA* SPP.) WITH AN AGGREGATA-LIKE Apicomplexan

S. Jones1, R. Appy2, 1Fisheries and Oceans Canada, Pacific Biological Station, British Columbia, Canada; 2Cabrillo Marine Aquarium

21*P 9:40  EFFECTS OF CELL-LINEAGE SPECIFIC RELMα IN IMMUNITY AND INFLAMMATION TO HOOKWORM *NIPPOSTRONGYLUS BRASILIENSIS*

H. Batugedara, G. Chen, J.J. Patel, M.G. Nair. Division of Biomedical Sciences, School of Medicine, University of California Riverside

22*FP 10:00  FEAR AND FEEDING: RISK OF INFECTION PREDICTS PARASITE AVOIDANCE BEHAVIOR

C. Fong1, A. Kuris1, H. Posner2. 1University of California Santa Barbara; 2Harvard University

23*P 10:20  INTERACTIONS BETWEEN THE VELVETY TREE ANT *LIOMETOPUM OCCIDENTALE* (HYMENOPTERA: FORMICIDAE) AND PHORID FLIES (DIPTERA: PHORIDAE)

L.J. Vigil, C. Courtney-Hogue. California State University Northridge

10:40 – 11:00  BREAK
11:00 – 12:30  
**Plenary Session: Ballroom B (Ronald Tutor Campus Center)**

Dr. Larry Allen, Department of Biology, California State University Northridge

“The Return of the Kelp Forest King, Giant Sea Bass *Stereolepis gigas* off California”

12:30 – 1:20  
**LUNCH BREAK**

24*P  
1:20  
**PENNELLA BALAENOPTERA: THE BIOLOGY OF A MESOPARASITIC COPEPOD ON WHALES**

D. Alps, J. Passarelli. 1 California Whales and Wildlife; 2 Cabrillo Marine Aquarium

25*FP  
1:40  
**DIVERSE PARASITES OF SENORITA WRASSE (*OXYJULIS CALIFORNICA*) IN SANTA BARBARA KELP FORESTS**

A. Hernandez, D.N. Morton. University of California Santa Barbara

26*FP  
2:00  
**PARASITE DIVERSITY WITHIN COMMON KELP FOREST SURFPERCHES (EMBIOTOCIDAE)**

D. Morton. University of California Santa Barbara

27  
2:20  
**PARASITE ASSEMBLAGES OF DOUBLE-CRESTED CORMORANTS (*PHALACROCORAX AURITUS*) DIFFERENTIATE HOST POPULATIONS AND MIGRATION BEHAVIOR**

K.L. Sheehan. Marine Biology Research Division, Scripps Institution of Oceanography, University of California San Diego

28  
2:40  
**BASELINE SURVEY OF PARASITES OF SHORECRABS (*PACHYGRAPSUS CRASSIPES*) AND LONGJAW MUDSUCKERS (*GILLICHTHYS MIRABILIS*) FOR THE SEAL BEACH NATIONAL WILDLIFE REFUGE THIN-LAYER SALT MARSH SEDIMENT AUGMENTATION PILOT PROJECT**

R. Appy, K. Gilligan. 1 Cabrillo Marine Aquarium; 2 Seal Beach National Wildlife Refuge

3:00 – 3:20  
**BREAK**

**Session 2: Contributed Papers, Marine**  
**Location: Ballroom C (Ronald Tutor Campus Center)**

Chair: John Roberts, California State University Dominguez Hills (Emeritus)

29*P  
3:20  
**UNEXPECTED DISCOVERY OF A NEW CILIATE PARASITE IN A WELL-STUDIED POPULATION OF LINED SHORE CRABS**

D.C. Metz, R.R. Sheehy, M.T. Close, H.J. Small, J.M. Carrillo, R.M. Overstreet, J.D. Shields, R.F. Hechinger. 1 Scripps Institution of Oceanography; 2 Department of Biology, Radford University; 3 Aquatic Health Sciences, Virginia Institute of Marine Science; 4 Gulf Coast Research Laboratory, University of Southern Mississippi; 5 Environmental and Aquatic Animal Health, Virginia Institute of Marine Science

30  
3:40  
**THE MONKEYFACE PRICKLEBACK *CEBIDICHTHYS VIOLACEUS* GENOME: A SOURCE FOR UNDERSTANDING BIOLOGY IN A COMPLEX ENVIRONMENT**

J. Heras, D.P. German. Department of Ecology and Evolutionary Biology, University of California Irvine

31  
4:00  
**THE SPECIFIC AND EXCLUSIVE MICROBIOME OF THE DEEP-SEA BONE-EATING SNAIL *RUBYSPIRA OSTEOVORA***

H.S. Aronson, S.K. Goffredi. Department of Biology, Occidental College
32* 4:20 TAXONOMY AND GROWTH KINETICS OF MARINE BACTERIA IN BATCH CULTURE
C. Dotson, Vistamar School, El Segundo, CA

34 4:40 THE OCCURRENCE OF A MUTATION IN THE LABORATORY POPULATION OF THE POLYCHAETOUS ANNELID NEANTHES ARENACEODENTATA
D.J. Reish, B. Feld. Department of Biological Sciences, California State University Long Beach

5:00 END OF SESSION

5:00 – 7:00 POSTER SESSION    Location: Ballroom B (Ronald Tutor Campus Center)
Friday, May 6, 2016

Session 3: Contributed Papers, Marine

Location: Ballroom D (Ronald Tutor Campus Center)

Chair: Ann Bull, Bureau of Ocean Energy Management

35*  8:00  ENVIRONMENTAL VARIABILITY AND INVESTMENT IN THERMAL DEFENSES: THE IMPORTANCE OF RECENT HISTORY
C. Prince, B.J. Allen. Department of Biological Sciences, California State University Long Beach

36*  8:20  RECENT THERMAL HISTORY DETERMINES MICROALGAL RESPONSE TO ACUTE TEMPERATURE STRESS ON ROCKY SHORES
E. Hunt, L.P. Miller, M.W. Denny, B.J. Allen. 1Department of Biological Sciences, California State University Long Beach; 2Department of Biological Sciences, San Jose State University; 3Hopkins Marine Station of Stanford University

37*  8:40  THERMAL DEFENSE STRATEGY DETERMINES LIMPET RESPONSE TO ACUTE TEMPERATURE STRESS ON ROCKY SHORES
T.F. Kroupa, L.P. Miller, M.W. Denny, B.J. Allen. 1Department of Biological Sciences, California State University Long Beach; 2Department of Biological Sciences, San Jose State University; 3Hopkins Marine Station of Stanford University

38*  9:00  PREDICTING EFFECTS OF ENVIRONMENTAL VARIABILITY ON THERMAL RISK TO BLACK ABALONE: COMBINING ECHOMECHANICS AND BEHAVIOR
E. A. Duncan, L.P. Miller, M.W. Denny, B.J. Allen. 1Department of Biological Sciences, California State University Long Beach; 2Department of Biological Sciences, San Jose State University; 3Hopkins Marine Station of Stanford University

39*F  9:20  ACCLIMATED METABOLIC Q10 OF THE CALIFORNIA HORN SHARK HETERODONTUS FRANCISCI
S.M. Luongo, C.G. Lowe. Department of Biological Sciences, California State University Long Beach

40*  9:40  LACTATE PRODUCTION IN THE HERMIT CRAB PAGURUS SAMUELIS SUBJECTED TO TEMPERATURE AND BURIAL STRESSES
M.G. Valere-Rivet, S.G. Dunbar. Department of Earth and Biological Sciences, Loma Linda University

41  10:00  ECOATLAS: AN ONLINE VISUALIZATION TOOL FOR EELGRASS DISTRIBUTION
A.K. Obaza, C. Grosso, W.B. Chesney. 1NOAA Fisheries, West Coast Region; 2Ocean Associates, Inc. Arlington, VA; 3San Francisco Estuary Institute

42  10:20  QUANTITATIVE RELATIONSHIPS BETWEEN SOUND PRODUCTION AND ABUNDANCE IN FISH SPAWNING AGGREGATIONS
T.J. Rowell, D.A. Demer, J.J. Cota Nieto, O. Aburto-Oropeza, J.R. Hyde, G.L. D’Spain, B.E. Frisman. 1Scripps Institution of Oceanography, University of California San Diego; 2Centro para la Biodiversidad Marina y la Conservación A.C., BCS, Mexico; 3NOAA Southwest Fisheries Science Center; 4Marine Sci Institute Univ. of Texas, Austin

10:40 – 11:00  BREAK
11:00 – 12:30  Plenary Session: Ballroom B (Ronald Tutor Campus Center)
Dr. Larry Allen, Department of Biology, California State University Northridge
“The Return of the Kelp Forest King, Giant Sea Bass Stereolepis gigas off California”

12:30 – 1:20  LUNCH BREAK

Session 3: California Climate Policy  Location: Ballroom D (Ronald Tutor Campus Center)
Chair: Yael Nahmias, USC Environmental Studies Program and Department of Political Science

1:20  Welcoming remarks: Yael Nahmias, USC Environmental Studies Program and Department of Political Science

43 1:40  CALIFORNIA’S RESPONSE TO CLIMATE CHANGE: LEADING IN MITIGATION, LAGGING IN ADAPTATION
D.A. Mazmanian. Arnold Schwarzenegger Institute of State and Global Policy and Sol Price School of Public Policy, University of Southern California

44 2:00  HOW WILL LOS ANGELES ADAPT TO CLIMATE CHANGE? AN ECONOMIST'S PERSPECTIVE
M.E. Kahn. Department of Economics, Spatial Sciences Institute, and Environmental Studies Program, University of Southern California

45 2:20  THE ART OF THE POSSIBLE: CUTTING EMISSIONS WITH MICROGRIDS AT UC SAN DIEGO
B. Washom. Strategic Energy Initiatives, University of California San Diego

46 2:40  THE CLIMATE CRISIS AND WHAT ANGELENOS CAN DO ABOUT IT
J. Parfrey. Climate Resolve

3:00 – 3:20  BREAK

47 3:20  EXPLAINING PUBLIC ATTITUDES ON CLIMATE CHANGE
D. Chong. Department of Political Science, University of Southern California

48 3:40  EXAMINING THE WHO, WHERE, AND HOW OF ENVIRONMENTAL ORGANIZATIONS IN LOS ANGELES: THE LA STEWARDSHIP MAPPING AND ASSESSMENT PROJECT (STEW-MAP)
M. Romolini. Center for Urban Resilience, Loyola Marymount University

49 4:00  ENVIRONMENT, ECONOMY, AND EQUITY: ADDRESSING CLIMATE CHANGE WITH LA’S SUSTAINABLE CITY PLAN
S. Bornstein. Office of Los Angeles Mayor Eric Garcetti

50 4:20  THE FUTURE OF THE LOS ANGELES RIVER
C. Armstrong. LARiverWorks, Office of Los Angeles Mayor Eric Garcetti

4:40  Concluding remarks and discussion: Yael Nahmias, USC Environmental Studies Program and Department of Political Science

5:00  END OF SESSION

5:00 – 7:00 POSTER SESSION  Location: Ballroom B (Ronald Tutor Campus Center)
Friday, May 6, 2016    5:00 – 7:00 PM

Session: Poster Session   Location: Ballroom B (Ronald Tutor Campus Center)

33  THE EFFECTS OF CEC: 17β-ESTRADIOL ON Atherinops Affinis Vitellogenin (VTG) DEVELOPMENT  
A.M. Rabe¹, D. Li². ¹Loyola Marymount University, Los Angeles, CA; Environmental Monitoring Division, City of Los Angeles, Hyperion Water Reclamation Plant

51  A HANDHELD HEMATOLOGY ANALYZER  
V. Liu¹, A. Lee². ¹Flintridge Preparatory School; ²Department of Biomedical Engineering, University of California Irvine

52*  THE EFFECTS OF DIETHYLSTILBESTROL AND METHYLPARABEN ON WEHI 7.1 CELLS  
M. Barba, C. Broussard. Department of Biology, University of La Verne

53  CREATE A NEW TARGET-SPECIFIC CYTOTOXIC RNA AND EXAMINE ITS VIABILITY FOR USE AGAINST HIV  
B.W. Ng¹, J.C. Burnett². ¹Walnut High School; ²Department of Molecular and Cellular Biology, Beckman Research Institute

54*  POST-PLEISTOCENE RANGE EXPANSION OF SCELOPORUS OCCIDENTALIS IN THE WESTERN AND CENTRAL GREAT BASIN  
M.L. Thompson¹, M.A. Thompson², J. Archie¹. ¹Department of Biology, California State University Long Beach; ²Department of Biology, California State University Fullerton

55*  ‘PAINTS ROCK’ – AN INTERDISCIPLINARY RESEARCH PROJECT BETWEEN THE GEOLOGY AND CHEMISTRY DEPARTMENTS AT PASADENA CITY COLLEGE TO SYNTHESIZE SUSTAINABLE PAINTS FROM NATURAL MINERALS  
V. Sanchez, J. Portillo, M. Ramos, J. Blatti, J. Ashcroft. Natural Sciences Division, Pasadena City College

56*  PYRITE CRYSTALS AND 3D TOPOGRAPHY AS EVIDENCE FOR HYPOSTOMAL POSITION IN AGNOSTOID ARTHROPODS  
M.A Miguel, L.A. Ritterbush. Department of Geology, California Lutheran University

57  PALEO FLOODING EVENTS CANADA DEL PUERTO, SANTA CRUZ ISLAND, SOUTHERN CALIFORNIA  
T. LeBeau, N. Morgan, B. Carter. The Nature Conservancy of Santa Cruz Island; The Natural Reserve System of Santa Cruz Island

58  MEASURING RUNOFF FECAL INDICATOR BACTERIA REMOVAL EFFICIENCY IN THE BALLONA CREEK RAIN GARDEN, CULVER CITY, CALIFORNIA  
J.S. Allen, J. Dorsey. Seaver College of Science and Engineering, Environmental Science Department, Loyola Marymount University

59  MEASURING RUNOFF POLLUTANT REMOVAL EFFICIENCY IN THE BALLONA CREEK RAIN GARDEN, CULVER CITY, CALIFORNIA  
N. Enciso, J.S. Allen, J. Dorsey. Seaver College of Science and Engineering, Environmental Science Program, Loyola Marymount University
IS WATER POLLUTION AN ENVIRONMENTAL JUSTICE ISSUE? A CASE STUDY OF CALIFORNIA AND LOUISIANA

O.M. Trombadore, J.A. Sohm. Environmental Studies Program, University of Southern California

A COMPARATIVE STUDY OF WATER EFFICIENCY AND GROWTH FOR BOK CHOY IN A RAISED BED AND AQUAPONICS SYSTEM

K. Wang, M. Enloe, M. Chan, D. Kim. Environmental Studies Program and Wrigley Institute of Environmental Studies, University of Southern California

TIMING OF DEATH IN C57BL/6 EMBRYONIC THYMOCYTES UPON IN VITRO EXPOSURE TO DIETHYLSLETILBESTROL

K. Alpi, L. Dinh, J. Cervantes, C. Broussard. Department of Biology, University of La Verne

INTEGRATED GEOLOGICAL AND CHEMICAL PROCESSES IN PROBLEM-BASED LEARNING LABORATORY

G. Armstorff, R. Flores, J. Monroy, J. Ashcroft. Natural Sciences Division, Pasadena City College

MORPHOLOGICAL RESPONSES OF SHORE BIRDS TO PARASITE INFECTIONS OF KIDNEY WORMS AND TRACHEAL GAPE WORMS


CARDIAC MRI BASED INVESTIGATION INTO THE RELATION BETWEEN ACUTE INFARCT SIZE AND LONG-TERM FUNCTIONAL INDICES

J. Kim

AIRSHIP HULL OPTIMIZATION USING ARTIFICIAL NEURAL NETWORK AND COMPUTATIONAL FLUID DYNAMIC SIMULATIONS

S. Chen¹, R. Boyd². ¹Palos Verdes Peninsula High School; ²Lockheed Martin Aeronautics ADP

A NOVEL SPIRAL MICROFLUIDIC DEVICE FOR URINALYSIS

B. Liu, R. Liu, A. Lee. Department of Biomedical Engineering, University of California Irvine

THE EFFECTS OF DIETHYLSTILBESTROL AND METHYLPARABEN ON JURKAT T CELLS

A. Valiente, C. Straight, C. Broussard. Department of Biology, University of La Verne

BIOPHYSICAL AND FUNCTIONAL CHARACTERIZATION OF A CALCIUM ACTIVATED POTASSIUM CHANNEL IN TRYPANOSOMA CRUZI

C. Skorka, V. Jimenez. Center for Applied Biotechnology Studies and Department of Biological Sciences, California State University Fullerton

EFFECTS OF DIETHYLSTILBESTROL AND METHOXYCHLOR METABOLITE, 2,2-BIS-(P-HYDROXYPHENYL)-1,1,1-TRICHLOROETHANE (HPTE) ON CELL VIABILITY IN JURKAT T CELLS

J. Batres, D. Gonzalez, C. Broussard. Department of Biology, University of La Verne

PEER PRESSURE: SOCIAL MOTILITY AND DIFFERENTIATION IN TRYPANOSOMA CRUZI

H. Lynch, D. Arroyo, V. Jimenez. Center for Applied Biotechnology Studies and Department of Biological Science, California State University Fullerton

EL4 CELL LINE DEATH IN RESPONSE TO DIETHYLSTILBESTROL (DES) AND 2,2-BIS-(P-HYDROXYPHENYL)-1,1,1-TRICHLOROETHANE (HPTE) EXPOSURE
73*F REPRODUCTIVE PHYSIOLOGY OF PACIFIC SANDDAB (CITHARICHTHYS SORDIDUS) COLLECTED NEAR A WASTEWATER OUTFALL SITE IN SOUTHERN CALIFORNIA
V.L. Park, K.L. Forsgren. Department of Biological Science, California State University Fullerton

74*F ACUTE 17ß-ESTRADIOL EXPOSURE DOES NOT IMPACT GONADAL DEVELOPMENT IN JUVENILE TOPSMELT (ATHERINOPS AFFINIS)
C.C. Robinson1, D. Li2, K.A. Young1. 1Department of Biological Sciences, California State University Long Beach; 2Los Angeles City Sanitation, Environmental Monitoring Division

75*P MOLECULAR ECOLOGY OF ASCAROPHIS (SIMILASCAROPHIS) SP. (NEMATODA: CYSTIDICOLIDAE) FROM FISH AND CRUSTACEAN HOSTS FROM SOUTHERN CALIFORNIA, MEXICO AND CHILE
H. Munkacsi, R. Appy, G. Munoz, S. Goffredi. Occidental College; Cabrillo Marine Aquarium; Universidad de Valparaiso, Valparaiso, Chile

76* THE SKIN OF THE GIANT KEYHOLE LIMPET; A UNIQUE BACTERIAL HABITAT GOVERNED BY TISSUE TYPE AND HOST GEOGRAPHY.

77* MINERAL HAND SPECIMEN ID USING PHYSICAL PROPERTIES OBSERVED IN HAND SPECIMEN AND BASIC SEM ANALYSIS AS PART OF A 2 YEAR COLLEGE INDEPENDENT STUDY PROJECT
G. Armstorff, J. Ashcroft, M. House. Natural Sciences Division, Pasadena City College

78*P FEATHER QUIL MITE INFECTIONS OF COASTAL BIRDS FROM CALIFORNIA

79 SEX EFFECTS BUT NO SEASONAL DIFFERENCES IN THE DIGESTIVE PHYSIOLOGY OF A NEWLY HERBIVOROUS LIZARD
B.A. Wehrle1, B.Q. Nguyen-Phuc1, R.K. Dang1, Z. Tadic2, M. Krajnovic2, A. Herrel3, D.P. German1. 1Department of Ecology and Evolutionary Biology, University of California Irvine; 2Division of Animal Physiology, University of Zagreb, Zagreb, Croatia; 3Département d'Ecologie et de Gestion de la Biodiversité, Paris, France

80* EFFECT OF WATER DEPRIVATION ON THERMOREGULATORY STRATEGY OF DESERT IGUANAS (DIPSOSAURUS DORSALIS)
M.A. Thompson, C.R. Tracy. Department of Biology, California State University Fullerton

81*P THE INFLUENCE OF HABITAT AVAILABILITY ON INTESTINAL HELMINTH PARASITE COMMUNITIES OF COASTAL BIRDS

82* TEMPORAL PATTERNS OF DIVERSITY EFFECTS IN A RESTORED COASTAL WETLAND
K.J. Gonzalez1, M. Fitzgerald1, J.L. Funk2, C. Whitcraft1, B.J. Allen1. 1Department of Biological Sciences, California State University Long Beach; 2School of Earth and Environmental Sciences, Chapman University

83*F UNDERSTANDING FISH HABITAT IN A TIDALLY RESTRICTED URBAN LAGOON
QUANTIFYING THE RELATIVE IMPORTANCE OF POSITIVE INTERACTIONS ACROSS A STRESS GRADIENT IN THE ROCKY INTERTIDAL ZONE
J.A. Mann, B.J. Allen. Department of Biological Sciences, California State University Long Beach

RELATEDNESS AND DIFFERENTIAL DISEASE RESISTANCE IN CALIFORNIA HALIOTIDS
A.R. Braciszewski, D.P. German. Ecology and Evolutionary Biology Department, University of California Irvine

THE REPRODUCTIVE MORPHOLOGY OF THE BLACK PERCH (*EMBIOTOCA JACKSONI*): A PRELIMINARY INVESTIGATION
E.C. Ruelas, A.D. Barraza, K.L. Forsgren. Department of Biological Sciences, California State University Fullerton

THE SECRET LIFE OF BABY GIANTS: THE RECRUITMENT OF THE ENDANGERED GIANT SEA BASS
S. Benseman, L. Allen. California State University Northridge

INVENTORY OF SUBTIDAL MARINE LIFE IN BIG FISHERMAN'S COVE, SANTA CATALINA ISLAND
A. Looby, D.W. Ginsburg. Environmental Studies Program, University of Southern California

THE EFFECTS OF OCEAN WARMING AND ACIDIFICATION ON SEAWEED GROWTH AND URCHIN GRAZING
L.M. Briggs, J.R. Smith. Biological Sciences Department, California State Polytechnic University Pomona

ENERGETIC EFFICIENCY OF GROWTH IN MORPHOLOGICALLY DIFFERENT LARVAL SEA URCHINS
A.J. Rendleman, J.A. Rodriguez, A. Ohanian, B. Chang, E.S. Chang, D.A. Pace. Department of Biological Sciences, California State University Long Beach

HOST CHOICE AFFECTS FECUNDITY IN THE GASTROPOD *CREPIDULA ONYX*
A.R. Von Tungeln, B. Pernet. Department of Biological Sciences, California State University Long Beach

REPRODUCTION AND DEVELOPMENT OF THE SPINY CUP-AND-SAUER SNAIL (*CRUCIBULUM SPINOSUM*) IN NEWPORT BAY
J. Chang¹, T. Kostenbader², B. Pernet¹. ¹Department of Biological Sciences, California State University Long Beach; ²Jordan High School

SALINITY TOLERANCE OF LARVAE, JUVENILES, AND ADULTS OF THE NON-INDIGENOUS ANNElid *FICOPOMATUS ENIGMATICUS*
J. Peria, V. Langland, B. Pernet. Department of Biological Sciences, California State University Long Beach

GROWTH AND FEEDING EFFICIENCY IN LARVAL STAGES OF *DENDRASTER EXCENTRICUS* AT TWO DIFFERENT FOOD CONCENTRATIONS
J.A. Rodriguez, E. Chang, A. Ohanian, A. Rodriguez, A.J. Rendleman, D.A. Pace. Department of Biological Sciences, California State University Long Beach
95* PHENOTYPIC PLASTICITY IN FEEDING STRUCTURES IN PRE-FEEDING LARVAE OF ECHINOID AND ASTEROID ECHINODERMS
C. Sojka, B. Pernet. Department of Biological Sciences, California State University Long Beach

96*F ROCKY REEF FISH DIVERSITY RESPONSES TO EL NIÑO AND THE NORTH PACIFIC GYRE OSCILLATION
E. Rhiel, M.J. Robart, C.M. Williams, J.P. Williams, D.J. Pondella, II. Vantuna Research Group, Department of Biology, Occidental College

97*F SPAWNING FRACTION IN KELP BASS (PARALABRAX CLATHRATUS) PEAKS IN MID TO LATE SUMMER ACROSS BREEDING SEASON IN SOUTHERN CALIFORNIA
C.N. Craig¹, M.M. Williams¹, K.M. Walker², C.F. Valle², K.A. Young¹. ¹Department of Biological Sciences, California State University Long Beach; ²California Department of Fish and Wildlife, Los Alamitos, CA

98* EXPULSION OF FOREIGN OBJECTS BY FOUR SPECIES OF ECHINODERMS: PISASTER GIGANTEUS, PATIRIA MINIATA, STRONGYLOCENTROTUS PURPURATUS, AND PARASTICHOPUS CALIFORNICUS
S.A. Wynglarz, T. Nguyen, D. Zacherl, C.R. Tracy. Department of Biology, California State University Fullerton

99* MAXIMIZING SUCCESS OF ARTIFICIAL REEF PLACEMENT OFF THE COAST OF CALIFORNIA
S.T. Schwab¹, A.J. Zellmer¹, C.M. Williams¹, J.T. Claisse², D.J. Pondella, II¹. ¹Vantuna Research Group, Department of Biology, Occidental College; ²Department of Biology, California State University Pomona

100 MALE-FEMALE BEHAVIOR IN THE POLYCHAETOUS ANNELID NEANTHES ARENACEODENTATA
B.G. Feld, D.J. Reish. Department of Biological Sciences, California State University Long Beach

132 LONG-TERM STABILITY OF FISH COMMUNITIES IN SAN DIEGO BAY
A. Roeper¹, A.J. Zellmer¹, C.M. Williams¹, J.T. Claisse², D.J. Pondella, II¹. ¹Department of Biology, Occidental College; ²Biological Sciences Department, California State Polytechnic University
Saturday, May 7, 2016

Session 1: Marine Mammals: Southern California Behavioral Response Study (SOCAL-BRS)
Location: Ballroom A (Ronald Tutor Campus Center)

Chair: Diane Alps, California Whales and Wildlife

101 8:00  SOCAL-BEHAVIORAL RESPONSE STUDY INTRODUCTION, OVERVIEW, AND SPONSOR PERSPECTIVE
J. Calambokidis\textsuperscript{1}, A. Kumar\textsuperscript{2}. \textsuperscript{1}Cascadia Research, Olympia, WA; \textsuperscript{2}Living Marine Resources Program, NAVFAC EXWC, Port Hueneme, CA

102 8:20  OVERALL METHODS AND RESULTS OF THE SOUTHERN CALIFORNIA BEHAVIORAL RESPONSE STUDY (SOCAL-BRS)
B. Southall\textsuperscript{1, 2}. \textsuperscript{1}Southall Environmental Associates, Inc., Aptos, CA; \textsuperscript{2}Long Marine Laboratory, University of California Santa Cruz

103 8:40  MARINE MAMMAL MONITORING ON NAVY RANGES (M3R): THE APPLICATION OF PASSIVE ACOUSTICS FOR EXAMINING THE EFFECT OF SONAR ON CETACEANS
D. Moretti. Division Newport, Naval Undersea Warfare Center, Newport, RI

104 9:00  PASSIVE ACOUSTIC STUDIES ASSOCIATED WITH THE SOUTHERN CALIFORNIA BEHAVIORAL RESPONSE STUDY
J. Barlow\textsuperscript{1}, J.L. Keating\textsuperscript{1}, S. Guan\textsuperscript{2, 3}, S. Rankin\textsuperscript{1}. \textsuperscript{1}NOAA Southwest Fisheries Science Center; \textsuperscript{2}NOAA Fisheries Office of Protected Resources; \textsuperscript{3}The Catholic University of America

105 9:20  NOVEL ANALYTICAL APPROACHES TO STUDY FEEDING AND CALLING BEHAVIOR IN BALEEN WHALES
A. Allen\textsuperscript{1}, A. Stimpert\textsuperscript{2}. \textsuperscript{1}Cascadia Research, Olympia, WA; \textsuperscript{2}Moss Landing Marine Laboratories, California State University

106 9:40  THE INFLUENCE OF PREY ON BLUE WHALE (BALAENOPTERA MUSCULUS) BASELINE FORAGING ECOLOGY, KINEMATICS, AND SONAR PLAYBACK EXPERIMENTS
E. Hazen\textsuperscript{1, 2}. \textsuperscript{1}NOAA/NMFS/SWFSC/Environmental Research Division, Pacific Grove, CA; \textsuperscript{2}Ecology and Evolutionary Biology, University of California Santa Cruz

107 10:00  COMPLEMENTARY ANALYSES OF BEHAVIORAL RESPONSES TO SONAR IN BLUE WHALES (BALAENOPTERA MUSCULUS)
B. Southall. Southall Environmental Associates, Inc., Aptos, CA

108 10:20  BASELINE STUDIES OF RISSO'S DOLPHIN ACOUSTIC, DIVING AND SOCIAL BEHAVIOUR
P. Arranz\textsuperscript{1}, F. Visser\textsuperscript{2, 3}. \textsuperscript{1}Sea Mammal Research Unit, University of St Andrews, Scotland; \textsuperscript{2}Kelp Marine Research, Netherlands; \textsuperscript{3}Institute of Biology, Leiden University, Netherlands

10:40 – 11:00  BREAK
11:00 – 12:30 Plenary Session: Ballroom B (Ronald Tutor Campus Center)
Dr. Virginia Naples, Northern Illinois University
“The Gaping Truth: Adaptations For a Sabertooth Lifestyle”

12:30 – 1:20 LUNCH BREAK

109 1:20 TRACKING RISSO’S DOLPHIN MOVEMENTS WITH PHOTO-ID AND COMBINED TAG AND FOLLOW INFORMATION

110 1:40 INSIGHTS INTO THE UNDERWATER BEHAVIOR, SPECIES INTERACTIONS, AND BIOMECHANICS OF BALEEN WHALES USING INTEGRATEDVIDEO AND INERTIAL SENSORS
J. Goldbogen, D. Cade. Hopkins Marine Station of Stanford University

111 2:00 USE OF MEDIUM DURATION HIGH-RESOLUTION ARCHIVAL TAGS TO EXAMINE WHALE BEHAVIOR AND RESPONSE TO NAVY SONAR AND OTHER HUMAN ACTIVITIES
J. Calambokidis. Cascadia Research, Olympia, WA

2:20 Panel Discussion

2:40 Panel Discussion

3:00 – 3:20 BREAK

Saturday, May 7, 2016

Session 1: Contributed Papers, Marine Mammals
Location: Ballroom A (Ronald Tutor Campus Center)

Chair: Diane Alps, California Whales and Wildlife

112* 3:20 FIN WHALE TRACKS OFFSHORE OF SOUTHERN CALIFORNIA FROM PASSIVE ACOUSTIC MONITORING
L.M. Varga, S.M. Wiggins, J.A. Hildebrand. Scripps Whale Acoustics Lab, Scripps Institution of Oceanography, University of California, San Diego

113*FP3:40 EPIDEMIOLOGICAL MODELS TO CONTROL THE SPREAD OF INFORMATION IN MARINE MAMMALS
Z. Schakner1, M.G. Buhnerkempe1,2, M.J. Tennis3, R.J. Stansell4, B.K. Van Der Leeuw4, J.O. Lloyd-Smith1,2, D.T. Blumstein1. 1Department of Ecology & Evolutionary Biology, University of California Los Angeles; 2Fogarty International Center, National Institutes of Health; 3Pacific States Marine Fisheries Commission; 4U.S. Army Corps of Engineers

114 4:00 THE PARADOX OF THE WHALE GUT MICROBIOME: BALEEN WHALES HOST A UNIQUE BACTERIAL COMMUNITY WITH SIMILARITIES TO BOTH CARNIVORES AND HERBIVORES
J. Sanders1,5, A. Beichman1,2, J. Roman3, J. Scott4, D. Emerson4, J. McCarthy1, P. Girguis1. 1Harvard University; 2University of California Los Angeles; 3Gund Institute for Ecological Economics; 4Bigelow Laboratory for Ocean Sciences; 5University of California San Diego
HUMAN DISTURBANCE ON CALIFORNIA SEA LIONS (*Zalophus californianus*) OFF DANA POINT, CALIFORNIA
I. Lee, L.L. Stelle, H. Thiltgen. Department of Biology, University of Redlands

PHOTO ID OF OFFSHORE BOTTLENOSE DOLPHINS (*Tursiops truncatus*) IN SOUTHERN CALIFORNIA USING DARWIN
E.M. Walters, T. Camper, L.L. Stelle. Department of Biology, University of Redlands

END OF SESSION
Southern California Academy of Sciences 2016 Session Schedule

Saturday, May 7, 2016

Session 2: Contributed Papers, Terrestrial  Location: Ballroom C (Ronald Tutor Campus Center)

Chair: Edith Read, E Read and Associates, Inc.

117 8:00 FIRST REPORT OF ISOLATED SOFT OSTEOCYTES FROM NANOTYRANNUS VERTEBRA AND METATARSAL BONES COLLECTED AT HELL CREEK FORMATION, JORDAN, MT
M. Armitage. 587 North Ventu Park Road, Thousand Oaks, CA

118* 8:20 USING SPECIES HABITAT MODELS TO ANALYZE THE INTERACTION BETWEEN THE WESTERN GRAY SQUIRREL AND THE EASTERN FOX SQUIRREL IN CALIFORNIA
R. Garcia, A.E. Muchlinski, H.L. Qiu. California State University Los Angeles

119* 8:40 SQUIRREL CSI: WHO ARE YOU? A GENETIC ANALYSIS OF A WESTERN GRAY SQUIRREL POPULATION IN SOUTHERN CALIFORNIA
C.L. DeMarco¹, A. Aguilar¹, E. Torres¹, D. Cooper², A. Muchlinski³. ¹Department of Biological Sciences, California State University Los Angeles; ²Cooper Ecological Monitoring, Inc., Oak Park, CA

120* 9:00 CHANGES IN THE DISTRIBUTION OF THE EASTERN GRAY SQUIRREL, SCIURUS CAROLINENSIS, IN CALIFORNIA FROM 1900-2014 WITH PROJECTIONS OF ITS FUTURE RANGE
C. Creley¹, F. Shilling², A. Muchlinski³. ¹Department of Geosciences and the Environment, California State University Los Angeles; ²Department of Environmental Science and Policy, University of California Davis; ³Department of Biological Sciences, California State University Los Angeles

121* 9:20 POPLAR TREE BIOMECHANICS VARIES WITH POSITION WITHIN A TREE
A.B. Baer, A.L. Jacobsen. Department of Biology, California State University Bakersfield

122 9:40 A REGIONAL PERSPECTIVE ON TRASH AND DEBRIS FROM RIVERS TO THE SEA IN SOUTHERN CALIFORNIA
S.L. Moore¹, M.A. Sutula¹, K. Schiff¹, T. VonBitten², G. Lattin³. ¹Southern California Coastal Water Research Project; ²Amec Foster Wheeler; ³Algalita Education and Marine Research

123*F 10:00 EVIDENCE FOR NEGATIVE EFFECTS OF DROUGHT TO BAETIS SP. (SMALL MINNOW MAYFLY) ABUNDANCE IN A SOUTHERN CALIFORNIA STREAM
E. Montgomery¹, R. Dagit¹, C. Garcia¹, J. Krug¹, K. Adamek¹, S. Albers¹, K. Pease². ¹Resource Conservation District of the Santa Monica Mountains; ²Heal the Bay

124 10:20 ESTIMATING TWO DECADES OF FLOW DATA WITH THREE YEAR HYDROLOGIC MODELS
K.S. McCune¹, S. Adams², B. Bledsoe², R. Mazor¹, A. Sengupta¹, E. Stein¹. ¹Southern California Coastal Water Research Project; ²Colorado State University

10:40 – 11:00  BREAK
11:00 – 12:30  Plenary Session: Ballroom B (Ronald Tutor Campus Center)  
Dr. Virginia Naples, Northern Illinois University  
“The Gaping Truth: Adaptations For a Sabertooth Lifestyle”

12:30 – 1:20  LUNCH BREAK

125  1:20  A SURVEY OF ANGLERS TO ASSESS FISH CONSUMPTION FROM SAN DIEGO BAY  
S.L. Moore, S.J. Steinberg, P. Smith. Southern California Coastal Water Research Project

126  1:40  THE EARLY LATE DUCHESNEAN (LATE MIDDLE EOCENE) TITUS CANYON LOCAL FAUNA FROM THE SOUTH-CENTRAL GRAPEVINE MOUNTAINS OF DEATH VALLEY NATIONAL PARK, INYO COUNTY, EASTERNMOST CENTRAL CALIFORNIA—A PRELIMINARY REPORT  
E.B. Lander. Paleo Environmental Associates, Inc., and Natural History Museum of Los Angeles County Department of Vertebrate Paleontology

127  2:00  NEW RECORDS OF FRESHWATER BONY FISHES FROM THE LATE MIocene–PLIOCENE BOUSE FORMATION OF SOUTHEASTERN CALIFORNIA AND WESTERN ARIZONA  
M.A. Roeder. Department of Paleontology, San Diego Natural History Museum

2:20  END OF SESSION
Southern California Academy of Sciences 2016 Session Schedule

Saturday, May 7, 2016

Session 3: Contributed Papers, Marine Location: Ballroom D (Ronald Tutor Campus Center)

Chair: Ann Bull, Bureau of Ocean Energy Management

128*  8:00  PERVERSIVE PLASTICS: A NEW CHALLENGE FOR CRABS AND OUR SANDY BEACH ECOSYSTEM  
D.A. Horn, C. Steele, S. Anderson. California State University, Channel Islands

129*  8:20  TRENDS IN MARINE DEBRIS IN VENTURA COUNTY: CHANGES OVER THE LAST 30 YEARS ON MAINLAND AND CHANNEL ISLANDS BEACHES  
M. Miller, California State University, Channel Islands

130  8:40  IMPACTS OF MICROPLASTIC DEBRIS IN SANDY BEACH ECOSYSTEMS  
C. Steele, D.A. Horn, V.N. van Heerden. California State University, Channel Islands

131*  9:00  INTERFERENCE BY LARGE INEDIBLE PARTICLES REDUCES CLEARANCE RATES OF ECHINODERM LARVAE  
D. Lizárraga, A. Danihel, B. Pernet. Department of Biological Sciences, California State University Long Beach

133  9:20  AGE STRUCTURE AND GROWTH RATES OF VERMILION ROCKFISH (SEBASTES MINIATUS) ALONG CALIFORNIA COAST  
B.J. Peña, L.G. Allen. Department of Biology, California State University Northridge

134*F  9:40  EFFECTS OF ESTUARY OPENING ON POPULATION CONNECTIVITY OF CALIFORNIA KILLIFISH (FUNDULUS PARVIPINNIS)  
B.E. Weiser, M.A. Steele. Department of Biology, California State University Northridge

135*  10:00  PHYSIOLOGICAL EFFECTS OF ANGLING AND HANDLING STRESS ON SOUTHERN CALIFORNIA KELP BASS, PARALABRAX CLATHRATUS  
C. McGarigal, C.G. Lowe. Department of Biological Sciences, California State University Long Beach

10:20 END OF SESSION

10:40 – 11:00 BREAK

11:00 – 12:30 Plenary Session: Ballroom B (Ronald Tutor Campus Center)  
Dr. Virginia Naples, Northern Illinois University  
“The Gaping Truth: Adaptations For a Sabertooth Lifestyle”

12:30 – 1:20 LUNCH BREAK
Southern California Academy of Sciences 2016 Session Schedule

Saturday, May 7, 2016

Session 4: Research Training Program I

Location: Ronald Tutor Campus Center, Franklin Suite 350

Chair: Gordon Hendler, Natural History Museum of Los Angeles County

8:20 Welcoming remarks: Gloria Takahashi, La Habra High School (Emeritus), Cerritos College

136* 8:40 AN INTEGRATED LAB-ON-A-CHIP DEVICE INCORPORATING NOVEL MICROPUMPS, MICROVALVES, AND AN ACOUSTIC MICROMIXER FOR DISEASE DIAGNOSTICS

Benjamin Liu¹, H. Liu². ¹Arcadia High School; ²RD Bio Sciences, Inc.

137* 9:00 ROLE OF FLAVINS IN UNIQUE GROWTH CHARACTERISTICS OF SHEWANELLA ONEIDENSIS MR-1 CELLS GROWN IN THE PRESENCE OF GRAPHITE FELT

J.M.D. Tabuada¹, N.P. Shroff³, N.P. Shroff³, S.E. Finkel². ¹California Academy of Mathematics and Sciences; ²Department of Biological Sciences, University of Southern California

138* 9:20 DNA SEQUENCE VARIANTS THAT CORRELATE WITH CANINE SKULL SHAPE AND HUMAN BRAIN CANCER

C. Horowitz¹, D. Weisenberger², A. Patel¹. ¹Crossroads School for Arts & Sciences; ²Canine Genomics

139* 9:40 CONTACT ORDER AND ITS APPLICATION ON THE HYDROPHOBIC-POLAR LATTICE MODEL FOR PROTEIN FOLDING THROUGH ANT COLONY OPTIMIZATION

M.C. Xu¹, S. White², O. Arnold¹. ¹Beckman High School; ²Department of Physiology and Biophysics, University of California Irvine

140* 10:00 THE ROLE OF MIR133B IN SPINAL CORD RECOVERY FOLLOWING A CERVICAL CONTUSION IN MICE

P. Tanasescu, C. Danilov, P. Tanasescu¹, Y. Gu¹, C.A. Danilov¹. ¹Keck School of Medicine, University of Southern California

141 10:20 RESEARCH ON ALZHEIMER'S USING NON-NEGATIVE MATRIX FACTORIZATION

S. Ko¹, M. Pellegrini². ¹Harvard Westlake; ²Department of Molecular, Cell, and Developmental Biology, University of California Los Angeles

10:40 – 11:00 BREAK

11:00 – 12:30 Plenary Session: Ballroom B (Ronald Tutor Campus Center)

Dr. Virginia Naples, Northern Illinois University

“The Gaping Truth: Adaptations For a Sabertooth Lifestyle”

12:30 – 1:20 LUNCH BREAK
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<th>Time</th>
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<tr>
<td>1:20</td>
<td>THE SUMO E3 LIGASE PIAS1 INTERACTS WITH HUNTINGTIN IN THE NUCLEUS</td>
<td>R. Li, L. Thompson, E. Morozko.</td>
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<td>1:40</td>
<td>STUDENT ELECTRONIC CIGARETTES CULTURE AND USE IN A SANTA MONICA HIGH SCHOOL; A PUBLIC CASE STUDY AND SURVEY</td>
<td>H. Nasseri, A. Patel. Crossroads School for Arts &amp; Sciences</td>
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<td>2:00</td>
<td>UTILIZING NON-INVASIVE TECHNOLOGY TO MEASURE UNTETHERED RESPIRATORY AND CARDIAC PATTERNS OF REPTILES IN NON-LABORATORY ENVIRONMENTS</td>
<td>S. Karben, J. Hicks. 11501 Reeves Street, Los Angeles, CA</td>
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<td>2:20</td>
<td>EFFECT OF RETINOIC ACID ON THE EXPRESSION OF CD141 AND REGULATION OF T-SUPPRESSOR CELLS IN THE LUNG MUCOSA</td>
<td>C. Nguyen, A. Agrawal. 1Marina High School; 2Institute for Immunology, University of California Irvine</td>
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<td>2:40</td>
<td>AN ENTRCHEMICAL WATER HEATER</td>
<td>L. Lin, S. Kazadi, X. Ye. 1Walnut High School; 2Jisan Research Institute</td>
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Southern California Academy of Sciences 2016 Session Schedule

Saturday, May 7, 2016

Session 5: Research Training Program II
Location: Ronald Tutor Campus Center, Franklin Suite 351

Chair: Kathy Phalen, Southern California Junior Academy of Sciences Board

147*  8:40  INVESTIGATING THE ROLE OF THE CIRCADIAN CLOCK IN TOLL-LIKE RECEPTOR 7 INDUCED INFLAMMATORY ACTIVITY
C.J. Huang¹, E. Van Spyk², B. Andersen². ¹Walnut High School; ²Department of Biological Sciences, University of California Irvine

148*  9:00  CORRELATION BETWEEN TOTAL POSITIVE MATRICES AND PLANAR NETWORKS
C. Wong, G. Karaali. Pomona College

149*  9:20  CAFFEINE EXTRACTION IN COFFEE AND OVER-THE-COUNTER DRUGS
J. Nunez, K. Flynn, M. Galloway

150*  9:40  EXAMINING A NEW METHOD FOR THE DISCOVERY OF HYPOTHETICAL EXOTIC PARTICLES
J. Park, D. Whiteson, University of California Los Angeles Community School; Department of Physics and Astronomy, University of Los Angeles Irvine

151  10:00  INVESTIGATING THE ROLE OF TWO NEW GENES POTENTIALLY INVOLVED IN LIPID METABOLISM
U. Tan¹, J. Burke², J. Yaghoubian², S. Fuchs², M. Peterfy³. ¹Walnut High School; ²Western University of Health Sciences, College of Osteopathic Medicine of the Pacific; ³Cedars-Sinai Medical Center

152*  10:20  HYBRID MULTI-WALLED CARBON NANOTUBE TiO2 ELECTRODE MATERIAL FOR NEXT GENERATION ENERGY STORAGES.
S. Marler, J. Li. Sherman E. Burroughs High School

10:40 – 11:00  BREAK

11:00 – 12:30  Plenary Session: Ballroom B (Ronald Tutor Campus Center)
Dr. Virginia Naples, Northern Illinois University
“The Gaping Truth: Adaptations For a Sabertooth Lifestyle”

12:30 – 1:20  LUNCH BREAK

153*  1:20  SENSORY GATING, BLINK RATES, AND SYMPTOMS IN BIPOLAR DISORDER AND SCHIZOPHRENIA
M.S. Low¹, J.V. Patterson². ¹Marina High School; ²Department of Psychiatry, University of California Irvine Medical Center

154*  1:40  FABRICATION AND EVALUATION OF THE USE OF DRY ELECTRODES IN A LONG-TERM WIRELESS HEART MONITORING SYSTEM
M.G. Tang, M. Khine, M. Chu, Department of Biomedical Engineering, University of California Irvine
155* 2:00  ENTANGLING TIME-BIN QUBITS USING AN OPTICAL SWITCH: LASER ATTENUATION AND MACH-ZEHNDER INTERFEROMETER CONSTRUCTION
J. Choi, Y. Li, C.W. Wong, Oxford Academy

156* 2:20  THE EFFICACY OF TOPOISOMERASE I SUMO-INHIBITING COMPOUNDS IN SENSITIZING CELLS TO CAMPTOTHECIN
A. Abing, Y. Liu, M. Li. Beckman Research Institute

2:40 END OF SESSION
1  50 YEARS OF DEVELOPING ENVIRONMENTAL SCIENTISTS, EDUCATORS AND STEWARDS

A.M. Muscat. President and CEO, Catalina Island Conservancy

Since its beginning in 1965 the Wrigley Marine Science Center has been an extraordinary gathering place for programs and people dedicated to deepening our understanding of environmental complexity and the role of humans in marine and terrestrial ecosystems. Through its numerous programs in research, undergraduate and graduate education, k-12 and public outreach, and scientific diving safety and technology, a body of work and a group of environmental leaders have emerged that have furthered our ability to protect and enhance the natural resources of Catalina Island and far beyond. Highlights of these efforts underscores the importance of "The Wrigley” continuing to provide the intellectual and physical infrastructure necessary to support world-class research and learning across generations in the service of environmental stewardship.

2  DIVERSITY, SEASONALITY, AND PRIMARY PRODUCTIVITY OF A ROCKY INTERTIDAL COMMUNITY NEAR THE WRIGLEY INSTITUTE FOR ENVIRONMENTAL STUDIES ON LEEWARD SANTA CATALINA ISLAND

S.N. Murray. Department of Biological Science, California State University Fullerton

Prior to the 1970s, little was known about the structure of rocky intertidal communities on Santa Catalina Island or on the other seven islands in the Southern California Bight. Studies were initiated during this period to characterize these communities and others throughout the Bight to establish their status prior to offshore oil and gas leasing in the region. This work sponsored by the Bureau of Land Management (subsequently Minerals Management Service and now Bureau of Ocean Energy Management) was envisioned to serve as a baseline for determining future changes in populations and communities. At the time, these investigations greatly expanded our knowledge of rocky intertidal communities in the Southern California Bight, and in particular those located on the eight Channel Islands. Several of these study sites were revisited in 1999-2003 with support from the University of Southern California Sea Grant program and the Bureau of Ocean Energy Management (BOEM). Based on these data sets, the rocky intertidal communities near the Wrigley Institute for Environmental Studies (WIES) will be described and discussed. Emphasis will be placed on the biogeographic affinity, diversity, seasonality, and primary productivity of a Big Fisherman Cove community near WIES.

3  LIFE HISTORY OF THE INVASIVE SEAWEED SARGASSUM HORNERI AT SANTA CATALINA ISLAND

L.M. Marks. D.C. Reed, S.J. Holbrook. Marine Science Institute, University of California, Santa Barbara

*Sargassum horneri* is a fast growing brown alga native to shallow reefs of eastern Asia. It has spread aggressively throughout southern California, USA, and Baja California, Mexico, since it was first detected in the eastern Pacific in 2003. Because *S. horneri* can be locally very abundant and highly persistent, its continued expansion in the eastern Pacific poses a major threat to the sustainability of native ecosystems. Understanding the life history of *S. horneri* in its invaded range and determining the efficacy and feasibility of its removal are essential to the development of an effective management plan. To inform removal efforts, we investigated the phenology of this annual seaweed and the effect of removal of adults from 60 square meter areas on subsequent recruitment. The vast majority of reproduction occurred in the spring, and the removal of adults in late winter reduced recruitment in the next generation by approximately 30%. Based on the reduction in recruitment we observed, removing *S. horneri* for several consecutive years could substantially reduce populations. Such efforts should be targeted in places such as the leading edge of the invasion or areas of special biological or cultural significance.
GRAIN TRAPPING BY FILAMENTOUS CYANOBACTERIAL AND ALGAL MATS: IMPLICATIONS FOR STROMATOLITES – SOME OF THE OLDEST FOSSILS ON EARTH

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Stromatolites are commonly defined as laminated organo-sedimentary structures built by the activity of microbes, chiefly cyanobacteria, where filamentous microbes trap and bind sediment or foster mineral precipitation, creating layers. Stromatolites represent some of the earliest potential evidence of life on Earth, and as macroscopic manifestations of microbial processes, they are targets for astrobiological investigation (e.g., Mars). However, because of the poor fossilization potential of microbes and a lack of appropriate modern analogues (most modern examples are coarse-grained, whereas ancient ones are much finer), robust evidence for biogenicity is uncommon in ancient stromatolites. To better understand how to interpret the texture in ancient stromatolites, we conducted experiments to test the grain trapping and binding capabilities of filamentous cyanobacterial mats and trapping in larger filamentous algal mats in order to better understand grain size trends in stromatolites. Mats collected from Catalina Harbor were cut into squares, inclined in saltwater tanks at the Wrigley Marine Science Center at angles from 0 to 75° (approximating the angle of lamina in typical stromatolites), and grains of various sizes were delivered to their surface. Trapping of grains by the cyanobacterial mats depended strongly on how far filaments protruded from the sediment surface, grain size, and the mat’s incline angle. The cyanobacterial mats were much more effective at trapping fine grains beyond the abiotic slide angle than larger grains. In contrast, the much larger algal mats trapped medium and coarse grains at all angles, but fine grains were not trapped. Our experiments suggest that (i) the presence of detrital grains beyond the abiotic slide angle can be considered a biosignature in ancient stromatolites where biogenicity is in question, and, (ii) where coarse grains are present within stromatolite laminae at angles beyond the abiotic angle of slide (e.g., most modern marine stromatolites), typical cyanobacterial-type mats are probably not solely responsible for the construction, giving insight into the evolution of stromatolite microfabrics through time.

AN END TO THE MYTILUS-PANULIRUS STORY: COLLAPSE OF MUSSEL BEDS ON CATALINA AND ELSEWHERE IN THE REGION

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From the 1980s to the early 2000s, my students and I published experimental studies showing that spiny lobsters limited the distribution of mussel beds on Bird Rock, while very low mussel recruitment preempted the establishment of adult mussel populations in wave-sheltered Big Fisherman Cove. However, from the 1980s to the present the mussel beds on Bird Rock declined, and now are completely absent. Examining photographic records taken at two other Southern California sites indicates that collapse is occurring throughout the region. Details of the photographs suggest that the collapse is driven by rising sea surface temperatures and falling ocean production. The mean size of matrix mussels diminished, suggesting reduced ration. The vertical range on the shore contracted for each bed, as predicted by models with reduced mussel recruitment and growth. A 33-year time series of panoramas at Bird Rock, shows a stepping down of areal coverage, entailing steep declines coinciding with El Niño events and stasis in the intervening years. The El Niño / La Niña cycles were embedded in a long-term trend with the late 1970s marking the end of a 30+ year period of relatively cool SSTs and the beginning of the El Niño events. Global warming, it appears, is causing shores throughout the region to assume the appearance of Big Fisherman Cove.
6 SCALE DEPENDENT DRIVERS OF MPA PERFORMANCE: A CASE STUDY OF THE SPINY LOBSTER (PANULIRUS INTERRUPUTS) ON SANTA CATALINA ISLAND

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Marine Protected Areas (MPA) are a key tool for resource managers in the conservation and management of coastal resources. However, mismatches in the scale of MPA design and the scale at which target species utilize habitat may affect estimates of MPA performance and overall MPA success. In this study, we describe the utilization of intertidal habitat by the California spiny lobster, Panulirus interruptus, inside and outside of a long standing MPA on Santa Catalina Island, California, USA. Our results indicate that lobsters outside the MPA were greater in number and body size and, had a higher ratio of reproductively active females. This difference is suggested to be due to the presence of mussel beds comprised of the mussel, Mytilus californianus, outside of the MPA which comprised 75% of the diet, as estimated through stable isotope analysis, of lobsters outside the MPA. Through the application of landscape based survey methods, we highlight how the performance of an individual MPA may originate at sub-meter scales via interactions between the underlying geological and biogenic habitat that lobsters preferentially forage across. We close with a discussion on the need to integrate landscape based survey approaches, assessments of sub-meter geological and biogenic habitat with, stable isotope analysis to move towards incorporating bio-energetic performance of MPAs into current assessments of MPA success.

7 EVALUATING THE JUVENILE KELP BASS FISHERY PRODUCTION IN EELGRASS BEDS IN A SOUTHERN CALIFORNIA MARINE PROTECTED AREA

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Modeling annual biomass production in fish populations is crucial for resource management and conservation. For example, improved estimates of secondary productivity in juvenile and adult cohorts are important metrics for evaluating Essential Fish Habitat (EFH) and Marine Protected Area (MPA) management. We evaluated the fishery value of eelgrass within the Blue Cavern State Marine Conservation Area by measuring the inferred growth of juvenile kelp bass over a 2-year period. Using Akaike’s Information Criterion, the preferred model for predicting kelp bass abundance in eelgrass beds includes eelgrass length and density, but not eelgrass frequency. This information is useful in designing surveys that evaluate eelgrass function as both a food resource and nursery habitat. Using existing production models, kelp bass length and abundance data were converted to secondary productivity with values ranging from 0 to 189 g m⁻² yr⁻¹ (average 28 ± 4 g m⁻² yr⁻¹). This scope of annual production values highlights the importance of standardizing sampling times relative to fish recruitment events and habitat seasonality. This study improves the accuracy of modeling secondary productivity and quantifies the nursery value of eelgrass for juvenile kelp bass while highlighting the importance of accounting for seasonal variation to better inform management decisions.

8 SHIFTS IN ATTACK BEHAVIOR OF AN IMPORTANT KELP FOREST PREDATOR WITHIN MARINE RESERVES

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Marine reserves have increasingly become a valuable tool with which to manage ecosystems. These reserves consistently restore populations of top predators, often reducing availability of their favored prey. We hypothesized that such prey reduction in reserves causes protected predators to alter their attack
behavior to include less palatable prey, potentially amplifying top-down effects on community structure. To test this hypothesis, we presented the relatively unpalatable sea hare, *Aplysia californica*, to freely foraging spiny lobsters (*Panulirus interruptus*) in four pairs of marine no-take reserves and adjacent fished areas. We found that lobsters only attacked sea hares inside reserves, where lobster density was significantly greater than that of adjacent fished areas. Such attack of otherwise unpalatable prey exclusively in no-take reserves was likely caused by increased hunger because in the laboratory only food-deprived lobsters attacked sea hares. These findings are the first to suggest that management involving no-take reserves may have unintended consequences on community structure that result from behavioral change in key predators in the face of increased competition for food. We suspect that these effects may become more widely detected as reserves across the globe grow older and are researched further.

9 OCTOPUS ECOLOGY THROUGH THE AGES: CONTINUING INVESTIGATIONS OF OCTOPUS BIMACULATUS AROUND CATALINA ISLAND

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Octopuses are ubiquitous and important marine predators, yet our understanding of their complex and flexible interactions with temperate communities remains limited. Over the last 40 years, the majority of research conducted on California octopus species has occurred through the USC Wrigley Institute for Environmental Studies (WIES). Dr. Richard Ambrose began investigating the populations of the California two spot octopus, *Octopus bimaculatus*, in the late 1970s and measured their population fluctuations, den fidelity, reproductive timing, and dietary preferences. Using a combination of intensive SCUBA surveys, acoustic telemetry, and stable isotope analysis, my research builds off this foundation and applies new technologies and techniques to our understanding of octopus ecology. Additionally, comparing past and present data has identified ways in which the octopus populations have changed in correlation with the establishment of the Catalina Marine Science Center State Marine Reserve (CMSCSMR). Results from acoustic telemetry suggest that *O. bimaculatus* is highly mobile relative to other octopus species of equivalent size, likely more mobile than Dr. Ambrose’s work estimated, and exhibits high variability in movement patterns. Stable isotope analysis reveals that tissue from octopuses found inside and outside the CMSCSMR differ in dietary composition. Finally, octopus density in this area has increased in the last 40 years, and high variability in octopus abundance suggests many interactive factors influence abundance patterns. This collective body of work, made possible by the USC WIES, has contributed greatly to our understanding of octopus ecology and variability, as well as our overarching understanding of kelp forest dynamics and community interactions.

10 FORTY YEARS OF STUDYING FISH AND SHARK MOVEMENTS AT CATALINA ISLAND: WHAT HAVE WE LEARNED?

**C.G. Lowe**. Department of Biological Sciences, California State University Long Beach

Some of the earliest studies of movements of sharks were first conducted at Catalina Island with the advent and development of acoustic telemetry in the 1970’s. In these studies on blue sharks (*Prionace glauca*) and angel sharks (*Squatina californica*) goals were to simply quantify extent of spatial movements and their diel patterns. As acoustic telemetry technology improved, became miniaturized and cheaper, more movements studies have been done at Catalina Island on a range of reef associated fishes and coastal sharks. Using the Catalina Marine Science Center Marine Life Refuge, one of the oldest no-take marine reserves in southern California, home range and habitat use was determined for kelp bass (*Paralabrax clathratus*), barred sand bass (*P. nebulifer*), California sheephead (*Semicossyphus pulcher*), and ocean white fish (*Caulolatilus princeps*), providing some of the first empirical evidence of how well these important food fishes can be protected within a small MPA. Physiological and behavioral ecology studies have been done on leopard sharks (*Triakis semifasciata*) that are known to aggregate during summer months in shallow beach habitats at Catalina, providing some of the most compelling evidence of behavioral thermoregulation made on any shark species. Currently, autonomous underwater vehicles are being customized to actively track tagged fishes and sharks at Catalina, providing us with a much more
detailed understanding of how fish respond to environmental conditions and the context under which they move. A majority of this transformational research was made possible due to access and use of the USC Wrigley Marine Science Center.

11 ASSESSING RESILIENCE TO STRESSORS IN THE CHANGING OCEAN: UNIQUE INFRASTRUCTURE AT THE USC WRIGLEY MARINE SCIENCE CENTER FOR THE STUDY OF DEVELOPMENTAL PHYSIOLOGY


Developmental stages of marine animals are sentinels for the study of the biological impacts of natural and anthropogenic stressors in the ocean. Furthermore, the analysis of the processes that impact survival and growth of embryonic and larval stages is helping remove critical bottlenecks for sustainable aquaculture. Within the Southern California region, the USC Wrigley Marine Science Center offers a unique combination of environmental and infrastructure resources for studying larval stages of marine animals. A multi-decade commitment to large-scale animal culture facilities has been instrumental to our research on the genetic and physiological bases of responses to environmental stressors. To predict resilience, we take the approach of quantifying metabolic limits of animals, and their capacity to trade-off energy allocation under stress. Recently we observed that, even when growth rates of larvae are not detrimentally impacted by ocean acidification, dramatic compensation in rates of protein synthesis and ion transport occurs at the cellular level. The latter require major changes in energy allocation. The addition of instruments for monitoring seawater carbonate chemistry has supported our efforts to understand how aragonite under-saturation, related to ocean acidification, impacts the mechanisms and energetic cost of calcification in larval forms. Integration of environmental chemistry, genomics, genetics, biochemistry and physiology is contributing to an understanding of the potential of marine organisms to adapt to environmental change.

12 LARGE DATASET PORTALS AND PLACE-BASED EDUCATION OF UNDERGRADUATE STUDENTS: DON’T TELL THEM – SHOW THEM APPROACHES

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Researchers and science educators have found that students often misunderstand scientific ideas presented in STEM classes. Working with genuine scientific data helps students develop better scientific reasoning and a deeper understanding of fundamental concepts. A partnership between the Wrigley Institute for Environmental Studies, several faculty and NSF is providing experiential learning through mentored science training programs and through the development of online queryable access to several large marine science datasets. Students that have opportunities to personally data-mine rich, long-term datasets increase understanding of the process and nature of science. The experiential learning and use of authentic data, supplemented by rich literature provide unique opportunities for first-hand, data-driven learning by evaluating time series trends. This presentation will summarize some of these programs and introduce the publicly available datasets and resources available to researchers and educators studying complex issues such as climate change, assessments of ocean health, and mechanisms of ocean function.

13 DRIVERS OF ABUNDANCE OF TWO COMMON REEF FISHES: INTERSPECIFIC COMPETITION OR SOMETHING ELSE?

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Two of the most common reef fishes at Santa Catalina Island are the bluebanded goby (*Lythrypnus dalli*) and the blackeye goby (*Rhinogobiops nicholsii*). These species exhibit patterns of abundance that classic ecological theory might identify as evidence of interspecific competition between them. Indeed, that was
one of the working hypotheses that I set out to test over 25 years ago when I began working on these species at the Wrigley Marine Science Center. The pattern in space is that where one species reaches its highest density, the other species will be sparser; and in time, years when one species is particularly abundant, the other species will be less abundant than normal. While this pattern could be caused by competition between the species, other factors could instead cause it. Initially, I focused on whether predators could create this pattern. That work revealed that each species suffers a higher risk of predation in the habitat in which the other species is most abundant. And field experiments revealed no evidence for interspecific competition. Available evidence suggests that the year-to-year variations in the relative abundance of the two species are well predicted by water temperature, with the bluebanded goby having banner years when the water is warm, and the blackeye goby being most abundant during cold-water years. Thus, the spatial and temporal patterns of abundance of these two fishes appear not to be driven by competition, but instead by predation and, likely, the effects of water temperature on reproduction and recruitment.

14 REPRODUCTIVE Ecology OF Southern california Kelp Forest Fishes AROUND SANTA CATALINA ISLAND

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Understanding the mating systems of fishes can lead to vast improvements in their management and conservation. Many factors contribute to the mating behavior and sexual pattern of fishes, including local population density, sex ratio and size structure. The courtship, spawning behavior and reproductive biology of three wrasses living around Santa Catalina Island has been observed and recorded at sites surrounding the Wrigley Marine Science Center since 2001. The three species of wrasse living within the southern California bight vary broadly with respect to sexual pattern and mating system. California sheephead (Semicossyphus pulcher) are protogynous hermaphrodites and large males maintain territories within which they spawn with multiple females on a given evening. Rock wrasse (Halichoeres semicinctus) use a dualistic mating system whereby populations have both primary and secondary males and both group and pair spawning occur between late morning and early afternoon. The señorita (Oxyjulis californica) is a gonochoristic species who spawns in large groups containing one or two females and 10-30 males, in the early morning hours. All three species spawn throughout the warmer summer months (June – September) and mating system and group number varies with density of the local population. In addition, populations of the blackeye goby (Rhinogobiops nicholsii) have been recently observed to study the incidence of sex change under variable sex ratios. In populations with a low proportion of males, more females did indeed change sex, which suggests that protogynous fishes may not be male limited under conditions of frequent male removal, such as heavy fishing pressure.

15 INFLUENCE OF THE STRUCTURE OF AN INVASIVE ALGA ON THE DISTRIBUTION OF Fishes

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In temperate marine environments, the physical structure of algae (e.g., giant kelp) can provide important shelter from predation for juvenile fishes and increased access to food. Recent variation in local sea surface temperature has led to decreases in giant kelp and increases in the invasive alga Sargassum horneri along the southern California coast. The structure of S. horneri is different from that of giant kelp and other native algae with respect to height and complexity. These changes are expected to alter the distribution of fishes throughout the water column. To investigate the effects of these changes, we conducted underwater visual surveys of the fish and algal assemblage at seven sites along the leeward coast of Santa Catalina Island. Transect surveys were performed at three strata: upper-water column, midwater column, and benthic, to quantify differences in the fish assemblage due to variation in algal structure. The results indicate that the fish assemblage differs among different depth strata and that this difference depends on the type and density of algae present. There were seasonal differences in the fish assemblage among sites due to differences in algal composition and density among seasons. The results of this study indicate that the fish assemblage is influenced by changes in algal structure, and suggests the
importance of considering algal identity, structure, and density when attempting to predict fish distribution in a changing marine environment.

16*  **TeMcS JUST MAKES SENSE: ROLE OF A MECHANOSENSITIVE CHANNEL IN **  
**TRYPANOSOMA CRUZI**

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To complete its life cycle *Trypanosoma cruzi*, the protozoan parasite that causes Chagas disease, must endure drastic environmental changes, including variations in osmolarity and ionic conditions. *T. cruzi* has a robust osmoregulatory response, however, the osmosensors detecting the changes and triggering compensatory responses are unknown. Mechanosensitive channels, which are activated by stretching the plasma membrane, are associated with osmoregulation in other organisms. In silico analysis of the *T. cruzi* genome revealed the presence of a bacterial-like mechanosensitive channel (TeMcS). We hypothesize that TeMcS is involved in *T. cruzi* osmoregulation and infectivity. To investigate the biological role of TeMcS, knockdown mutants mediated by CRISPR/Cas9 and overexpressing mutants were generated followed by phenotypic analyses. We found a differential localization of TeMcS in the three main life stages of *T. cruzi*. The channel is localized in the contractile vacuole of epimastigote and trypomastigote forms, and in the plasma membrane of amastigotes. TeMcS knockdown mutants showed a defect in growth in comparison to wild-type parasites. Under hyposmotic stress, overexpressing parasites swell significantly less, while knockdown mutants increase their volume significantly compared to WT parasites. Furthermore, in the presence of known ion channel blockers, including gadolinium and nifedipine, we found significant differences in the parasite’s ability to detect and compensate osmotic changes. Importantly, TeMcS-KD parasites have a significant defect transforming into infective forms and are unable to invade mammalian cells. Our results indicate that TeMcS is involved in osmotic stress regulation as well as regulation of parasite transformation and infectivity. Funding Sources: NIH Grant R00AI101167, MHIRT Program, CSUF HHMI, CSUF RSCA.

17*P  **CHARACTERIZATION OF PUTATIVE CALCIUM BINDING PROTEINS IN **  
**TOXOPLASMA GONDII**

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*Toxoplasma gondii* is a protozoan obligate intracellular parasite belonging to the phylum Apicomplexa, and the causative agent of toxoplasmosis. Toxoplasmosis is characterized by the rapid and uncontrolled proliferation of the infective stage (tachyzoite) in the tissues of the immunosuppressed, fetuses, and recently in Southern California sea otters. During the lytic cycle, in which *T. gondii* replicates and multiplies, the coordinated entry and exit of calcium is required for the initiation of invasion-linked traits. The release of calcium from intracellular stores such as the plant-like vacuole (PLV) initiate parasite gliding motility, conoid extrusion and microneme adhesion protein release. However, the molecular mechanisms by which these events are initiated have not yet been fully elucidated. This study characterizes two putative calcium binding proteins (CBP) which contain EF hand domains and have been shown to have high transcript and protein expression levels. We have successfully subcloned these genes (CBP1 and CBP2) into *T. gondii*-specific, epitope-tagged, constitutive over-expression vectors. Immunofluorescence assays for CBP1 showed expression along the periphery of the PLV, whereas CBP2 illustrated expression within the conoid. Over-expression of CBP1 caused significant changes in intracellular calcium regulation including a reduced response to calcium-activated calcium entry. We are currently engineering conditional expression mutants and KO mutants to further define the role and importance of these calcium regulatory proteins during the lytic cycle of *T. gondii*. Understanding the molecular and genetic underpinnings of calcium regulation will be instrumental in advancing our knowledge to fight infections of *T. gondii* as well as related parasites.
18*P BIOCHEMICAL ELUCIDATION OF A K+/H+ EXCHANGE PATHWAY THAT REGULATES PARASITE BEHAVIOR DURING THE LYTIC CYCLE OF THE HUMAN PARASITE TOXOPLASMA GONDII

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Toxoplasma gondii is an obligate, intracellular parasite capable of infecting all mammals. Previous studies have established the importance of K+ and pH for regulating parasite behavior where high [K+] correlates with replication and high [H+] correlates with invasion. Interestingly, there is no genetic evidence for a K+/H+ exchanger nor a Na+, K+-ATPase pump. We hypothesize that K+ and H+ response mechanisms are linked by an indirect exchange mechanism and play a critical role in regulating parasite behavior. Using the intracellular pH fluorescent probe, BCECF-AM, we show that T. gondii tachyzoites acidify more rapidly at low pH in the absence of extracellular K+ than in standard conditions. Importantly, the addition of K+ back to the potassium-free buffers rescue parasites from acidification. Analysis of membrane potential, using the fluorescent probe, DiSC₃(5), determined that acidic conditions caused a marked depolarization, while elevated levels of K+ caused hyperpolarization of the parasite membrane. We then used Giemsa staining to test the survivability of extracellular parasites to varied conditions of pH and K+ ion concentration. Interestingly, parasites displayed no adverse response to long duration acidic conditions with or without K+. These data reveal a robust ion regulatory pathway in tachyzoites with a K+/H+ exchange mechanism serving a critical function. This exchange mechanism may function as a sensory switch informing the parasite when to replicate (high [K+] leading to hyperpolarization) and when to invade (low pH leading to depolarization). The genetic elucidation of this K+/H+ exchange pathway may serve as a drug target for treating parasite infections.

19*P ASSESSING THE VIRULENCE POTENTIAL OF THE TACHYZOITE STAGE OF THE APICOMPLEXAN PARASITE, TOXOPLASMA GONDII, WHILE EXPOSED TO SEAWATER CONDITIONS

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Dissemination of the Apicomplexan parasite, Toxoplasma gondii, into California Marine Coastal Regions has been observed for the past two decades. The presence of this foreign parasite in marine environments has caused many adverse effects, including lethal encephalitis in California Sea Otters. To our knowledge, the potential role the tachyzoite lytic form plays in marine transmission has never been studied, despite this form being the most infective stage of T. gondii. We hypothesize that T. gondii tachyzoites have robust homeostatic mechanisms that allow for maintained survivability and infectivity while exposed to seawater conditions. We used Giemsa staining to test for parasite survivability during exposure to seawater (16°C). Additionally, we tested survivability in seawater by using a highly quantitative flow cytometric “Live/Dead” fluorescent stain. Results from both experiments showed that tachyzoites incubated in seawater for up to 90 minutes were able to survive just as well as control treatments. Preliminary results assessing the invasion ability of tachyzoites while subjected to marine-like conditions demonstrated that tachyzoites maintain the ability to infect mammalian host cells in seawater, albeit at a reduced frequency. We are currently assessing specific components of the parasite invasion repertoire, including the release of adhesive microneme proteins and the extension of the conoid invasion machinery from the apical end of the parasite. Preliminary results indicate tachyzoites can still elevate their conoid while in seawater. These results indicate that tachyzoites are more robust than previously assumed and their role in the transmission of toxoplasmosis to California Marine Environments should be re-considered.
INFECTION OF GHOST SHRIMP (*NEOTRYPAEA SPP.*) WITH AN *AGGREGATA*-LIKE APICOMPLEXAN

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During a study on the distribution of ghost shrimp (*Neotrypaea* spp.) parasites along the California coast, white cysts were observed in specimens collected in Los Angeles Harbor. Morphological and genetic studies suggest that the cysts are meronts of a coccidian (Apicomplexa) similar to *Aggregata octopiana* (Schneider, 1875) Frenzel, 1885. *Aggregata* species are intracellular parasites with a two-host cycle. Gametogony and sporogony occur in the digestive tract of cephalopods, while asexual development (merogony) occurs in the digestive tract of crustaceans. In ghost shrimp developing meronts were found in the submucosa of the intestine and large meronts containing merozoites were present in the hemocoel/muscle tissue throughout the body. In the Los Angeles Harbor, 89.7% of *N. californiensis* (n = 310) were infected with 1 to 124 meronts (x̄=11.5). Meronts have been seen in ghost shrimp (*N. gigas*) at other localities associated with adjacent eelgrass beds including Alamitos Bay, Anaheim Bay, and San Quintin Bay in Baja California. No infections were evident in *N. californiensis* collected north of Pt. Conception. While no cephalopod has yet been implicated as a final host, the two-spot octopus (*Octopus bimaculoides*) is common in eel grass beds and rocky intertidal areas in Southern California. Ongoing investigation seeks to confirm the identity of this parasite.

21*P EFFECTS OF CELL-LINEAGE SPECIFIC RELMα IN IMMUNITY AND INFLAMMATION TO HOOKWORM *NIPPOSTRONGYLUS BRASILIENSIS*

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Resistin-like molecule α (RELMα) is a host-derived protein that is highly expressed following helminth infection. We previously showed that during *Nippostrongylus brasiliensis* (Nb) hookworm infection, RELMα -/- mice suffered from a heightened inflammatory response, including increased mortality, weight loss and lung inflammation compared to wild-type (WT) mice. Additionally, compared to WT, RELMα -/- mice had lower parasite egg burdens. Therefore, following hookworm infection, RELMα protects from excessive infection-induced inflammation in the lung, but paradoxically, impedes worm expulsion from the gut. RELMα is expressed by epithelial cells and hematopoietic cells, however, the functional impact of cell-lineage specific RELMα expression is unknown. To address this, we generated bone marrow chimera mice that were RELMα deficient in hematopoietic cells or non-hematopoietic cells and infected them with Nb. Interestingly, compared to WT mice, mice with RELM1 ± deficient non-hematopoietic cells had both exacerbated lung pathology and increased parasite burdens. In contrast, mice with RELMα deleted from hematopoietic cells had less parasite burden, and higher numbers of neutrophils, eosinophils, and T cells in the lung. These mice also had higher levels of RELMα detected by lung tissue RNA and protein in bronchoalveolar lavage fluid. Collectively, these findings suggest that cell-lineage specific RELMα has distinct effects on infection outcome and therefore plays a decisive role in immunity to helminths. The observations of this study sheds light on a deeper mechanistic role of RELMα in worm clearance and can aid in elucidating cell intrinsic mechanisms through which RELMα mediates inflammation.

22*FP FEAR AND FEEDING: RISK OF INFECTION PREDICTS PARASITE AVOIDANCE BEHAVIOR

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Animals have a nested sequence of defenses to guard against parasitism. Behavior is often the first line of defense. Parasitism and parasite avoidance behaviors are costly; thus, the strength of parasite avoidance behavior should reflect the uncertain risk of infection and the likely cost of such an infection. We experimentally evaluate the parasite avoidance behavior of a barnacle, *Chthamalus fissus*, versus its
isopod parasite, *Hemioniscus balani*. *H. balani* is an ephemeral semelparous parasitic castrator, a single parasite prevents its host from producing eggs. Thus, the cost of infection is high. We conducted experimental observations in a laboratory setting of *C. fissus* to quantify the effects of infection status and reproduction status on filtration rates in the presence of an infectious stage of *H. balani*. When infectious stages were present, barnacles decreased filtration rate by ~ 50% when they were uninfected and were non-reproductive, conditions associated with high risk of infection. Infected and reproductive barnacles did not respond to the presence of an infectious stage. The difference in response based on barnacle condition implies a high cost of reduced feeding as a parasite avoidance behavior.

23*P INTERACTIONS BETWEEN THE VELVETY TREE ANT *LIOMETOPUM OCCIDENTALE* (HYMENOPTERA: FORMICIDAE) AND PHORID FLIES (DIPTERA: PHORIDAE)

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Phorid fly parasitoids of ants are capable of decapitating their host during development and have been used as biological control agents for imported fire ants. In California, little is known about the behavioral interactions between the native Velvety Tree Ant host, *Liometopum occidentale*, and its Phorid fly parasitoids. This system is native to Southern California, occupying precious habitats that have been in decline due to human development, changing weather patterns, and fierce competition from invasive species. Specifically, we examined the effect of fly parasitoids on ant foraging patterns, and observed and quantified behavioral displays exhibited by ants in the presence of these flies. We also studied species diversity of parasitoids infecting the Velvety Tree Ant from several locations.

24*P *PENELLA BALAENOPTERA*: THE BIOLOGY OF A MESOPARASITIC COPEPOD ON WHALES

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*Pennella balaenoptera* are mesoparasites found on marine mammals. These crustaceans are among the largest of the parasitic copepods. Information on *P. balaenoptera* is very sparse; there is little knowledge of the life cycle of this species and no knowledge of the presumed intermediate host(s). A literature review compares the marine mammal hosts and the range of these hosts which *P. balaenoptera* has been reported to infect, however presence appears to be highly underreported. Access to complete and intact specimens is challenging due to the pelagic nature of the hosts. Coordination with marine mammal stranding networks has provided reports of several new host species accounts, as well as specimens for examination. Additionally, mark-recapture studies of fin whales in Southern California have documented growth rates and development of *P. balaenoptera*. 
Parasites can play large ecological roles, but are unaccounted in most food webs. In giant kelp forests off of Santa Barbara, CA the Señorita Wrasse (Oxyjulis californica) is abundant and central in the food web, making it a likely host for trophically transmitted parasites. However, there are no published records of endo-parasites for this species. Our objective was to survey the parasites of O. californica. Trained divers collected O. californica by spear (N=17) at two kelp forests off Santa Barbara and we conducted a full parasitological assessment. Fish were dissected and larval stages of 4 major endo-parasite groups were found. Juvenile nematodes (Nematoda) had the highest frequency and were abundant in liver and stomach tissues. Larval tapeworms (Cestoda) were common in intestinal mesenteries. Larval stages of digenetic flukes (Trematoda) were often encysted at the base of the fins. A single adult fluke was found in the body cavity. Thorny-headed worm larvae (Acanthocephala) were found in liver and stomach tissues. Based off the types of parasites found and published information on diet of the fish, we created a list of likely predators and prey of O. californica, which may be used to inform construction of a more accurate food web.

Several species of surfperch (Embiotocidae) comprise a significant proportion of the fish biomass in mainland kelp forests in the Santa Barbara Channel, CA. As a part of a larger study describing the role of parasites in kelp forest food webs, we surveyed the metazoan parasites of the kelp perch (Brachyistius frenatus), black perch (Embiotoca jacksoni), pile perch (Rhacochilus vacca), rubberlip perch (Rhacochilus toxotes), and rainbow seaperch (Hypsurus caryi). Acanthocephalan cystacanths were common, with one species of Corynosoma in particular found in all 5 host species. Trypanorynch metacestodes were also common, with Nybelinia sp. found in 4 of the 5 host species. Digeneans were present as both metacercaria and adults, and varied among species. The overall parasites community within these species was compared in terms of richness and diversity. The parasite community within each host species informs the trophic relationships and degree of niche overlap of these fish within the kelp forest food web.

Wildlife management plans are often designed to control or conserve species, subspecies, and populations, and to implement these practices, reliable techniques to identify target groups are needed. Some groups (migratory) of Double-crested Cormorants (Phalacrocorax auritus) are the subject of lethal population control, while others are protected from harassment (resident). Migratory P. auritus are likely to contain helminthic parasite communities that differ from those of non-migratory, resident birds, because they encounter a wider variety of habitats and intermediate host communities during migrations. Here, five distinct assemblages of helminth parasites collected from 218 P. auritus culled from 11 sites in Alabama, Minnesota, Mississippi, and Vermont are reported. The assemblages of P. auritus parasites are distinct among many sampling locations and can be used to correctly predict where a host cormorant has been feeding. We provide evidence for mixing of cormorants at a regional scale using discriminant analysis, which suggests there is a single population of migratory cormorants. Furthermore, our models strongly differentiate between migratory and resident breeding P. auritus in the southeastern United States.
States. These models could serve as effective tools for managers interested in both the population control of migratory cormorants and the conservation of non-migratory, resident birds.

28 BASELINE SURVEY OF PARASITES OF SHORECRABS (PACHYGRAPUS CRASSIPES) AND LONGJAW MUDSUCKERS (GILLICHTHYS MIRABILIS) FOR THE SEAL BEACH NATIONAL WILDLIFE REFUGE THIN-LAYER SALT MARSH SEDIMENT AUGMENTATION PILOT PROJECT

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As part of a long-term monitoring project, parasites of striped shorecrabs (Pachygrapsus crassipes) and longjaw mudsuckers (Gillichthys mirabilis) were surveyed prior to implementation of the Seal Beach National Wildlife Refuge Thin-Layer Salt Marsh Sediment Augmentation Pilot Project (Project). The Project includes application of a thin-layer of clean sediment to a 10-acre site in the Anaheim Bay refuge to raise the marsh plain elevation in response to ongoing adverse effects of subsidence and sea level rise on salt marsh habitat and light-footed Ridgeway’s rail (Rallus obsoletus levipes). The focus of this parasite study is to examine the rate of reestablishment of food webs as measured by parasite recruitment. During the pre-project survey, 8 parasite species were enumerated for 377 shorecrabs and 7 parasite species were enumerated for 19 mudsuckers collected at the control and project sites. Parasites of shore crabs were predominantly larval stages of parasites found in birds whereas parasites enumerated for mudsuckers were adult forms. Hosts in control and project sites showed similar levels of infection. However, distribution of parasites within each site was variable even for some proximate localities, suggesting that these hosts undergo very limited movement. Control and project sites will be surveyed following project completion and once the hosts reestablished in the project area.

29*P UNEXPECTED DISCOVERY OF A NEW CILIATE PARASITE IN A WELL-STUDIED POPULATION OF LINED SHORE CRABS

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Our recent surveys at Carpinteria Salt Marsh (Santa Barbara Co., CA) revealed that lined shore crabs (Pachygrapsus crassipes) were commonly infected by a previously unreported parasitic ciliate. This discovery was a surprise: these crabs have been examined for parasites for over 15 years at this and other localities. To better understand this parasite, we examined methods of detection, infection prevalence, cell morphology, DNA-sequence based phylogenetic relationships, host pathology, and possible transmission routes. Unstained smears of hemolymph drawn from live crabs permitted simple and rapid identification of infected crabs, revealing 13.0% prevalence (9.0-18.5%, 95% CI, n = 193). Morphological analysis and phylogenies constructed from ITS1 and ITS2 sequences placed the ciliate in the Order Apostomatida. However, the parasite did not group with known genera and lied basal to all other apostomatidans. Histological comparisons of healthy and infected crab tissues revealed unusually extensive ciliate-caused pathology. We could not generate experimental infections from a variety of lab and field techniques. This, combined with the ciliate’s placement within the Apostomatida, indicate that crab molting may play a role in parasite transmission. However, prevalence increased in injured crabs, alternatively suggesting that infection is facilitated by crab fighting or failed bird predation. The results indicate that this ciliate represents a new genus, and perhaps a new family. The sudden emergence of a novel, easily-detectable parasite at such a well-studied locality suggests that the ciliate has recently increased in abundance or recruited to Carpinteria Salt Marsh. The parasite’s geographic range and ecosystem impacts are not yet known.
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We sequenced the genome of the intertidal, herbivorous fish, *Cebidichthys violaceus* (Teleostei: Stichaeidae), to elucidate the genetic underpinnings of dietary specialization and intertidal existence in this species. *C. violaceus* is part of a phylogeny that showed independent intertidal invasion and evolution of herbivory in comparison to other herbivorous stichaeids (e.g., *Xiphister mucosus*). A juvenile individual collected from San Simeon, California was used to sequence the *C. violaceus* genome, and the genome was generated with Illumina and Pacific Biosciences (PacBio) datasets with 107X and 37X coverage, respectively. From our genomic datasets, we conducted a *de novo* assembly of the Illumina reads and then a hybrid assembly with both Illumina and PacBio datasets. We estimated the genome to be 526,436,767 base pairs with a N50 scaffold size of 2.4 Mb. In conjunction, we generated RNA-Seq data from nine tissue types (brain, gill, gonads, heart, liver, mid intestine, proximal intestine, pyloric caeca, and spleen) for annotation of the genome. We are using this data set to better understand the multitude of processes that allow a fish to be herbivorous and to tolerate the vagaries of intertidal existence (e.g., temperature fluxes, and breathing water and air). Moreover, what we learn from *C. violaceus* will be used to inform analyses of other fishes in the family Stichaeidae, which features dietary diversity, ontogenetic dietary shifts (including a shift from carnivory to herbivory in *C. violaceus* and other taxa), and large biogeographic ranges spanning the eastern and western Pacific Ocean.

H.S. Aronson, S.K. Goffredi. Department of Biology, Occidental College

*Rubyspira osteovora* is an unusual deep-sea snail, from ~3000 m depth in Monterey Canyon, that obtains nutrition exclusively from the bones of decomposing whales on the seafloor. It is not known whether their nutrition comes from whalebone itself or from bacteria on surfaces. This study aimed to characterize the gut microbiome of *Rubyspira*, compared to the surrounding microbial communities in sediment and on whalebone surfaces, as well as to other deep-sea snails with more typical diets. Analysis of 16S rRNA gene sequences revealed that environmental samples hosted much higher bacterial diversities (average Shannon index of 4.4; n = 2), compared to *Rubyspira* tissues (average Shannon index of 2.4; n = 12). No single bacterial species (based on 97% similarity) accounted for more than 21% of recovered sequences in the bone and sediment samples. On the other hand, *Rubyspira* tissues, including digestive gland, intestine, and stomach were dominated by only two bacterial species: *Mycoplasma* sp. and *Psychromonas* sp. (up to 74% and 67% of total recovered sequences, respectively). These two bacteria, along with *Psychrilyobacter* sp. (up to 36%), accounted for between 43-92% of the total recovered sequences, with other minor OTUs usually present at very low abundances. Interestingly, the numerical abundance of these three groups remained similar over six years of sampling, suggesting a long-term association with the snails. Further, these bacterial genera were not present in environmental samples or other deep-sea gastropods, further supporting the uniqueness of the *Rubyspira* gut microbiome, and a possible role of these dominant bacteria in their unusual nutrition.

C. Dotson. Vistamar School, El Segundo, CA

The proliferation of bacteria in seawater extracted from the ocean for use in exhibits at the Manhattan Beach Roundhouse Aquarium was investigated. The exhibits are effectively batch cultures, i.e., closed-loop systems in which bacteria cells grow in a fixed volume and are nutrient limited. 16S rRNA gene sequencing revealed that a strong shift in taxonomy to the class gammaproteobacteria occurred during batch cultivation (9% → 72% of total) and that pathogenic vibrios became dominant (~ 60% of total). The
luminescent species *V. splendidus* and *V. harveyi* were isolated on thiosulfate-citrate-bile salts-sucrose (TCBS) agar, which is selective for vibrios. Adenosine triphosphate (ATP) luminometer measurements, turbidity measurements, and plate counts were used to derive growth rates for these isolates in marine broth (0.6-1.0h per generation). ATP assays were also used to define the growth kinetics of mixed batch cultures and the efficacy of ultraviolet (UV) light for bacterial inactivation. Bacterial growth was dependent on the degree of seawater filtration, which suggested substantial predation by protists larger than 5µm. The reduction in bacterial density with respect to increasing UV fluence conformed with the Chick-Watson Law. Resumption of exponential growth occurred in darkness for the UV-treated bacterial assemblage, consistent with photoreactivation induced by vibrio quorum sensing. This appears to be the first investigation of the utility of ATP luminometry for aquaria. It was concluded that luminometers rapidly identify bacterial proliferation in aquaria and can also be used to establish the efficacy of aquarium UV sterilizers.

33  THE EFFECTS OF CEC: 17β-ESTRADIOL ON *ATHERINOPS AFFINIS* VITELLOGENIN (VTG) DEVELOPMENT

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Organisms are impacted by natural and synthetic chemicals that enter ground and surface waters through runoff, industrial and municipal waste discharges, and/or atmospheric deposition. Effluent discharged from municipal wastewater treatment facilities are a major source of contaminants of emerging concern (CECs) to receiving waters. CECs comprise a vast number of chemicals that are generally unregulated. These CECs have detrimental effects toward our environment as well as waste treatment facilities that are not designed to manage them. 17β-estradiol (E2) is a CEC commonly found in effluent. E2 is a human female sex hormone and steroid, essential for the regulation of the estrous and menstrual female reproductive cycles and necessary for the development of female reproductive tissues. E2 has been shown to have feminizing effects in other species, e.g. in male fish such as, the development of ovarian tissue within testes and the production of vitellogenin (VTG), an egg yolk-producing protein, found in blood and tissue. Ongoing study at Hyperion Water Reclamation Plant exposing specimen to concentrations of E2, aims to determine the lowest concentration at which E2 does not cause *Atherinops affinis* to express the VTG gene, the lowest concentration at which an effect is noticeable and finally the concentration that elicits an effect in 50% of the organisms. This will be done through RNA extractions, subsequently used to synthesis cDNA and finally qPCR analysis in order to determine the expression of VTG. Determining the concentration(s) at which estradiol elicits feminizing effects, will provide insight to this CEC throughout public waters.
THE OCCURRENCE OF A MUTATION IN THE LABORATORY POPULATION OF THE POLYCHAETOUS ANNELID *NEANTHES ARENACEODENTATA*

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A laboratory population of the polychaete *Neanthes arenaceodentata* was established in 1964 from six worms collected from Los Angeles Harbor. This population has undergone over 200 generations with no additional worms added. This population is characterized by having red eyes and bright orange eggs. While checking the offspring from a behavioral experiment, we noted some of the worms had black eyes. We examined the offspring from the aquarium and found that the ratio of black eyed to red eyed was 3:1. The initial crosses from these worms were black X black and red X red. It was further noted that color of maturing ova was different: black eyed worms had pale ova and red eyed worms had bright orange ova. Results from the P1 crosses have indicated that males and females with the same eye color produced offspring with the same characteristic colored eyes and ova. The unusual sexual characteristic of this species is that the female reproduces once, but the male is capable reproducing as many as nine times. Initial results with parents of black eyes produced black eyed offspring; this male was then mated with a red eyed female and their offspring were 8 black eyed and 2 red eyed. Ova color coincided with the eye color of the female. Experiments are in progress or planned to conduct all possible eye color combinations.

**35* ENVIRONMENTAL VARIABILITY AND INVESTMENT IN THERMAL DEFENSES: THE IMPORTANCE OF RECENT HISTORY**

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Climate change models predict an increase in the frequency and intensity of extreme thermal events, suggesting that exposure to stressful high temperatures will likely become more common for many organisms. Because investment in thermal defenses is energetically expensive, a trade-off is expected to occur between thermal tolerance and growth or reproduction. In a paired laboratory and field study, we investigated how frequency of exposure to chronic heat stress influenced allocation of resources to competing demographic parameters in the California mussel, *Mytilus californianus*. After a 4 week acclimation period, we exposed mussels in the lab to 32 °C during a 6-h simulated low tide 0, 1, 4, or 7 days per week for 8 weeks. We also transplanted mussels into plots exhibiting a range of thermal conditions along a horizontal gradient of wave-exposure at Abalone Cove Shoreline Park, Rancho Palos Verdes, CA. We then challenged both groups with an acute exposure to a more extreme temperature (36, 39, or 42°C) for 5 sequential days under controlled conditions in the lab. Our data provide support for the idea that acclamatory responses to temperature stress can drive trade-offs among traits, as predicted by theory. Chronic sublethal heat stress invoked a cost to individuals, expressed as a reduction in relative shell growth or size-specific tissue mass. However, increased frequency of prior thermal conditioning resulted in higher survival following acute exposure to potentially lethal temperatures.

**36* RECENT THERMAL HISTORY DETERMINES MICROALGAL RESPONSE TO ACUTE TEMPERATURE STRESS ON ROCKY SHORES**

**E. Hunt**1, L. Miller2, M. Denny3, B.J. Allen1. 1California State University Long Beach; 2San Jose State University; 3Hopkins Marine Station of Stanford University

In addition to higher average temperatures, global climate change is also resulting in higher temperature variability, increasing the risk that species’ tolerance limits will be exceeded. Our study was designed to determine how prior thermal history and the intensity of an acute high temperature challenge might affect post-stress photosynthetic performance of microalgae on rocky shores. We manipulated temperature variability on artificial substrata in the mid-intertidal zone, allowing microalgae to settle under low, natural, or high variation for at least one month. We then measured community-level net photosynthetic rate (NPR) for each experimental plate under benign conditions with a LICOR LX-1600, before and after exposure to one of five peak temperatures (18, 24, 28, 32, or 36 °C) during a 4.5-hour simulated low tide.
The more extreme the acute temperature challenge, the more negative the effect on post-exposure NPR. More surprisingly, microalgae grown on low variation plates in the field were twice as vulnerable as microalgae on normal and high variability plates. We are using scanning electron microscopy (SEM) and high-performance liquid chromatography (HPLC) to analyze changes in the identity and relative abundances of microalgal taxa for indications of variation in microalgal functional group composition and diversity.

37* THERMAL DEFENSE STRATEGY DETERMINES LIMPET RESPONSE TO ACUTE TEMPERATURE STRESS ON ROCKY SHORES

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Climate change models predict increases in the frequency and intensity of extreme weather events. The fitness consequences to many organisms will be determined by their capacity to adjust their thermal sensitivities and the associated energetic costs. Our study was designed to determine how thermal defense strategy (constitutive versus induced) and the intensity of an acute high temperature challenge might affect post-stress physiological performance of limpets on rocky shores. The limpets Lottia scabra and L. austrodigitalis are typically found living together in the high intertidal zone, but may adopt different strategies for dealing with thermal stress. L. scabra exhibits high constitutive levels of the stress protein Hsp70 but no additional induced synthesis at high temperatures, whereas L. austrodigitalis exhibits low levels of constitutive Hsp70 and high inducibility. We measured respiration rate for field-collected and lab-acclimated individuals of each species under benign conditions in the lab, before and after exposure to one of five peak temperatures (14, 24, 28, 32, or 36 °C) during a 4.5-hour simulated low tide. Unlike L. scabra, L. austrodigitalis exhibited a significant increase in oxygen consumption following aerial exposure to high temperature, consistent with activation of the heat shock response. We expect ongoing analyses to show a positive correlation between individual respiration rate and Hsp70 expression level in our experimental limpets.

38* PREDICTING EFFECTS OF ENVIRONMENTAL VARIABILITY ON THERMAL RISK TO BLACK ABALONE: COMBINING ECHOMECHANICS AND BEHAVIOR

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Black abalone (Haliotis cracherodii) were once a common intertidal inhabitant on rocky shores in California, but have experienced dramatic population declines and local extinctions due to overharvesting and the emergence of withering syndrome (WS). Susceptibility of black abalone to infection by WS is related to higher body temperature variability during aerial exposure at low tide, suggesting that temperature stress is a key risk factor determining their long-term viability. Our research is designed to quantify how body temperatures and associated risk of disease to black abalone might be altered in response to anthropogenic climate change. We created a heat-budget model for black abalone and coupled it with long-term meteorological records at Hopkins Marine Station (HMS) to generate information about environmental and topographic controls of body temperature at this site. We simultaneously collected real-time data across microhabitats at HMS on the distributions of body temperatures of live abalone with a calibrated infrared camera and operative environmental temperatures with species-specific thermal mimics. These data will be combined to derive quantitative measures of the thermal quality of the habitat at HMS and the precision, accuracy, and effectiveness of thermoregulation by black abalone in the field.
ACCLIMATED METABOLIC Q10 OF THE CALIFORNIA HORN SHARK, HETERODONTUS FRANCISCI

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It is unclear how global sea temperature changes will affect many marine organisms, particularly ectothermic elasmobranchs. A better understanding of their metabolic Q10, temperature sensitivity, is needed in order to make realistic predictions as to how some populations will react over time. Oxygen consumption was used as a proxy to measure acclimated metabolic rates of the horn shark, Heterodontus francisci, at winter and summer temperatures (16 °C and 20 °C, respectively) typically experienced in a given year and to measure metabolic Q10. Sharks were kept in a large holding tank at one of the desired temperatures for two weeks prior to the trial to allow for physiological acclimation. Trial duration varied among individuals and temperature, trials took up to 12 hours with re-saturation of oxygen occurring when levels reached 80% saturation. Sharks tested to date have ranged in size (37-45cm TL) and weight (0.41-0.679 kg) (n=8). The resting, pre-prandial metabolic rates of the horn shark at 16 °C and 20 °C were 32.6 ± 9.5 mg O$_2$ kg$^{-1}$ hr$^{-1}$ and 44.4 ± 8.8 mg O$_2$ kg$^{-1}$ hr$^{-1}$, respectively. Of the eight horn sharks that we have tested, we estimate a metabolic Q10 of 2.31. These data provide a baseline for understanding the current physiological state of these organisms relative to present sea conditions, but can be modeled to help predict and manage behavioral responses associated with increased sea temperature.

LACTATE PRODUCTION IN THE HERMIT CRAB, PAGURUS SAMUELIS, SUBJECTED TO TEMPERATURE AND BURIAL STRESSES

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Sediment deposition along the Southern California coastline results from river discharge, human waste discharge, dredging, and storms. Extreme weather events, such as storms and temperature extremes due to climate change, are expected to increase sediment loads in intertidal regions and cause changes in the distribution of intertidal organisms. Studying low trophic level invertebrates provides better understanding of the impacts of climate extremes at higher trophic levels. To investigate synergistic effects of temperature and shallow burial on the physiology of intertidal invertebrates, we subjected the hermit crab, Pagurus samuelis, to shallow burial (3 and 6 cm) at 5, 20, and 30 °C, and quantified the production of lactic acid after 2, 4, and 6 hours. We also injected hermit crabs with sodium lactate and monitored their survival following 24 hours. Lactic acid was significantly higher in crabs buried at 3 cm (mean ± SE, 38.0 ± 2.48 mM) and 6 cm (39.2 ± 2.48 mM) than control animals (0 cm, 12.8 ± 2.54 mM), and correlated with increasing time and higher temperature. Hermit crabs surviving burial events had significantly lower lactic acid than those that did not survive. All hermit crabs survived injection of sodium lactate at concentrations up to 300mM. Accumulation of high levels of lactic acid following burial indicates that shallow burial in the intertidal regions causes hypoxic conditions, which results in extensive anaerobiosis in organisms, and can lead to death. Physiological responses of intertidal hermit crabs to shallow burial and high temperature indicate that both may be contributing factors to the restructuring of intertidal communities as a possible response to climate change.

ECOATLAS: AN ONLINE VISUALIZATION TOOL FOR EELGRASS DISTRIBUTION

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Eelgrass (Zostera marina and Z. pacifica) provides myriad ecosystem functions and services in both estuarine and shallow nearshore areas along the open coast. Dense coastal development in Southern California puts eelgrass at risk. Because of its significant contributions to a healthy ecosystem and susceptibility to anthropogenic activities, eelgrass warrants ongoing monitoring and assessment of its regional status. NMFS is working with regional stakeholders to compile spatial data of eelgrass distribution and promoting the continued monitoring of eelgrass throughout California. These data are now being made public on EcoAtlas (ecoatlas.org), a visualization tool that aggregates data from different
sources on the condition and extent of aquatic resources, and the activities that affect these resources, on a common map. Thus far, 27 surveys of particular bay and coastal area systems throughout California have been included. In addition, spatial data and survey reports on 46 development projects depicting mitigation have also been uploaded. NMFS is hopeful that increasing the availability of eelgrass distribution and project data will provide additional regional context for resource management decisions and research activities. Wider dissemination and continued augmentation of these data is an integral component of eelgrass conservation with applications to scientists, resource managers and the general public.

42 QUANTITATIVE RELATIONSHIPS BETWEEN SOUND PRODUCTION AND ABUNDANCE IN FISH SPAWNING AGGREGATIONS

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The management and conservation of fish populations requires accurate measurements of density to estimate fish abundance and biomass. Fisheries-independent surveys utilizing active acoustics (echosounders) may provide accurate estimates for fishes that form spawning aggregations (FSAs), but this method has not been applied to coastal estuaries and is often hindered by the cost and complexity of data collection and processing. The broad occurrence of sound production in fishes that form FSAs in estuaries provides an opportunity to use passive-acoustic methods to estimate fish abundances from measurements of sound levels in a more cost-effective and efficient manner; however, difficulties in correlating sound production with fish density have prevented the widespread use of this approach. In this study, we compared Gulf Corvina (Cynoscion othonopterus) sound levels with measurements of density from active-acoustic surveys. We found that the relationship between measurements was variable across the duration of surveys but stabilized during the timing of spawning, resulting in an equation to estimate density directly from sound level measurements. Our results confirm that active-acoustic methods provide robust, independent measurements of density, abundance, biomass, and spatial distribution of fish at FSAs in shallow estuaries. They also indicate that sound levels can be used to determine fish density and distributions, which may be used to estimate the abundance and biomass of fishes at FSAs. We anticipate that our approach is broadly applicable to other soniferous fishes that form FSAs in coastal estuaries representing a cost-effective and efficient method to assess fish populations and associated fisheries in these habitats.

43 CALIFORNIA'S RESPONSE TO CLIMATE CHANGE: LEADING IN MITIGATION, LAGGING IN ADAPTATION

D.A. Mazmanian. Professor of Public Policy and Academic Director, Arnold Schwarzenegger Institute of State and Global Policy, USC Sol Price School of Public Policy, University of Southern California

Professor Mazmanian will provide an overview of California's notable leadership in mitigating the global rise of greenhouse gas emissions through strong and well enforced state policy for more than a decade. He will also discuss how California has yet to demonstrate comparable leadership in land use and development policies, in anticipation of the adverse effects of a changing climate in California in the coming years and decades.
44 HOW WILL LOS ANGELES ADAPT TO CLIMATE CHANGE? AN ECONOMIST’S PERSPECTIVE

M.E. Kahn. Department of Economics, Spatial Sciences Institute, and Environmental Studies Program, University of Southern California

Matthew Kahn will speak about the role that the "Big Data" revolution will play in helping individuals and firms to adapt to new climate change risks. From insurance pricing to water pricing to providing easy access to the poor to public cooling centers, improvements in data quality will help to pinpoint new risks and opportunities. Armed with such data, new entrepreneurs will identify market opportunities that both create profit and enhance safety during a time of increased risk.

45 THE ART OF THE POSSIBLE: CUTTING EMISSIONS WITH MICROGRIDS AT UC SAN DIEGO

B. Washom. Strategic Energy Initiatives, University of California San Diego

Byron Washom will discuss the role of universities in energy innovation, and how it can be supported by the private sector. Washom will describe UCSD diverse and innovative energy portfolio. He will explain how UCSD has designed and implemented innovations in zero- and low-carbon technologies to its microgrid that self-generates over 80% of UCSD annual electrical load. Washom will also talk about a range of additional strategic initiative for energy storage, the world’s first fuel cell-absorption chiller, and advanced EV charging stations.

46 THE CLIMATE CRISIS AND WHAT ANGELENOS CAN DO ABOUT IT

J. Parfrey. Executive Director, Climate Resolve

We could all become solar-powered vegan bicyclists tomorrow -- arguably, a good thing -- and yet our collective good behavior will not be sufficient to stop the consequences of climate change. Emissions have reached a point that impacts are inevitable. The question is now of severity and our ability to adapt. Not to be gloom-and-doom -- there's some good news here. For the steps we take to reduce future emissions and prepare our cities could also make our cities more livable and resilient. Mr. Parfrey will discuss how we can meet the climate challenge in California and improve our lives at the same time.

47 EXPLAINING PUBLIC ATTITUDES ON CLIMATE CHANGE

D. Chong. Department of Political Science, University of Southern California

Whether social and political differences on climate change can be bridged to enable action on policy solutions is one of the central political issues of our time. In addressing this question, Professor Chong will evaluate public attitudes, beliefs, and policy preferences, and the dynamics of social conflict and consensus. He also will discuss the impact of scientific information, the economy, and the effects of framing on opinions. On the broad themes of climate change – its causes, the views of experts, the need for policy action – a plurality or majority of the public generally gets it right, in the sense of being on the same side as the scientific authorities. There are also favorable trends suggesting that knowledge of the effects of human action on the atmosphere and climate, although not sophisticated, has progressed significantly compared to past generations, and that skepticism toward climate change will be harder to sustain among new generations that have a stronger environmental consciousness.
48 EXAMINING THE WHO, WHERE, AND HOW OF ENVIRONMENTAL ORGANIZATIONS IN LOS ANGELES: THE LA STEWARDSHIP MAPPING AND ASSESSMENT PROJECT (STEW-MAP)

M. Romolini. Center for Urban Resilience, Loyola Marymount University

Progress towards urban sustainability goals requires implementation of a suite of projects, from the site to the regional scales. Groups and organizations that conduct this work often collaborate across sectors to leverage resources such as knowledge, funding, volunteer labor, and technical expertise. Understanding the scope of natural resources projects, organizations, and collaborations is often difficult at the metropolitan scale. Yet this information can be incredibly useful for research and practice. This presentation will introduce the Los Angeles Stewardship Mapping and Assessment Project (LA STEW-MAP), an effort to inventory and survey all of the environmental stewardship organizations in Los Angeles, map their stewardship activities, and evaluate their collaborative networks. STEW-MAP is a national program and thus leverages established work in New York City, Baltimore, Seattle, Philadelphia, Chicago, and San Juan, Puerto Rico. We will discuss preliminary results of the LA effort and describe how this project can support urban natural resources planning and management in Los Angeles.

49 ENVIRONMENT, ECONOMY, AND EQUITY: ADDRESSING CLIMATE CHANGE WITH LA’S SUSTAINABLE CITY PLAN

S. Bornstein. The Mayor’s Office, City of Los Angeles

In April 2015, Mayor Eric Garcetti released LA’s first-ever Sustainable City pLAn (pLAn). The pLAn is a roadmap to achieve tangible, short-term results while setting the path to strengthen and transform Los Angeles in the decades to come. By addressing the environment, economy, and equity together, Los Angeles is moving toward a truly sustainable future. Sabrina Bornstein will discuss the key aspects of LA’s roadmap for climate action, and the progress and challenges in implementing the pLAn.

50 THE FUTURE OF THE LOS ANGELES RIVER

C. Armstrong. Director, LARiverWorks, Office of Los Angeles Mayor Eric Garcetti

As climate change reduces key water resources for millions of people in Southern California, what role can the L.A. River have in addressing ecological, economic, and social problems in the region? Dr. Armstrong will discuss implementation of the Los Angeles River Revitalization Master Plan and policies for reestablishing the river as an integral part of public life in the city. The discussion will highlight progress, challenges, and uncertainties involved in designing and implementing a comprehensive strategy that must balance improved water management and conservation, expanded public access, more resilient infrastructure and sustainable restoration in the context of complex, interrelated environmental and social equity considerations.

51 A HANDHELD HEMATOLOGY ANALYZER

V. Liu1, Abraham Lee2. 1Flintridge Preparatory School; 2Department of Biomedical Engineering, University of California Irvine

As the need for an accurate and complete blood analysis (including blood cell counts and cell differentiation) increases, there is a greater demand for micro devices that can perform such tasks in a portable and inexpensive format. Most of the conventional hematology analyzers are bulky and expensive (~$150k), and can only be used in clinical laboratories. In this project, we developed a microfluidic enhanced blood smear device that can be used to concentrate and separate white blood cells (WBCs) from red blood cells (RBC) using acoustic microvortex induced by Lateral Cavity Stimulation, followed by imaging using an iPhone based microscope and automatic cell morphology recognition using a cell image analysis software. This portable device expedites blood analysis process by automating cell separation
and morphology analysis. By concentrating WBCs in a small area, it takes one far less time to analyze a blood sample than the time needed on a blood smear. In addition, a method for differentiating and counting different types of blood cells using two cell image analysis programs: ImageJ and Cell Profiler, was developed. By teaching a computer how to differentiate blood cells, I created a database of cell images and increased the speed at which blood analysis occurs. With this database, the computer program can replace conventional manual cell counts and morphology analysis using microscope which suffers from low reproducibility and is prone to human error. Furthermore, I built an iPhone based microscope that can take pictures of blood cells in a microfluidic device for further analysis.

52* THE EFFECTS OF DIETHYLSITBESTROL AND METHYLPARABEN ON WEHI 7.1 CELLS

M. Barba, C. Broussard. Department of Biology, University of La Verne

Exposure to environmental toxicants, such as endocrine disrupting chemicals (EDCs), may promote far-reaching alterations of critical periods of development that later influence adult-onset diseases. Our immune system and the thymus are particularly sensitive to the toxicity of many environmental chemicals. In the present study two well-known endocrine disruptors, Diethylstilbestrol (DES) and Methylparaben (MPB), were examined to elucidate possible mechanisms of action of EDCs during gestational development of the immune system. DES is a model EDC that was prescribed to pregnant women from the 1940s to the 1970s to alleviate pregnancy complications, but was banned when it became increasingly clear that it did not. In fact, DES induced developmental problems for the offspring and increased cancer incidence in the mothers and the offspring. MPB is a preservative found in many personal care products. WEHI 7.1 cells, a murine suspension cell line derived from thymus lymphoma tissue, were selected to determine whether the cell line was a good model system for primary embryonic thymocytes. The first step was to determine whether these chemicals affect the viability of WEHI 7.1 cells in a similar fashion to their effects on primary embryonic thymocytes. Preliminary data suggest that DES does reduce viability, whereas MPB does not, at similar doses and timing to findings in primary embryonic thymocytes. These results suggest that the WEHI 7.1 cell line may indeed be a good model system for studying the EDC mechanisms responsible for immune system impairment.

53 USE OF APTAMERS AS A PLATFORM TO CREATE siRNA AND NOVEL sgRNA "CHIMERAS" AIMED AT TREATING AND PREVENTING HIV INFECTION

B.W. Ng¹, J.C. Burnett². ¹Walnut High School; ²Department of Molecular and Cellular Biology, Beckman Research Institute

Scientists have spent years researching and developing better methods to treat AIDS (Acquired Immune Deficiency Syndrome), the final stage of the HIV (Human Immunodeficiency Virus) infection. A recent discovery of the use of aptamers holds promise as a vehicle of delivery for certain therapeutic agents; the aptamer binds to a specific cell surface receptor and internalizes its cargo. The purpose of this project is twofold: to create a method of treatment for prevention and post-infection of HIV. In doing so, two different constructs to both treat and prevent HIV infection were designed. By linking a cytotoxic siRNA to an HIV aptamer, a targeted delivery system for use against HIV was created. Cells transfected with a reporter system were treated with the aptamer-siRNA; the results of the qRT-PCR assay show that the siRNA is effective in killing the gp160-expressing HeLa reporter system cells, while the aptamer is functioning correctly and delivering the siRNA. Therefore, the aptamer-siRNA chimera is proved to be effective in targeting and eliminating HIV cells. For HIV prevention, an aptamer-sgRNA, a novel construct, was designed for use to guide the CRISPR-Cas9 genome editing enzyme to knock out the CCR5 gene, which encodes for the primary receptor HIV viral entry. Results indicated that the novel construct has been successfully internalized into reporter system cells. The aptamer-sgRNA construct has been moved from the in vitro to the in vivo stage, and is being tested in a sample study of nine lab mice.
Pleistocene and post-Pleistocene geological events and climate fluctuations had dramatic effects on the distribution of native flora and fauna throughout the Great Basin (GB). Available habitat for mesic-adapted species, such as the western fence lizard (Sceloporus occidentalis), would have changed considerably during this period. Populations of *S. occidentalis* are currently found at intermediate elevations in isolated and semi-isolated mountain ranges throughout the GB. Phylogenetic analysis of mtDNA sequences identified four major clades within the GB with >5% sequence divergence between them and low-levels of sequence variation within western and central clades. Based on the patterns of mtDNA differentiation, we predicted: i) significant nuclear gene differentiation between clades and ii) loss of allelic diversity from south to north, reflecting range expansion. Analysis of mtDNA and nuclear microsatellite DNA (five loci) was carried out for over 30 populations of *S. occidentalis* within the GB. Statistical analysis of microsatellite DNA using ΔST, IBD Web Service, and Structure found significant genetic differentiation in microsatellite loci between mtDNA clades; which is consistent with restricted gene flow (ΔST values between clades were greater than within clade values). Significant genetic variation in terms of isolation by distance and loss of allele diversity from southern to northern populations were found in both western and central clades. However, greater genetic differentiation was seen in the western clade than in the central clade. The genetic structure and patterns of differentiation seen in *S. occidentalis* are consistent with post-Pleistocene northward range expansion and restricted gene flow between clades.

**55* ‘PAINTS ROCK’ – AN INTERDISCIPLINARY RESEARCH PROJECT BETWEEN THE GEOLOGY AND CHEMISTRY DEPARTMENTS AT PASADENA CITY COLLEGE TO SYNTHESIZE SUSTAINABLE PAINTS FROM NATURAL MINERALS**

**V. Sanchez**, J. Portillo, M. Ramos, J. Blatti, J. Ashcroft. Natural Sciences Division, Pasadena City College

The Early Career Undergraduate Research Experience (eCURe) is a program at Pasadena City College (PCC) designed to give underrepresented students an undergraduate research experience in the natural or physical sciences at the onset of their careers to better inform their decision to pursue a career in science through highly collaborative and interdisciplinary research projects. This unique experience inspires enthusiasm for scientific research by introducing students to research projects with broader impact in terms of energy, the environment and emerging scientific technologies. In this eCURe research project, students from the geology and chemistry departments have teamed up to synthesize sustainable paints from natural minerals and test their resultant properties, which includes mineral identification through analysis via a Scanning Electron Microscope (SEM) and elemental identification. In this highly interdisciplinary project, geology and chemistry students at PCC are working together, learning to integrate the concepts from their science courses into a research-based setting, generating novel questions, designing experiments, conducting research and analyzing the results. Students used their paints to construct beautiful images connecting chemistry to color, pigments, Nature and art—with the aim of at teaching chemical concepts in a creative way and emphasizing intersections between science and art. This innovative community college research program has inspired our students at PCC to continue scientific research they have become passionate about as they transfer to four-year institutions.
The hypostoma, a ventral mouthplate in trilobites with implications for feeding mode, is rarely preserved in agnostoid arthropods. Because of rarity of preservation, disturbance during preservation, or variation among genera, there are conflicting reports about hypostomal position, size, and muscle attachments. We present two new indirect sources of information on these mouthplates in Middle Cambrian specimens from the Wheeler Shale of Western Utah: euhedral pyrite crystals on the dorsal exoskeleton marking the position of anterior wings of the hypostoma beneath the carapace; and rectangular collapsed areas on the glabella immediately posterior of, and in some cases slightly overlapping with, the transglabellar furrow. Spacing of euhedral pyrite crystals closely approximates the distance between anterolateral and posterolateral edges of preserved hypostomata. Rectangular collapse structures closely approximate areal estimate of the hypostoma on specimens where it is directly preserved on ventral surfaces. Locations of both crystals and collapse structures cluster around a hypostomal position that slightly overlaps the transglabellar furrow but primarily occupies space beneath the posterior lobe of the glabella, supporting a more posterior position than is commonly reported for the hypostoma in these animals. Slight angular variations from this position are presumed to be artifacts of movement during ecdysis or slight agitation of the exoskeleton at the time of deposition.

An investigation of possible major flooding event(s) in Canada del Puerto of Santa Cruz Island. The inlet of the canyon from the central valley of the island has a number of large boulders that were surveyed and analyzed by thin section. There was a focus upon a particularly large accumulation of boulders over three feet where the canyon changes direction from a general North-South direction to East-West. The distance from the creek bed to the boulders and the elevation of the boulders from the creek was measured. The angular dimensions of each boulder were measured with a meter detailed sketches were made. Hand samples were collected for thin sections. Surveyed the elevation distance of each of the boulders from the creek bottom. A general survey of the terrain and geology shows that data was inconclusive as to whether the boulders were from landslide or major flooding event. However, further studies may be conducted through bore samples of trees growing in boulders to determine a rough age of deposition. Also, swath maps of the marine terrace can be obtained in search of flood debris and age of the flooding events to show a correlation between the two. It is suspected that the concentration of boulders were carried to the bend by an extreme flooding event and deposited as the velocity of the water slowed around the bend. The origin of the boulders may have been a natural dam that is occasionally created between the central valley and the inlet of the canyon.

Runoff in Southern California is commonly impaired by fecal indicator bacteria (FIB) from urban storm drains and sprawling urban development. Other contaminants such as metals, oils and increasing chemicals of emerging concern are common to urban runoff, resulting in the increased usage of Low Impact Development (LID) strategies that use bio-retention and filtration to capture polluted runoff. The BCRG serves as a 1000ft long biofiltration system that collects runoff from 5ha of commercial area during rainstorms. During the 2015-16 rainy season, our goal is to sample three storms; presently, four
have been sampled. During each storm, sets of samples are collected from four inlets and two outlets during rising, peak, and descending arms of a storm, and Hobo water-level data loggers are used to measure flows. The goal of this study is to measure the FIB removal efficiency of the Ballona Creek Rain Garden (BCRG) located in Culver City, California by determining the loading of FIB entering the gardens, and when filled, discharging into Ballona Creek. Concentrations of FIB (most probable number/100 ml) were determined from chromogenic substrate testing using Idexx materials. Using a Vitek bacterial identification system, species were isolated to examine the diversity and variation of bacteria entering and exiting BCRG. Preliminary data shows a decrease in FIB over the course of the storm in runoff destined for Ballona Creek. Greater inlet flow compared to outlet flow signifies that the bio-infiltration system is retaining significant portions of water (exact amount to be determined). This process is ongoing as data will continually be assessed throughout the summer, and again over the 2016-2017 rainy season.

59  MEASURING RUNOFF POLLUTANT REMOVAL EFFICIENCY IN THE BALLONA CREEK RAIN GARDEN, CULVER CITY, CALIFORNIA

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Runoff in urban settings can contaminate surface water with bacteria, metals, oil, and other pollutants. One solution to dealing with these contaminants is through the use of Low Impact Development (LID) strategies using biofiltration systems that capture and infiltrate contaminated runoff back into the ground. Through natural processes, pollutants are decontaminated and groundwater supplies are augmented. The goal of this study is to measure the pollutant removal efficiency of the Ballona Creek Rain Garden located in Culver City, California, by determining the loading of pollutants entering the gardens, and when filled, discharging into Ballona Creek. This 1000 ft biofiltration system captures runoff from about 5 ha of commercial area during rainstorms. During the 2015-16 rainy season four rain events have been sampled. During each storm, sets of samples were collected from four inlets and two outlets during rising, peak, and descending arms of a storm, and Hobo water-level data loggers are used to measure flows. Samples were tested for fecal indicator bacteria, total suspended solids, turbidity, metals, and petroleum products. Pollutant removal efficiencies will be determined by estimating pollutant loading where the total flow is multiplied by the average concentration for each contaminant entering and leaving the gardens. Preliminary data show that all rain events sampled had a much larger flow of water entering the rain garden when compared to water leaving the rain garden. While concentrations do not differ much between input and output data, the difference in flows causes the load of contaminants into the garden to be greater than that leaving the garden, suggesting that contaminated water is being sequestered in the rain garden. As the contaminated water filters through the soil and into the rain garden, it can be assumed that the contaminants remain within the soil, allowing clean water to reenter the water table.

60  IS WATER POLLUTION AN ENVIRONMENTAL JUSTICE ISSUE? A CASE STUDY OF CALIFORNIA AND LOUISIANA

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Releases of toxic water pollutants have the potential to effect the health and well being of our population, and pollution in the U.S. is often found to disproportionately impact people with lower socioeconomic status. To investigate if water pollutants disproportionately impact people in lower economic brackets or minority races, data from EPA’s Toxic Release Inventory (TRI) and the U.S. Census Bureau were mapped for California and Louisiana using ArcGIS. California and Louisiana were chosen because they are both coastal states, but differ in their location and rank of the toxicity of their release. Median household income and race data were taken from the Census Bureau and mapped in ArcGIS by county subdivisions using choropleth mapping. Race was divided into five categories: White, Hispanic, Asian, Black, and other, and mapped based on the predominant race in the county subdivision. Median household income was broken up into five categories ($0 - $24,000, $24,000 – $48,000, $48,000 – $96,000, $96,000 – $192,000, and $192,000-250,000+) based on the national poverty line of $24,000. All
facilities from EPA’s 2013 TRI dataset with surface water releases were also mapped. The resulting maps depicted the location of a polluting facility, the toxicity of the water release, and the predominant race and income of the citizens inhabiting that county subdivision. Quantitative data were extracted from these maps and analyzed using statistical analysis. Results indicate that there may be no correlation between the location and toxicity of water pollution with people in lower economic classes or minority races.

61* A COMPARATIVE STUDY OF WATER EFFICIENCY AND GROWTH FOR BOK CHOY IN A RAISED BED AND AQUAPONICS SYSTEM

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Aquaponics systems are one of the vanguards in sustainable farming practice. They are known for utilizing natural nutrient recycling processes, high water efficiency and minimum environmental impact. However, limited quantitative knowledge is known regarding growing efficiency and water usage between aquaponics and traditional soil-based agriculture. A comparative study to investigate growth efficiency and water consumption of bok choy (a form of cabbage) in two different media – soil and an aquaponics system was carried out in this study. Both the soil bed and the aquaponics system were located within 10 feet from each other in a South LA Urban Farm, experienced similar environmental conditions, and provided the same amount of area for planting (~16 ft²). Ten bok choy seedlings were transplanted into each system on the same day when Bok Choy seedlings were 3-5 inches tall, and care was taken to select individuals that displayed similar characteristics. The pH, ammonia, nitrite and nitrate concentrations were measured for each system at the beginning and end of the experiment. Biometrics including plant height and leaf area were documented weekly. The bok choy were harvested after four weeks, and total biomass, chlorophyll content, and nutrient content of leaves were analyzed. Results will compare and contrast the growth of bok choy in traditional soil bed and the aquaponics system, providing valuable information about water efficiency and the potential of aquaponics systems for growing bok choy.

62* TIMING OF DEATH IN C57BL/6 EMBRYONIC THYMOCYTES UPON IN VITRO EXPOSURE TO DIETHYLSTILBESTROL

K. Alpi, L. Dinh, J. Cervantes, C. Broussard. Department of Biology, University of La Verne

Endocrine disrupting chemicals are known to be a cause of cancer and immune dysfunction. Humans are constantly exposed through everyday consumer products such as agricultural food sprayed with pesticides, plastic containers, house paints and beauty products. Several environmentally prevalent EDCs have been investigated and shown to impair normal endocrine functionality. The earliest exposure to EDCs can occur in utero through prenatal exposure of the mother. This period is critical as gestation is the time for growth and development of all organ systems of the embryo. As such gestation is highly sensitive to any imbalance or exposure to EDCs. The purpose of this study was to examine the in vitro timing of cell death induced by Diethylstilbestrol (DES) in C57BL/6 embryonic thymocytes—the cells of the thymus that are responsible for the maturation of a central component of the immune system – in order to better understand the roots of EDC-induced immune dysfunction. DES is a model endocrine disruptor that was previously prescribed to pregnant women from the 1940s to the 1970s to prevent pregnancy complications, but was banned due to adverse effects on mothers and their offspring. C57L/6 embryonic thymocytes were treated with 0, 100 pM, 100 nM, 50 µM, and 100 µM of DES for 3, 6, and 24 hours. Results suggest that cell death occurs as early as 3 hours at 50 µM and 100 µM concentrations of DES. To identify the mechanism DES-induced death, future studies should examine whether embryonic thymocytes are dying from necrosis or apoptosis.
INTEGRATED GEOLOGICAL AND CHEMICAL PROCESSES IN PROBLEM-BASED LEARNING LABORATORY

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Undergraduates in introductory geology courses at Pasadena City College learn about mineral properties that are useful in identifying individual minerals. Since most introductory geology students have not studied chemistry, our work with minerals stops with the major physical properties; students that continue to take mineralogy at PCC also work with petrographic techniques but have not traditionally had access to analytical equipment to study major element characteristics of mineral unknowns. For the most part, these mineral specimens are out of context, so mineral associations cannot be used to determine varieties. As a geology student with chemistry experience, I wanted to combine hand specimen identification with major element analysis obtained using a scanning electron microscope (Phenom Prox Table top SEM housed in the Chemistry Department at PCC) in order to determine whether these approaches provide additional insight into mineral unknowns and whether their combination might be suitable for other beginning students to combine as part of more regular coursework at PCC. I worked with 8 unknown mineral specimens which were new to me, using both methods to arrive at a mineral identification. Physical property tests that were introduced in introductory geology course such as cleavage, hardness, luster, streak, etc., were used to narrow down a short list of possible minerals for each specimen. Then I obtained major element analyses of each specimen using the SEM. I used the major element data to rule out possible candidates and conclusively identify the specimens. The physical property tests were highly effective at narrowing the possibilities, so that following up with the SEM was very effective and efficient. Mineral properties were adequate to identify most hand specimens without the SEM data, but several required the SEM data to rule out possible candidates. Further, the SEM data allowed the identification of varieties of certain minerals (e.g. Garnet). As part of this study, I learned about the importance of instrument calibration, specimen preparation and the need for a reliable standard. I plan to continue this work by developing a set of standards for use with our SEM and examining other materials in the instrument.

64*P  MORPHOLOGICAL RESPONSES OF SHORE BIRDS TO PARASITE INFECTIONS OF KIDNEY WORMS AND TRACHEAL GAPE WORMS


Infections by helminth parasites in final host birds often do not cause obvious, substantial pathology. However, even when morbidity or mortality are rare, hosts may elicit morphological responses to infections. Here we document whether any morphological changes take place in the lungs, trachea, kidneys, and spleen of coastal birds from California infected with gapeworms (Nematoda: Syngamidae) and kidney worms (Digenea: Renicolidae: Renicola spp.; Eucotylidae: Tanaisia spp.). We necropsied 247 birds from California estuaries, assessing respiratory organs and kidneys for infection. Parasites were counted, preserved, and identified to the lowest taxonomic level possible. In Least Sandpipers, a gapeworm infection can block over 65% of trachea area, but we were unable to detect pathology by means of lung weight or bilateral symmetry in organ weight. For kidney infections, preliminary analyses suggest the normalized weights of kidneys and spleens are smaller (26% and 32%, respectively) in infected birds compared to uninfected conspecifics. The degree of symmetry of these organs within individual hosts, however, appears to be equal between infected and uninfected birds. These data indicate that pathological atrophy of infected kidneys occurs with infections of Renicola spp. and Tanaisia spp. We discuss the larger implications of decreased kidney and spleen size to host condition.
CARDIAC MRI BASED INVESTIGATION INTO THE RELATION BETWEEN ACUTE INFARCT SIZE AND LONG-TERM FUNCTIONAL INDICES

J. Kim

Myocardial infarction can be evaluated using cardiac Magnetic Resonance Imaging (CMR). Cine images can be used to assess cardiac function and late-gadolinium enhancement (LGE) CMR can be used to assess infarct size. The objective of this investigation was to assess if the functional status following myocardial infarction in patients is dependent on acute infarct size. Patients (n=20) underwent cardiovascular magnetic resonance imaging on day 2 (acute) and month 6 (chronic) after the event. LGE and cine images were processed with cvi42 (Circle Imaging, Canada) to measure left-ventricular end-diastolic volume (EDV), end systolic volume (ESV), ejection fraction (EF), and acute infarct size from CMR images. Acute infarct size was regressed against chronic EDV, ESV, EF. The results showed that acute infarct size and functional volumetric indices (EDV, ESV, and EF) were correlated. The R for the three regressions between acute infarct size and EDV, ESV, and EF were 0.67, 0.73, and -0.76 respectively. The acute infarct size is predictive of the volumetric indices in the chronic phase. Thus, acute infarct size is a strong indicator of how well the heart function is impaired in the long term.

AIRSHIP HULL OPTIMIZATION USING ARTIFICIAL NEURAL NETWORK AND COMPUTATIONAL FLUID DYNAMIC SIMULATIONS

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This project developed a method that utilized the learning capability of the Artificial Neural Network (ANN) to optimize the airship hull shape with Computational Fluid Dynamic (CFD) simulations. The CFD simulations offered accurate calculation of the drag coefficient but required long computation time. The project’s objective was to use the ANN to reduce the number of CFD iterations and thus speed up the optimization. A parametric representation was developed to represent the three-dimensional hull by a few parameters. Initial hull shapes and their CFD-simulated drag coefficients were used to train the ANN. The ANN then produced a hull shape that potentially had the lowest drag coefficient. CFD simulations were followed to obtain the drag coefficient of the ANN-generated hull. The new set of data was added to the training set to retrain the ANN. This process was repeated until satisfactory hull shapes were obtained. Four optimization trials were performed. In all trials, the hull length and volume were 5 m and 2.2 m3, respectively. The free-stream air speed was 10 m/s, equivalent to a Reynolds number of 3.3x10^6. The first trial used nine unconstrained parameters to represent the hull shape and unrealistic hull shapes were produced. In the remaining trials, the hull shape was represented by five constrained parameters. Low drag hulls were successfully produced by the ANN in <10 optimization iterations in each trial. The drag coefficients were comparable to or lower than that of NACA Model 111. This clearly demonstrated the potential of the ANN-assisted optimization method.

A NOVEL SPIRAL MICROFLUIDIC DEVICE FOR URINALYSIS

B. Liu, R. Liu, A. Lee. Department of Biomedical Engineering, University of California Irvine

Urinalysis is transforming the field of disease diagnostics through its wide range of capabilities in detecting diseases such as proteinuria, diabetes, and kidney dysfunction. Identification of urine sediment particles (such as white blood cells, red blood cells, cast, crystal, and yeast) is critical since their presence in a urine sample indicates a number of possible medical conditions such as kidney stones, diabetes, and even tract infections. The need for advanced microfluidic devices is expanding as demands for more effective detection methods of urinary tract infections and disorders increase. In this project, a novel spiral microfluidic device is developed for automatic urine sediment particle separation followed by morphology analysis. This device was designed based on the principle of inertial separation using a spiral microchannel that led to particle separation based on their difference in mass, size, and inertial property. Particles in urine vary in size and mass. The device was fabricated using soft lithography technology and tested using human urine samples. The urine particles traveled through the spiral microchannel and were
separated based on varying inertial characteristics into the corresponding tangent branches. A mathematic model of this separation method involving the formation of dean vortices was established. Using this device, several types of urine particles were successfully sorted and separated, followed by particle morphology study under a microscope. Separation efficiency was determined. The experiments showed that the inertial separation technique using the spiral microchannel is more effective than the other leading separation methods such as microfiltering.

68* THE EFFECTS OF DIETHYLSTILBESTROL AND METHYLPARABEN ON JURKAT T CELLS

A. Valiente, C. Straight, C. Broussard. Department of Biology, University of La Verne

Endocrine disrupting chemicals (EDCs) have attracted attention in science and society due to their ubiquitous presence in our world. EDCs can be found in plastic bottles, makeup, food, pesticides, and even baby bottles. The present study seeks to identify how two specific EDCs, Diethylstilbestrol (DES) and Methylparaben (MPB), affect the mature immune system. DES was banned from use after being prescribed to millions of pregnant women to treat pregnancy complications. Instead, it’s use lead to miscarriages, birth defects, and cancer. On a cellular level, DES has been shown to induce cell death in immune cells such as thymocytes. Although DES has been widely studied and is used as a positive control in endocrine disruptor research, its mechanism of action in inducing cell death is not well-defined. MPB is a methyl ester widely used in cosmetics. To our knowledge, its effects on the mature immune system have never been investigated. The current study shows how these two chemicals, DES and MPB, affect Jurkat T cells (a mature immune cell line) at 0, 0.0005, 0.005, 0.05, 0.5, 5, and 50 µM for 3, 6 and 24 hours of exposure. Our results indicate that DES begins to kill the cells after 6 hours of exposure. MPB on the other hand has no notable effect at any time point tested. These results indicate that MPB, although a known EDC, does not affect the adult Jurkat T cell line, whereas DES is lethal to cells at 5 and 50 µM concentrations.

69*P BIOPHYSICAL AND FUNCTIONAL CHARACTERIZATION OF A CALCIUM ACTIVATED POTASSIUM CHANNEL IN TRYPANOSOMA CRUZI

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Chagas Disease is a parasitic infection caused by the protozoan Trypanosoma cruzi. The parasites develop in a changing environment where variations of osmolarity, ionic concentrations and pH are significant. Upon these changes, maintenance of constant intracellular conditions determine the survival and successful transmission of T. cruzi. We propose that different ion channels integrate a homeostatic network that allows the parasite to detect and respond to external changes. Combining molecular, cellular and electrophysiological approaches we are characterizing the expression and function of a putative calcium-activated potassium channel TcCaKC. The protein localizes in the plasma membrane of the main developmental stages of the parasite and heterologous expression in mutant yeast shows that TcCAKC is able to restore potassium permeation in deficient strains. We have obtained TcCaKC cRNA by in-vitro transcription and injected the mRNA into Xenopus laevis oocytes to characterize the biophysical properties of the channel by two-electrode voltage clamp. Oocytes expressing TcCaKC and exposed to voltage pulses show a significant increase in inward currents after addition of calcium ionophore ionomycin. Similar responses can be elicited by increasing free cytosolic calcium through pre-incubation with SERCA pump inhibitor thapsigargin. The responses are abolished by EGTA, suggesting that TcCaKC activation is depend of extracellular calcium. Ion selectivity, conductance and inactivation mechanisms are currently under study. Our results suggest that TcCAKC is a potassium channel that could be playing a significant physiological role in the parasites, contributing to the maintenance of the plasma membrane potential and intracellular pH regulation.
**EFFECTS OF DIETHYLSTILBESTROL AND METHOXYCHLOR METABOLITE, 2,2-BIS-(P-HYDROXYPHENYL)-1,1,1-TRICHLOROETHANE (HPTE) ON CELL VIABILITY IN JURKAT T CELLS**

**J. Batres**, D. Gonzalez, C. Broussard. Department of Biology, University of La Verne

Endocrine disrupting chemicals (EDCs) are present in the environment worldwide, impacting ecosystems, animal welfare, and human health. Exposure to these chemicals can come from many sources, such as produce with residues of herbicides and pesticides, food additives, supplements, prescription medications, plastics, and personal care products, including cosmetics. EDCs have been shown to cause alterations in the endocrine system. Studies have also suggested that human exposure alters the immune system, leading to increases in infection and autoimmune disease. Many studies have pointed to disruption of hormones, which include estrogens, androgens, and thyroid hormones, as the means for EDC disruption of the endocrine system. However, the exact mechanisms by which EDCs disrupt the immune system is still unclear. Diethylstilbestrol (DES), a synthetic estrogen prescribed to pregnant women from the 1940s to the 1970’s, and 2,2-bis-(p-hydroxyphenyl)-1,1,1-trichloroethane (HPTE), the metabolite of the organochlorine pesticide Methoxychlor (a replacement for the once widely used pesticide, DDT) were studied. Our research investigated whether HPTE and DES affect cell viability in the acute T cell leukemia cell line, Jurkat, and at what exposure dose and duration. Cells were exposed to 7 different concentrations of DES and HPTE (0, 0.0005, 0.005, 0.05, 0.5, 5, and 50 µM), for 3, 6, and 24 hours. Cell counts were conducted using PI staining and flow cytometry. Our preliminary data show a dose-dependent decrease in Jurkat T cell viability. Our work suggests that exposure to DES and HPTE decreases viability of mature T cells in a dose and time dependent manner.

**PEER PRESSURE: SOCIAL MOTILITY AND DIFFERENTIATION IN TRYPANOSOMA CRUZI**

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The protozoan parasite *Trypanosoma cruzi*—causative agent of Chagas’ disease—endures several environmental challenges as it completes its life cycle between the insect vector and mammalian host. Parasite growth is tightly regulated by the availability of nutrients and the number of cells, triggering the differentiation of non-infective into infective forms. In other trypanosomatids, the presence of quorum sensing and social motility have been recently described as mechanisms that influence parasite transformation and infectivity. Social motility has been widely described in bacterial species as an energy-requiring process that allows colonies of bacteria to perform several biological functions, including surface recognition and biofilm formation, in a community-centric organized fashion. In *T. cruzi* we have observed the induction of fast transformation from non-infective epimastigote into the infective metacyclic trypomastigote after a few hours of culture in semi-solid agarose plates. This transformation, known as metacyclogenesis, happens slowly in liquid media and the specific molecular factors that govern this process are still unknown. The rate of transformation is affected by stiffness of the agarose matrix, number of cells, pH fluctuations, stage of growth and parasite strain. We propose that surface recognition and quorum sensing are important triggers for differentiation. These preliminary findings could be the gateway to elucidating the factors that *Trypanosoma cruzi* uses to successfully navigate its highly variable microenvironment and regulate its transition to various developmental stages.

**EL4 CELL LINE DEATH IN RESPONSE TO DIETHYLSTILBESTROL (DES) AND 2,2-BIS-(P-HYDROXYPHENYL)-1,1,1-TRICHLOROETHANE (HPTE) EXPOSURE**

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The purpose of the immune system is to protect the body from invading pathogens and cancer cells. Endocrine disrupting chemicals or EDCs are chemicals that mimic the effects of natural hormones the body produces, which in turn can affect how the immune system functions. Diethylstilbestrol (DES), a
known endocrine disrupting chemical, was erroneous prescribed between the 1940s and 1970s to pregnant women to prevent pregnancy complications. Its use led to developmental defects in the offspring and increased the incidence of cancer in treated mothers and daughters. A second EDC of interest, Methoxychlor, was the pesticide that replaced DDT until it was not relicensed in 2004. Previous studies have shown that DES and 2,2-bis-(p-hydroxyphenyl)-1,1,1-trichloroethane (HPTE), methoxychlor’s primary metabolite, induce cell death in primary embryonic thymocytes. The effects of DES and HPTE on the C57BL/6N EL4 mouse lymphoma cells were examined to determine whether this cell line could serve as an effective model for the effects of EDCs on the immune system. EL4 cells were exposed to various concentrations (500pM, 5nM, 50nM, 500nM, 5µM, and 50µM) of DES or HPTE for 3, 6, and 24 hours. Cells were then stained with propidium iodide (PI) to examine changes in cell viability. Cell death increased at a DES and HPTE concentrations of 50µM, while showing little to no death at concentrations of 5µM and below. These results mirror those obtained using primary embryonic thymocytes, suggesting that the EL4 cell line may be a suitable model for identifying the mechanisms behind this cell death.

73*F REPRODUCTIVE PHYSIOLOGY OF PACIFIC SANDDAB (CITHARICHTHYS SORDIDUS) COLLECTED NEAR A WASTEWATER OUTFALL SITE IN SOUTHERN CALIFORNIA

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Wastewater effluent contains endocrine disrupting compounds that can potentially affect the physiology of marine organisms. We hypothesized that the reproductive physiology of Pacific sanddab (Citharichthys sordidus) collected at an outfall site would exhibit reproductive dysfunction. Female fish were collected from an outfall site (n=97) and a far-field site (n=110) in southern California during July and October 2014 and January and July 2015. Fish weight (g), standard length (cm), and ovarian weight (g) were recorded. Gonadosomatic index (GSI) was calculated (gonad weight/body weight x 100). Ovarian tissue was dissected, fixed, and embedded in paraffin wax for histological analysis. Female sanddab standard length and weight were greater (p<0.001 length; p<0.005 weight) at the outfall site during all months with the exception of January 2015. GSI was greater (p<0.001) at the outfall site in July 2014. Ovarian follicle composition at outfall and far-field sites in July 2014 was not significantly different (p=0.356 primary; p=0.155 secondary; p=0.432 vitellogenic). However, in October, there were more secondary (p=0.050) and vitellogenic ovarian follicles (p=0.020) in ovaries from fish collected at the far-field site compared to fish from the outfall site. In January 2015, there were more secondary ovarian follicles (p=0.013) in the ovaries from fish collected at the far-field site. Our data indicate the reproductive physiology of female Pacific sanddab displays considerable temporal and spatial variability. We are continuing to collect data to aid in our understanding of how wastewater effluent may impact the reproductive health of benthic fishes in southern California.

74*F ACUTE 17β-ESTRADIOL EXPOSURE DOES NOT IMPACT GONADAL DEVELOPMENT IN JUVENILE TOPSMELT (ATHERINOPS AFFINIS)

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The impact of environmental estrogen exposure on gonadal development in juvenile topsmelt (Atherinops affinis) is currently unknown. To better understand the reproductive implications of environmental estrogens on topsmelt, we hypothesized that acute estradiol exposure would impact topsmelt gonadal maturation. Juvenile topsmelt (n=120, age 6 months) were exposed to a variety of estradiol (E2) concentrations for 3 weeks: water, carrier control (ethanol), 0.5µg/L E2, 2µg/L E2, 4µg/L E2, or 8µg/L E2. Survival rate ranged from 75%-100% per exposure group, with no effect of concentration. Gonads (60-125 cross-sections per animal) were examined histologically from a subset of fish to determine gonadal development stage. Of the fish examined, 73% showed stage 0 undifferentiated gonads, 10% showed stage 1 (primary oocytes present), and 17% showed stage 2 (initial growth of oocytes), with no effect of exposure group on gonadal stage (p>0.05). Multiple individuals in the water group had developing gonads, with animals in stage 1 and stage 2. Only undifferentiated gonads (stage 0) were...
observed among individuals in the carrier control and 4µg/L E2 groups; however, individuals in the 0.5, 2, and 8µg/L E2 groups had stage 2 ovaries. Interestingly, only ovarian tissue showed differentiation, no progressing testis development was observed in any group. Overall, acutely exposing pre-pubescent tosmelt to increasing estradiol concentrations did not significantly impact early gonadal development. Future studies on more mature tosmelt to determine if estradiol exposure alters gonadal function could be important next steps to maximize the safety and minimize the impact of wastewater management.

**75**P MOLECULAR ECOLOGY OF ASCAROPHIS (SIMILASCAROPHIS) SP. (NEMATODA: CYSTIDICOLIDA) FROM FISH AND CRUSTACEAN HOSTS FROM SOUTHERN CALIFORNIA, MEXICO AND CHILE

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Cystidicolid nematodes are widespread parasites of both freshwater and marine fishes. Known life histories typically involve a single crustacean or insect intermediate host. While there are few reports of cystidicolids in the temperate Eastern Pacific, worms morphologically similar to Ascarophis (Similarascarophis) chilensis Muñoz, González & George-Nascimento, 2004, have been found to be common parasites of intertidal and nearshore fishes and invertebrates in the Southern California Bight. In this study, adult cystidicolids from six species of fish and larval stages from eight different crustaceans from intertidal/nearshore habitats from Southern California, Baja California and Chile were genetically sequenced. Based on DNA sequencing of the 18S rRNA gene, nearly all adult and larval specimens were found to comprise a single species, including the Chilean population which has been previously described as A. (S.) chilensis Muñoz, González & George-Nascimento, 2004. However, adult specimens from scorpionfish Scorpaena guttata, and the opaleye Girella nigricans represent different cystidicolid genera/species. Further sequencing of genes known for finer scale resolution among closely-related species, including the internal transcribed spacer regions and the mitochondrial cytochrome c oxidase gene, support these findings. These methods will make possible the detection of new and cryptic species and will be combined with morphological studies to describe both the larval and adult stages of cystidicolid nematodes in the Eastern Pacific.

**76*** THE SKIN OF THE GIANT KEYHOLE LIMPET; A UNIQUE BACTERIAL HABITAT GOVERNED BY TISSUE TYPE AND HOST GEOGRAPHY.


Efforts to understand beneficial interactions between bacteria and animals are increasing, yet little is still known about the microbes associated with marine invertebrates, which are exposed to a literal sea of bacteria. The giant keyhole limpet, Megathura crenulata, unlike other molluscs, has an unusually large surface area of mucus-coated skin. A possible unique and sustained microbial community associated with limpet skin has relevance to not only the basic understanding of bacterial establishment on biological surfaces, but also for aquaculture of this medically important mollusc. This study characterized the naturally-occurring microbial community of two skin regions of M. crenulata; the mantle that covers the shell and the muscular foot used to move along rocky reef surfaces. We PCR-amplified and barcode-sequenced a 291-bp segment of the bacterial 16S rRNA gene from DNA extracts of limpet skin swabs (n = 6 from each region). Bacteria belonging to a new group of Spirochaetaceae dominated the mantle (41% of recovered sequences on average), while foot regions were co-dominated by Flexithrix (25%) and Arenicella (22%). None of these groups were recovered from corresponding seawater samples. Further analysis revealed significant influence of both skin area and geographical location on the bacterial community (69% and 11% influence, respectively). Low bacterial diversity (avg Shannon Diversity index of 2.6-3.0), compared to seawater (avg Shannon Diversity index of 3.9), and dominance of only a few bacterial species suggests a specific and unique bacterial niche on M. crenulata skin. Preliminary studies of limpets in captivity showed greater variability and possible dysbiosis of the typical microbiome.
MINERAL HAND SPECIMEN ID USING PHYSICAL PROPERTIES OBSERVED IN HAND SPECIMEN AND BASIC SEM ANALYSIS AS PART OF A 2 YEAR COLLEGE INDEPENDENT STUDY PROJECT

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The importance of interdisciplinary research can be exemplified through a hands-on laboratory experiment that bridges two scientific fields. Using a Problem-Based Learning approach, the following lab experiment joins the fields of geology and chemistry in order to determine the identity of unknown minerals. Physical geological tests are combined with several chemical tests in order to obtain supportive data. Electron microscopy is utilized to verify the unknown samples identity. The importance of acquiring several useful data is demonstrated as means of arriving at an educated conclusion as to the identity of the unknown mineral.

FEATHER QUILL MITE INFECTIONS OF COASTAL BIRDS FROM CALIFORNIA


Feather mites within quills are thought to be host-specific with shared ectoparasite species occurring on closely related hosts. Feather mites are spread through host-to-host contact, often during the breeding season on nests and during flock socialization. The objective of our study was to examine the extent to which the distribution of feather mites in host feather quills is related to either or both host phylogeny and host ecology. We also investigate whether there is symmetry in the prevalence of feather quill mite infections on bird wings. We processed 246 California coastal birds for feather quill mite infections of the primary, secondary, major covert, tail, and body feathers. Preliminary data are of infection abundance recorded as 0, low intensity, or high intensity. We assess the distribution patterns of feather quill mites of birds with among phylogenetic and ecological groups and compare results to our predictions that the ecology of hosts (the habitats they interact with, their foraging strategies, and their flight behaviors) is more influential on the pattern of quill infection distribution than is phylogenetic relatedness. We also find that birds with infections on one wing are more likely to have feather quill mite infections on the other wing, but that the level of symmetry (feather types vs. specific infection locations) appears to vary among hosts.

SEX EFFECTS BUT NO SEASONAL DIFFERENCES IN THE DIGESTIVE PHYSIOLOGY OF A NEWLY HERBIVOROUS LIZARD


Few studies of diet incorporate analyses of what an animal is digesting. Knowing what an animal actually digests allows us to understand if its physiology and morphology are optimized for its nutritional source. A population of Italian Wall Lizards (*Podarcis sicula*) in Croatia has become primarily herbivorous and morphologically distinct from its source population in ~30 generations, making it a compelling example of rapid evolution. To characterize the changes that occur on this short timescale, we compared gut structure and enzyme activity across populations of males in spring and summer, and in females in spring. Our previous work documented few biochemical and histological changes in the herbivorous population’s guts from male lizards collected in summer. Despite these similarities, the herbivorous population more efficiently digested plants compared to their source counterparts. Stable isotope analyses revealed seasonal dietary differences, but also that the “herbivorous” population had elevated $\delta^{15}$N values in comparison to the source population. Although we found no differences in gut length among males, we did find differences in the cross-sectional surface area in some gut regions. Females from the herbivorous population, however, had the longest guts and we identified obvious valves in their hindguts. As such, we expected to find greater differences in gut enzyme activities across seasons and in females. We found no
seasonal differences in enzyme activity, but did find higher pancreatic amylase activity in “herbivorous” females. Thus, sex and population each appear to affect the strategy each group uses to accommodate their diets.

80* EFFECT OF WATER DEPRIVATION ON THERMOREGULATORY STRATEGY OF DESERT IGUANAS (DIPSOSAURUS DORSALIS)

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Lizards thermoregulate by modifying their physiology and/or behavior to maintain body temperatures ($T_b$) within a preferred temperature range ($T_{pref}$). When environments are not favorable for lizards to retain water balance, they also must modify physiology and/or thermoregulatory behavior to minimize water loss. $T_b$ can be lowered physiologically using cutaneous evaporative water loss and panting, but the additional water loss risks further dehydration and possibly death. Under restricted access to water, snakes and insectivorous lizards reduce $T_{pref}$ or expand the range of temperatures voluntarily tolerated, by changing thermoregulatory shuttling behaviors. Little is known about how herbivorous lizards, such as desert iguanas (Dipsosaurus dorsalis) modify their behaviors during restricted access to water. I predict that $D$. dorsalis will modify thermoregulatory strategies (i.e. shuttling behavior and $T_{pref}$) to prevent further water loss when under water stress. Shuttling behaviors and $T_{pref}$ were assessed for hydrated and dehydrated individuals using a shuttle box (high energetic cost) and thermal gradient (low energetic cost). Preliminary results suggest that $D$. dorsalis modified shuttling behaviors and $T_{pref}$ in accordance with hydration level possibly as a water conservation strategy. Further studies on the role of stress in initiating water-conserving mechanisms, such as modifying thermoregulation, are needed in order to model how $D$. dorsalis will respond to environments with changing water regimes, such as those expected under climate change, habitat modification or urbanization.

81*P THE INFLUENCE OF HABITAT AVAILABILITY ON INTESTINAL HELMINTH PARASITE COMMUNITIES OF COASTAL BIRDS


Habitat availability is a limiting factor that can influence species richness and community structure. For parasites, the host body and the specific organs in which infections occur represent limited resources. We hypothesized that helminth parasites living in the gastrointestinal tract of birds would increase in abundance and biomass with increasing bird size and intestinal volume. We also examined whether diversity changed as host resources became more abundant (i.e. larger in size). We processed 246 coastal birds from California for parasites, measuring host weight, intestinal size, and parasite richness, abundance, and biomass. Using the 20 most common parasite morphospecies, we estimated three diversity indices (Shannon, Simpson’s, and species richness). Preliminary analyses indicate that none of the parasite abundance, diversity, or richness related to host body weight. However, when parasite diversity indices were compared to intestinal volume, positive trends were consistently found. Although intestinal volume is related to body size, our preliminary results suggest that availability of intestinal habitat, and not body size alone, better explains the diversity and abundance of parasites in coastal birds of California.

82* TEMPORAL PATTERNS OF DIVERSITY EFFECTS IN A RESTORED COASTAL WETLAND

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The loss of as much as 90% of coastal wetlands in California over the past century has motivated research aimed at understanding the effects of such habitat decline. In particular, the loss of key ecosystem functions is thought to be due to observed reductions in species diversity. Studies of biodiversity-
ecosystem function (BEF) relationships are abundant in terrestrial systems, yet very few focus on marine ecosystems, especially in the context of restoration. Existing studies also tend to be relatively short-term, which may constrain the type and magnitude of diversity effects observed. To address this knowledge gap, we leveraged a recent $4.1 million project targeted at restoring full tidal flow to Colorado Lagoon, an urban coastal wetland in Long Beach, CA. We manipulated salt marsh plant diversity in a large-scale field experiment and monitored productivity in experimental plots one, two, and three years post-restoration. Overall diversity effects can be partitioned into complementarity and selection. Complementarity results from species exhibiting higher performance capacity on average in mixtures compared to in monoculture, whereas selection occurs when species that perform best in monoculture also do best in mixtures, relative to other species. After one year, we observed a significant positive effect of plant diversity on productivity due primarily to selection effects, consistent with results of other short-term studies. We are currently processing data from years two and three; our working hypothesis is that over time, complementarity may replace selection as the main driver of biodiversity effects as plant communities mature.

83*F UNDERSTANDING FISH HABITAT IN A TIDALLY RESTRICTED URBAN LAGOON

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Urban development often leads to modification of wetland habitat via culverts and other tidal restrictions. While culverts are useful in maintaining waterways, studies show that their presence can decrease connectivity between habitats, especially for fish species. This project aims to study the level of habitat connectivity between a tidally-restricted coastal lagoon and a large bay, located in Long Beach. These two habitats are connected only by a 268m box culvert. Predatory fish movements are being tracked using RFID technology as the fish traverse the culvert. It is expected that fish will be able to navigate the culvert to varying degrees based on life history traits. Preliminary results indicate there is a certain degree of movement between sites for two of the nine species tagged, however, further study is needed to understand the level of connectivity that currently exists. Habitat characteristics such as temperature, infaunal community structure, and prey fish abundance are being quantified to understand why fish may be preferentially utilizing one habitat over the other. Preliminary results indicate that there are important differences between the habitats which may drive fish movements through the culvert. During summer, temperatures are significantly higher in the lagoon versus the bay. Meanwhile, fish community composition between the sites differs with the bay having greater species richness. Obtaining information on key ecosystem processes will inform the short-term management of this marsh and provide feedback on how a particular action (in this case, conversion from a culvert to an open channel) could improve conditions for fish.

84* QUANTIFYING THE RELATIVE IMPORTANCE OF POSITIVE INTERACTIONS ACROSS A STRESS GRADIENT IN THE ROCKY INTERTIDAL ZONE

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A conceptual model by Bertness and Callaway predicts that the frequency of positive (versus competitive) interactions in ecological communities should increase with increasing environmental stress. A review of more than 50 published tests of this model in marine intertidal systems suggests that it has strong empirical support, based on the various authors’ interpretations of their results. However, in many (if not most) cases, the response variable assessed was the relative intensity, not frequency, of facilitation or competition. To confuse matters even more, many of these papers discuss expected and observed variation in the relative importance of positive interactions. Given that frequency, intensity and importance are clearly different concepts that may not be correlated, it is essential to distinguish among them and to evaluate them separately. Brooker and colleagues have proposed a new index to quantify the relative importance of different ecological inter actions across a gradient of physical stress. We are using this index to assess changes in the importance of facilitation, competition, predation, and recruitment for the California mussel, Mytilus californianus across a gradient of wave exposure (thermal stress) in the
rocky intertidal zone. We will then compare how variation in importance relates to changes in interaction intensity or frequency.

85 RELATEDNESS AND DIFFERENTIAL DISEASE RESISTANCE IN CALIFORNIA HALIOTIDS

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Many marine host-pathogen systems are poorly understood, and even less is known about how global climate change will affect the mechanisms of these systems. In the abalone and Rickettsiales-like organism (RLO) system, the RLO infects abalone digestive tissues and leads to extreme starvation and a characteristic “withering” of the gastropod foot. First identified in black abalone in California after an El Niño event, the withering syndrome-causing RLO (WS-RLO) has been seen in various sites around the world, and has been found in at least low levels in all abalone species examined, yet not all express WS. Some abalone species appear to be highly resistant to the disease, unless held at extremely high temperatures. This suggests that the resistant species possess some physiological resistance to the effects of high temperature. Our goal is to develop a detailed understanding of the abalone digestive system and the mechanisms for differential resistance across the Haliotis (abalone) genus. In order to clarify differential susceptibility in geographically neighboring species (such as the highly susceptible red abalone H. rufescens and relatively resistant green abalone H. fulgens), we are creating a robust phylogeny of Haliotis to determine whether certain branches are more susceptible to WS. This phylogenetic tree was created using concatenated data from multiple mitochondrial and nuclear genes, and will result in the most robust phylogeny of CA haliotids to date. Temperature limits are mapped onto the tree to determine whether the evolutionary history of the genus can explain why particular species are more sensitive to temperature.

86°F THE REPRODUCTIVE MORPHOLOGY OF THE BLACK PERCH (EMBIOTOCA JACKSONI): A PRELIMINARY INVESTIGATION

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Black perch are viviparous fish; the male transfers a spermatophore to the female via an intromittent organ. Larval development occurs within the ovarian cavity until birth. Our objective was to describe reproductive development of black perch. Reproductive tissues were examined using paraffin histological techniques. Females had one functional ovary and a secondary structure believed to be involved with sperm storage. The percentage of primary, secondary, and vitellogenic ovarian follicles in females 50–100 mm SL (n=5) and 101–150 mm SL (n=4) were not significantly different (p=0.8974, p=0.0858, and p=0.5804 respectively). In ovarian tissue from females >150 mm SL (n=2) only secondary and vitellogenic follicles were observed. All females had fertilized ova, and females 101–150 mm SL and >150 mm SL had developing young within the ovarian cavity. The percentage of spermatocytes and spermatids from males 101–150 mm SL (n=4) and >151 mm SL (n=2) did not appear to differ (37% vs. 31% and 30.5% vs. 28.3 %, respectively). The testicular tissue of males >151 mm SL appeared to have a greater percentage of spermatozoa (34.3% vs. 20.3%). There was evidence of spermatophore formation in testicular tissue of males >151 mm SL. The intromittent organs of male fish 101–150 mm SL consisted of a white patch with no external protrusion, but were enlarged and protruded in males >151 mm SL. Additional data will be collected throughout the year. By histologically describing the reproductive structures of black perch we will contribute to our understanding of reproductive biology of the perch family (Embiotocidae).
THE SECRET LIFE OF BABY GIANTS: THE RECRUITMENT OF THE ENDANGERED GIANT SEA BASS

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Little is known about the complete life history of giant sea bass (*Stereolepis gigas*) due to the over exploitation of their fishery in the early 1900’s, and depressed populations have prevented much detailed research. This study finally fills in gaps in the early life history of the juvenile giant sea bass by 1) determining distribution and general ecology for the young-of-the-year of *S. gigas* in the wild, 2) estimating growth rates, based on site aggregations in the wild, and otoliths analysis in the lab, and 3) finally determining pelagic larval duration and general temporal scale of their spawning period. The use of SCUBA transects, video, and lasers allows us to estimate cohort populations, individual sizes, and ecosystem quantifications while in the field, and collecting individuals for otolith analysis helps determine growth rates and planktonic larval duration. These observations have already discovered several previously unknown behaviors, including the “kelping” mimicking behavior, distinct distribution patterns across southern California primarily near underwater canyons, and their annual and daily temporal distribution. These early developmental process are crucial for completing the life history for any species, and this study is the only one of its kind to do so for this endangered species making it a key component to their life history, as well as a baseline for future work on not only *S. gigas*, but also similar species. Increasing knowledge about current and future populations, will allow us to make increasingly intelligent decisions about current fisheries management policies as well as future conservation efforts.

INVENTORY OF SUBTIDAL MARINE LIFE IN BIG FISHERMAN'S COVE, SANTA CATALINA ISLAND

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Big Fisherman’s Cove (BFC), located off California’s Santa Catalina Island, is part of a no-take marine reserve. It is a biologically diverse area and the location of numerous scientific studies performed in collaboration with the USC Wrigley Marine Science Center (WMSC). The primary objectives of this study were two-fold. The first was to describe BFC in detail, including the location of different habitat types as well as some of the natural history of the cove. The second was to establish an inventory of marine life found in BFC, using data and surveys from technical reports completed over the past 50 years. Underwater roving surveys were conducted on snorkel and SCUBA. One hundred and sixty-six macroalgae, marine plant, invertebrate, and fish species were recorded in total, and of these thirty-four were newly documented. As more species are found and recorded, more conclusions can be drawn on how the cove has changed over time.

THE EFFECTS OF OCEAN WARMING AND ACIDIFICATION ON SEAWEED GROWTH AND URMICH GRAZING

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Carbon dioxide concentrations in the atmosphere are currently higher than previously recorded and are continuing to rise. This greenhouse gas is the primary driver for changing climate scenarios, highlighted by increases in sea surface temperatures and decreases in seawater pH (acidification) that are modeled to exacerbate in the future. The singular effects of ocean warming and acidification are known to have major impacts on the biology and ecology of marine organisms; lesser known, however, are the combined effects of these stressors on organisms, particularly on biotic interactions. This study examines seaweed-herbivore interactions under combinations of current and future temperature (18 and 21°C) and pH (8.1 and 7.8) conditions. Growth rates of two seaweed species, a calcified red alga (*Lithothrix aspergillum*) and a non-calcified brown alga (giant kelp *Macrocystis pyrifera*), will be compared among manipulated seawater conditions in laboratory-controlled experiments. In addition, the feeding rates and feeding preference of a sea urchin herbivore (*Strongylocentrotus purpuratus*) for these two seaweeds will be compared among
water conditions. It is expected that both seaweeds will exhibit decreased growth at warmer temperatures while decreased pH conditions will result in slowed growth of the calcified alga, but increased kelp growth. Herbivory rates/preferences will vary under different water conditions with increased consumption of the calcified alga under high temperature and low pH. Knowledge of how ocean warming and acidification impacts trophic dynamics will aid in predicting the outcomes of climate change on ecosystem function and provide insight on management of coastal marine ecosystems.

90* ENERGETIC EFFICIENCY OF GROWTH IN MORPHOLOGICALLY DIFFERENT LARVAL SEA URCHINS

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Many marine animals undergo a planktonic, feeding larval stage in which exogenous nutrients are required for growth and development. Morphology is significant for feeding echinoderm larvae given their ciliated arms are used both for capturing algal particles and locomotion. The purple urchin (Strongylocentrotus purpuratus) exhibits a typical urchin larval body with eight arms. The crowned urchin (Centrostephanus coronatus) has a highly derived form with only two arms and a large body. We hypothesize that these larval forms have significantly different physiological strategies for growth and development. Energetic budgets were determined for both species based on algal ingestion, oxygen consumption, and protein growth. The crowned urchin acquired 186 mJ during the first 37 days of development, using 69 mJ for growth and development. The purple sea urchin ingested 1.3-times more energy during the first 25 days (242 mJ) and used 2.25-times more (155 mJ), resulting in energetic utilization rates of 6.3 and 2.1 mJ day\(^{-1}\). The crowned sea urchin exhibited a steady decline in net growth efficiency, whereas values for the purple sea urchin increased during the latter half of development, resulting from greater relative investment to growth than regulatory processes. This research shows a “short-term, high-energy” phenotype in the purple urchin while the crowned urchin exhibits a “long-term, low-energy” growth trajectory. This study establishes a link between form and function in early developing stages of marine invertebrates and the potential for contrasting responses to habitat perturbation and climate change in these larvae due to their different physiological strategies for growth.

91* HOST CHOICE AFFECTS FECUNDITY IN THE GASTROPOD CREPIDULA ONYX

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The gastropod Crepidula onyx is common in Alamitos Bay, where it is usually found as an epibiont on the bivalve Mytilus galloprovincialis on docks, or the gastropod Conus californicus in soft sediments. The two hosts differ in maximum shell length (~10 vs. 4 cm, respectively), potentially affecting epibiont size. We hypothesized that host species would have large effects on body size and fecundity of C. onyx. To test this hypothesis, we quantified body size, sex, and fecundity of C. onyx from both hosts. Females of C. onyx on Mytilus reached larger sizes (mean 38.4 mm length and 300.4 mg dry tissue mass) than those on Conus (19.9 mm, 66.9 mg). The body size of females of C. onyx had no effect on the number of egg capsules produced, but was positively correlated with capsule size and the number of embryos per capsule. Females of C. onyx on Mytilus produced broods containing a mean of 16318 embryos, ~2.4 times the number of embryos produced by those on Conus (6811). These results are consistent with our initial hypothesis. The two hosts may also differ in quality in other ways, including greater exposure to predators and reduced suspension feeding time for C. onyx on Conus. In Alamitos Bay, Mytilus thus seems to be superior to Conus as a host for C. onyx, and settlement choices by the planktonic larvae of C. onyx have large effects on their fitness. It is not yet clear if larvae discriminate among potential hosts at settlement.
REPRODUCTION AND DEVELOPMENT OF THE SPINY CUP-AND-SAUCER SNAIL *CRUCIBULUM SPINOSUM* IN NEWPORT BAY

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The calyptraeid snail *Crucibulum spinosum* is usually reported to produce egg capsules in which all embryos develop, and from which they hatch as feeding veliger larvae (Collin 2003). However, in a study of *C. spinosum* from southern California, Coe (1938) reported that a “considerable proportion” of embryos failed to develop; those that did develop hatched as veligers (he did not report on whether or not these required food). Coe’s observations are surprising because when non-developing (nurse) embryos are present in the egg capsules of calyptraeids, developing embryos almost invariably hatch as juveniles (Collin 2003). To verify Coe’s surprising result, we studied *C. spinosum* in a large intertidal population in Newport Bay. We collected adult snails in 2015 and 2016, and quantified adult size, fecundity, and numbers of nurse and developing embryos. We also used scanning electron microscopy to describe developmental stages. Nurse embryos were extremely common in broods of *C. spinosum*. On average, for every embryo that developed normally, 14 nurse embryos were present. Nurse embryos stopped developing soon after gastrulation. Developing embryos formed intracapsular veligers that ingested nurse embryos. Veligers typically metamorphosed into juveniles before hatching. Thus, *C. spinosum* from Newport Bay do produce nurse embryos, as Coe’s observations suggested; however, developing embryos hatch as juveniles, in contrast to all previous descriptions of development in the species. We plan to use molecular data to explore the possibility that *C. spinosum* from southern California are distinct from “conspecifics” elsewhere in their range.

SALINITY TOLERANCE OF LARVAE, JUVENILES, AND ADULTS OF THE NON-INDIGENOUS ANNELID *FICOPOMATUS ENIGMATICUS*

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A large, established population of the non-indigenous, reef-forming serpulid annelid *Ficopomatus enigmaticus* occupies the intertidal zone of the lower ~3 km of the Los Angeles River. A much smaller, low-density population deep in the Port of Los Angeles also appears to be established. Besides these two populations, both of which occur in habitats with summer/fall salinities of ~24-31 psu, *F. enigmaticus* appears to be absent from other apparently suitable intertidal habitats in Los Angeles and Orange Counties. In an effort to understand the factors limiting the distribution of *F. enigmaticus* in southern California, we examined the tolerance of three of its life history stages – larvae, juveniles, and adults – to acute salinity stress. We exposed individuals at each life history stage to salinities ranging from 0-35 psu, and recorded their survival over periods of a few days to weeks, depending on stage. Worms at all three life history stages eventually died in water of 0 psu salinity, but survival was high and did not vary with salinity at all salinities 7 psu and higher. Our results suggest that mortality in the face of acute salinity stress is unlikely to limit the distribution of *F. enigmaticus*. In future work, we will explore more subtle effects of salinity on the growth rate, reproduction, or ecological interactions of this serpulid.

GROWTH AND FEEDING EFFICIENCY IN LARVAL STAGES OF *DENDRASTER EXCENTRICUS* AT TWO DIFFERENT FOOD CONCENTRATIONS


Nutrient fluctuations play an important role in the development of invertebrates with a feeding larval stage, such as the echinoid *Dendraster excentricus* (common sand dollar). The objective of this study is to understand, from a physiological perspective, the phenotypic response of *D. excentricus* under different food concentrations. It was hypothesized that larvae raised at lower nutrient concentrations would possess higher biochemical growth efficiency as a consequence of their phenotypic plastic response. *D.*
excentricus larvae were fed concentrations of the algae *Rhodomonas* sp. at 1,000 cell/mL (low-fed) and 10,000 cells/mL (high-fed). At 21 days of age, for example, assimilation efficiency rapidly increased in low-fed larvae to a maximum of 62% and was only 47% for high-fed larvae. For gross growth efficiency, high-fed larvae had high values that decreased during development while low-fed showed low, but increasing efficiencies, with both arriving at a GGE of ~ 25% in late development. Net growth efficiency exhibited a similar pattern of change between both treatments with final values converging around 50% at day 30 post-fertilization. These data demonstrate the adaptive value of the phenotypic plastic response from a physiological perspective and show that the morphological phenotypic plastic response of low-fed larvae is supported by a significant biochemical response that elevates growth and assimilation efficiencies relative to high-fed larvae.

**PHENOTYPIC PLASTICITY IN FEEDING STRUCTURES IN PRE-FEEDING LARVAE OF ECHINOID AND ASTEROID ECHINODERMS**

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The pluteus larvae of numerous species of echinoid echinoderms demonstrate phenotypic plasticity in the size of their feeding structures: plutei reared in low concentrations of food build longer ciliary bands than those reared at high food concentrations. The larval ciliary band is used for swimming and food capture, and larvae with longer ciliary bands can clear water of particles at higher rates than larvae with shorter ciliary bands. Similar phenotypic responses may also occur in the bipinnariae larvae of asteroid echinoderms, though in this clade evidence is weaker since investigators have only rarely directly measured ciliary band length, instead using larval size as its proxy. In echinoids, the plastic response can be induced very early in development, even before larvae are capable of ingesting food particles. Phenotypic plasticity in pre-feeding stages has so far been documented only in three species of echinoids. We sought to determine if bipinnaria larvae of the asteroid *Astropecten armatus* were capable of exhibiting pre-feeding phenotypic plasticity in feeding structures. We first repeated previous experiments demonstrating pre-feeding phenotypic plasticity in larvae of the echinoid *Strongylocentrotus purpuratus* in order to make sure that our methods were robust. We then carried out similar experiments on larvae of *A. armatus*, using a modification of the method of McEdward (1985) to measure ciliary band length directly.

**ROCKY REEF FISH DIVERSITY RESPONSES TO EL NIÑO AND THE NORTH PACIFIC GYRE OSCILLATION**

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Since 1974, the Vantuna Research Group has been collecting quarterly transect dive data for fish assemblages at King Harbor, Redondo Beach and Rocky Point, Palos Verdes in Southern California. The analyses of these data illustrate an intriguing pattern particularly with regards to the El Niño/Southern Oscillation (ENSO) and the North Pacific Gyre Oscillation (NPGO) index. During El Niño years, the nutrient-rich cold water upwelling along the west coast of North America is suppressed, resulting in reduced nutrient availability for primary production and thus fewer food resources for fish. Additionally, warmer water associated with El Niño can cause giant kelp (*Macrocystis pyrifera*) die off, and consequent habitat loss for kelp forest fishes. Such effects of El Niño suggest that fish diversity and abundance would decrease during such events. Negative NPGO index values are also associated with suppressed coastal upwelling over decadal time-scales, which could compound the effects of El Niño on the fish community. The Shannon-Weiner diversity index (H') and species richness of fish were calculated annually at each site from 1979-2015. Low diversity values were observed during El Niño events occurring between 1979 and 1991, but that pattern broke down during the NPGO-positive years of the 1990s and early 2000s. It appears that the fish communities at Rocky Point and King Harbor may be responding to the interactive effects of shifts in ENSO conditions within the broader context of the NPGO regime. This has implications for predicting ecosystem responses on multi-decadal time-scales in the context of global climate change.
SPAWNING FRACTION IN KELP BASS (Paralabrax clathratus) PEAKS IN MID TO LATE SUMMER ACROSS BREEDING SEASON IN SOUTHERN CALIFORNIA

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Kelp bass, also known as calico bass (Paralabrax clathratus) are a common nearshore sportfish along the Southern California coast. While current investigations have updated reproductive parameters for female kelp bass, this study focused on male reproduction. To assess current male reproduction, kelp bass were collected from locations in Southern California between San Clemente and Palos Verdes across the estimated breeding season (May-October). Testes were embedded in paraffin, serial sectioned, and stained using hematoxylin and eosin for histological staging. Testis function was classified as: early spermatogenesis, late spermatogenesis, active spawning, or regression. While neither standard length (p>0.05) nor total body mass (p>0.05) differed significantly between collection months, gonadal somatic index (GSI) peaked in May, June, and July, as compared to GSI values in August, September and October (p<0.05). Testis function also differed across the collection months. Spawning fractions peaked in July and August as compared to all other months. The non-spawning fraction peaked in May, June, September, and October as compared to July and August. Early spermatogenesis was the predominant stage in May, with late spermatogenesis dominating in June. Spawning peaked in August, while spent and regressing testes peaked in September and October, respectively. These data suggest that male kelp bass reproductive efforts peak in July and August, which partially meshes with the June and July peak for female kelp bass spawning. Future studies with additional males will provide more insight about reproductive function of kelp bass.

EXPULSION OF FOREIGN OBJECTS BY FOUR SPECIES OF ECHINODERMS: PISASTER GIGANTEUS, PATIRIA MINIATA, STRONGYLOCENTROTUS PURPURATUS, AND PARASTICHOPUS CALIFORNICUS

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Various species of sea stars have incredible regeneration properties, allowing them to regrow whole limbs or expel foreign objects from the body. If echinoderms such as sea stars are capable of regenerating such significant parts of their anatomy, then perhaps the array of peculiar abilities is not limited to just one family or species of echinoderms. To investigate the expulsion of foreign objects within various echinoderm species, individuals from four different families of echinoderms were implanted with magnetic stir bars or PIT tags and monitored for behavioral and morphological changes and the localization of the implanted tag. All four species: Pisaster giganteus (Asteriidae), Patiria miniata (Asterinidae), Strongylocentrotus purpuratus (Strongylocentrotidae), and Parastichopus californicus (Stichopodidae) showed the ability to expel foreign objects, but the method of expelling is dependent on the individuals’ morphological and physiological characteristics. Preliminary results showed that individuals with more flexible ossicle structures had shorter retention times (P. giganteus: 4.8 ± 3.3 days; P. californicus: 5.0 ± 1.7 days), than those with more rigid ossicle structures (P. miniata: 27.0 ± 25.3 days; S. purpuratus: 74.0 ± 42.4 days), indicating that other species of echinoderms are capable of expelling foreign objects, and skin structure may affect the efficiency of this ability. Observing the travel and expulsion of objects from these species could be highly beneficial for understanding how advanced diseases such as the wasting disease are aided in their fatal dispersal throughout the echinoderm. The unsuspecting echinoderm may be trying to expel the disease by moving it through its body and instead, speeding the extirpation process.
MAXIMIZING SUCCESS OF ARTIFICIAL REEF PLACEMENT OFF THE COAST OF CALIFORNIA

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Natural rocky reefs are highly productive and ecologically significant ecosystems off the coast of Southern California. These reefs support commercial and non-commercial fish and invertebrate species, and thus are currently a target of restoration and enhancement efforts. One type of enhancement is through the creation of manmade reefs. In order to maximize manmade reef success, reefs will need to be placed in areas that can sustain or enhance greater secondary production. One such goal is to increase the stocks of commercial and recreational fish and invertebrate species. To begin to address this issue, we created an ecological niche model using distribution data and bioclimatic and geophysical GIS layers (MARSPEC) to predict the distribution of 32 keystone and economically important nearshore rocky reef associated species from Southern California. This model is independent of current rocky and manmade reef locations, and utilizes species point locations from dive surveys and GBIF species location data. By creating this ecological niche model, we are able to predict the most probable locations that fish and invertebrate species will thrive, thereby informing potential future manmade reef placement.

MALE-FEMALE BEHAVIOR IN THE POLYCHAETOUS ANNELID NEANTHES ARENACEODENTATA

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In the Neanthes arenaceodentata population, males fight males and females fight females; opposite sexes will pair and form a mucoid tube. The female dies after laying her eggs, but the male incubates the embryos for 21-28 days and is capable of reproducing up to nine times. Generally, the males and females lie parallel in a similar anterior position. Signs of aging include fusion of eyes, pigmentation on the prostomium, and loss of anterior appendages. It was previously presented at last year’s Academy that females will prefer sexually experienced males over inexperienced males up to some stage of the male’s reproductive history. The data presented indicates that after seven male reproductive periods, the female still prefers an experienced male over an unexperienced male. Data were collected in terms of the female’s selection, number of larvae produced, the position of the male and female in tube, and the apparent health of the male. Results show that in the male reproductive periods 1-7, the percentages of experienced males selected were: 62.69%, 72.73%, 78.95%, 72.73%, 50%, 50%, and 100% respectively. It is theorized that the lower percentage of female selectivity after the first reproductive stage may be the result of the elimination of the undesirable males. Fusion of the eyes was observed after the third reproductive period, and occasionally the elimination of antennae, tentacular cirri, or prostomium pigmentation occurred in older males.

SOCAL-BEHAVIORAL RESPONSE STUDY INTRODUCTION, OVERVIEW, AND SPONSOR PERSPECTIVE

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The SOCAL-Behavioral Response Study is a multi-year program started in 2010 to examine the response of different cetaceans in southern California to Navy sonar. The study represented the continuation of behavioral response studies conducted in other areas with a more narrow focus on beaked whales, which had yielded valuable information by small sample sizes at a very high cost. The goal of the SOCAL-BRS was to take advantage of the more diverse set of species present to examine response to sonar of a wider range of species in a more cost-effective manner using smaller vessels lead by more independent RHIBs that would conduct the tag deployments and behavior monitoring. The study initially focused on playback of mid-frequency sonar sounds using a scaled source operated from one of the research boats but has transitioned to collaborating with Navy ships to examine response from real Navy sonar. The SOCAL-
BRS has been supported principally by the Navy’s Living Marine Resources Program. The mission of the LMR program is to improve the best available science regarding the potential impacts to marine species from Navy activities, and improve the technology and methods available to the US Navy marine species monitoring program, while preserving core Navy readiness capabilities. The SOCAL-BRS has also been supported by the Office of Naval Research and has worked closely with NOAA.

102 OVERALL METHODS AND RESULTS OF THE SOUTHERN CALIFORNIA BEHAVIORAL RESPONSE STUDY (SOCAL-BRS)

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The SOCAL-BRS is an interdisciplinary, multi-team collaboration that uses high-resolution, multi-sensor tags to make detailed, direct measurements of behavioral responses in various species to Navy mid-frequency active sonar (MFAS). Individual animals are located using a combination of visual and passive acoustic methods, tagged, and tracked using visual and tag sensors before, during, and after controlled exposure experiments (CEEs). Simulated MFAS from research sound sources as well as the first-ever use of actual U.S. Navy ship-based MFAS are used during CEEs. The use of an experimental approach with high-resolution measurements of detailed behavior (diving, feeding, social interactions) provide controlled, scientific measurements of response, or lack of response, that are directly applicable to improving Navy environmental compliance assessments of behavioral response to MFAS. Over 175 high-resolution acoustic and movement tags have been deployed on individuals of ten cetacean species and over 80 CEEs have been conducted. Results including baseline behavioral data, many representing the first available data for protected marine mammal species, as well as behavioral responses to sound exposure have been published in more than a dozen scientific publications. Behavioral responses to MFAS and other mid-frequency sounds have been documented in several species with changes in diving and feeding behavior and avoidance of sound sources being the most common responses observed; some individuals did not respond despite relatively high received sound levels. Responses appear to depend on species (beaked whales the most sensitive) and exposure context (e.g., behavioral state, prey distribution, proximity to sound sources).

103 MARINE MAMMAL MONITORING ON NAVY RANGES (M3R): THE APPLICATION OF PASSIVE ACOUSTICS FOR EXAMINING THE EFFECT OF SONAR ON CETACEANS

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The Navy acoustic ranges including the Atlantic Undersea Test and Evaluation Center (AUTEC), the Southern California Offshore Range (SCORE), and the Pacific Missile Range Facility (PMRF) provide broad fields of bottom-mounted hydrophones designed to track undersea vehicles. These facilities are being leveraged to develop marine mammal passive acoustic Detection, Classification, Localization, and Density estimation (DCLDe) algorithms and systems. These in turn are being used to study the effect of sonar on cetaceans with a focus on beaked whales. To date Blainville’s, Cuvier’s, and Gervais’ beaked whales have been documented on the ranges despite the routine use of Mid-Frequency Active Sonar (MFAS). Tools for long-term population estimates are being applied. By combining passive acoustic with operational data, the population level response to sonar has been documented and a risk function for Blainville’s beaked whale derived. These data are also being used to inform a beaked whale Population Consequences of Acoustic Disturbance (PCAD) model to investigate the cumulative effect of repeat exposure to MFAS. During the Behavioral Response Study, M3R passive acoustics are being used both to detect the presence of multiple cetacean species including Cuvier’s beaked whales and fin whales as well as the presence of MFAS.
PASSIVE ACOUSTIC STUDIES ASSOCIATED WITH THE SOUTHERN CALIFORNIA BEHAVIORAL RESPONSE STUDY

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The passive acoustic projects within the Southern California Behavioral Response Study (SOCAL-BRS) have three main objectives: 1) to aid in finding beaked whales and sperm whales for tagging and study, 2) to document ambient noise and provide contextual information for behavioral responses, and 3) to understand propagation effects on simulated sonar signals. Using towed hydrophone arrays, we documented a moderate density of Cuvier’s beaked whales (Ziphius cavirostris) at the northern end of the Catalina Basin, and detected sperm whales (Physeter macrocephalus) and Baird’s beaked whales (Berardius bairdii) in other locations. With free-floating hydrophone recording systems, we measured the natural sound field during and between SOCAL-BRS playback experiments. Both the towed and free-floating hydrophones documented occasional sonar signals from Navy ships that were not associated with our study and which could have affected the results of our study. The free-floating recorders showed that sound levels from the simulated sonar signals remained elevated above ambient noise levels for 7 seconds after a distant test signal (~2 km) and for 15 sec after closer test signals (<1.3 km). We recommend the routine use of passive acoustic monitoring to provide needed context for all future behavioral response studies.

NOVEL ANALYTICAL APPROACHES TO STUDY FEEDING AND CALLING BEHAVIOR IN BALEEN WHALES

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Multi-sensor archival tags have become a relatively common tool for studying the underwater behavior of diving animals, including whales. The SOCAL BRS project is developing ways to utilize tag sensor data to enhance and expand upon baseline descriptions of tagged whale behavior in Southern California. Here we demonstrate two methods of identifying large whale behaviors using tag movement data. When lunge feeding, most fin whales rapidly accelerate towards schooling prey, and then abruptly decelerate as the mouth opens and the ventral pouch expands. These features of lunging are identifiable in tag data, with a large peak and then drop in both jerk (a metric of body acceleration) and flow noise, often accompanied by a right hand roll. We developed an automated program to detects lunges in fin whale tag data, which will significantly decrease data analysis time and can be used to augment studies across a range of species and tag types. We also demonstrated that call production by tagged fin whales can be confirmed via signatures in the tag accelerometer data. This technique allowed us to correlate body orientation, dive depths, and surface social behavior with call production for the first time. Behavioral metrics associated with elevated call rates included shallow maximum dive depths (10-15 m), little body movement, and negative pitch in body orientation. The call behavior characterizations will help with predicting calling behavior from surface behavior and informing interpretation of passive acoustic data, as well as with further investigating effects of anthropogenic sound on fin whales.

THE INFLUENCE OF PREY ON BLUE WHALE (BALAENOPTERA MUSCULUS) BASELINE FORAGING ECOLOGY, KINEMATICS, AND SONAR PLAYBACK EXPERIMENTS

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Blue whales (Balaenoptera musculus) are a mobile predator in the California current system that target a single prey resource, krill (Euphausia pacifica, Thysanoessa spinifera), and travel large distances to find and exploit these ephemeral patches. Long-term tagging efforts have provided data on broad scale movement and behavioral patterns of blue whales at the basin scale. However, less is known about the fine-scale relationships between krill and blue whale foraging behavior. We used multi-sensor digital
archival tags to define the fine scale dive parameters and lunge kinematics of blue whales and fisheries acoustics to determine how krill dynamics affect whale foraging behavior in both space and time. As part of the SOCAL-BRS project, we also were able to assess how prey influenced response to playback experiments. We deployed 14 tags in 2011 through 2013 off the southern California coast as a part of the SOCAL-BRS, collecting over 40 hours of concurrent prey and predator data. We used a combination of multivariate statistics (e.g. principle component and canonical correlation analyses) and generalized additive mixed models to examine lunge kinematics as a function relative to measurements of prey. We also calculated blue whale foraging efficiency as a function of prey density and depth. Finally, we also tested whether dive behavior changed as a function of SONAR exposure and prey patch metrics. Blue whale feeding rates and stereotyped feeding behaviors (e.g. 360° rolls) were directly related to prey patch metrics (e.g. depth, density, shape). Blue whales also changed foraging strategies, diving longer and lunging more frequently as a function of prey density. Data on prey and bottom depth were informative when interpreting response to SONAR playbacks. As the world’s largest predators and krill specialists, blue whales show a high degree of behavioral plasticity to satisfy their extreme energetic demands yet we need to contextualize the impacts that anthropogenic threats (e.g. climate change, noise) have on their ecology and life history.

107  COMPLEMENTARY ANALYSES OF BEHAVIORIAL RESPONSES TO SONAR IN BLUE WHALES (BALAENOPTERA MUSCULUS)

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We used field experiments to measure potential changes in behavior from noise exposure to blue whales off southern California from 2010-2014. High-resolution movement and acoustic data were obtained from DTAGs (n=43) while surface positions and behavioral observations were made through dedicated visual focal follows. Controlled exposure experiments were used to obtain direct measurements of behavior before, during, and after simulated and actual military mid-frequency active sonar (MFAS), pseudorandom noise (PRN), and no noise controls. For a subset of foraging animals, active acoustic measurements of prey around tagged whales were obtained as contextual covariates in response analyses. Potential changes in behavior resulting from exposure were analyzed using a combination of approaches. To assess potential responses across individuals exposed within various conditions, we used two approaches: principal component analyses with generalized additive mixed models (with and without prey covariates) to identify differences among related behavioral parameters, and hidden Markov models to evaluate behavioral state switching as a consequence of exposure. To investigate potential changes within individuals, we used parallel analyses of time-series data for selected behavioral parameters (e.g., diving, horizontal movement, feeding). This included both expert scoring of responses according to a specified behavioral severity rating paradigm and quantitative change-point analyses using Mahalanobis distance statistical metrics. The suite of results indicated that some blue whales (who predominantly use low frequency signals) responded to mid-frequency anthropogenic noise, but responses were generally brief, highly dependent on exposure context (particularly behavioral state and prey distribution), and did not follow a simple dose-response model based on received exposure level. Using multiple analytical methods to investigate different aspects of potential responses both across and within individuals provides a complementary and powerful means of evaluating both broader questions about species-typical response and the individual exposure-response data needed to inform probabilistic functions for assessments of potential human impact.

108  BASELINE STUDIES OF RISSO'S DOLPHIN ACOUSTIC, DIVING AND SOCIAL BEHAVIOUR

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Odontocetes use sound for communication, to navigate and locate prey. Early studies that categorized odontocete pulsed sounds had few means of discriminating signals used for biosonar-based foraging from those used for communication. This capability to identify the function of sounds is important for
understanding and interpreting behavior; it is also essential for monitoring and mitigating potential disturbance from human activities. Archival tags were placed on Risso’s dolphins (Grampus griseus) off California to: (1) quantify and discriminate between foraging and communicative pulsed-sounds; (2) match tag data with concurrently surface observations to investigate the use of communicative pulsed-sounds in relation to foraging, diving and social context. Two types of rapid click-series, buzzes and burst-pulses, were identified as produced by the tagged dolphins and classified based on their time association with click trains. Functional discrimination between the two vocal types was confirmed using a rotation test, with duration, amplitude and association with jerk (i.e., strong acceleration) as variables. The longer, lower-level, jerk-associated buzzes are used in this species to capture prey, as seen in other odontocetes. In contrast, the shorter, relatively louder burst-pulses are used outside of a direct, known foraging context, and appear to function in communication. Buzzes and burst-pulses were used differently across different stages of the dive cycle, behavioral states and social contexts. These findings allow for first assessments of the functional and contextual use of pulsed sounds in this species. Understanding these baseline behavioural parameters in detail enables interpretation of potential changes result of human disturbance during exposure experiments.

109 TRACKING RISSO’S DOLPHIN MOVEMENTS WITH PHOTO-ID AND COMBINED TAG AND FOLLOW INFORMATION


Risso's dolphins have been an important focal species for the SOCAL-Behavioral Response Study since they represent a deep-diving odontocete that occurs widely in the waters of the Southern California Bight. From 2010 to 2015, 34 Risso's dolphins were tagged with suction-cup attached tags and 12 playbacks of real or scaled mid-frequency sonar or pseudorandom noise were conducted. We report on our research effort conducting photographic identification of these animals and also some of the movements and tracks of individuals from our tag deployments and associated focal follows. Most animals were tagged when they were in slow traveling groups staying near the surface since Risso's were much harder to follow and approach when engaged in foraging when they were more dispersed and harder to approach. We developed detailed tracks of movements combining the pseudotracks based on the direction and accelerometry information off the tags and were ground-truthed with surface positions collected during focal follows. These allowed evaluation of changes in movement or avoidance in response to playback of sonar sounds. Through 2013, 884 unique Risso's dolphins had been individually identified based on dorsal fin shape, notches, and body scarring and pigmentation. Sightings and photo-identification of 254 individuals with many resightings from between 1 August and 30 September 2013 in the waters around Catalina Island documented the heavy use of near-shore waters especially at night and early morning hours where they were apparently feeding on squid.

110 INSIGHTS INTO THE UNDERWATER BEHAVIOR, SPECIES INTERACTIONS, AND BIOMECHANICS OF BALEEN WHALES USING INTEGRATED VIDEO AND INERTIAL SENSORS

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Bio-logging approaches to study the biology of free-ranging animals often focus on audio, movement or video, but rarely are these different data streams integrated. Here we custom engineered a tag to measure the fine-scale kinematics of cetaceans while simultaneously recording animal-borne video from dual cameras. The movement sensors included a pressure transducer and tri-axial inertial movement sensors (accelerometers, magnetometers, gyroscopes). The cameras were pointed either anteriorly 45 degrees to the right and left of the long axis of the tag, together generating a 180-degree view in the horizontal plane, or front and back to simultaneously view the head and fluke. We deployed these tags on blue whales and humpback whales off the coast of California. For the first time, we observed a wide-range of behaviors of the tagged whale, conspecifics, and parasites. These included interactions between whale lice, aggregations of prey (krill, anchovies) and non-prey (siphonophores) species, remora and whale live behavior, echelon swimming formations with other whales, and sympatric feeding with both whales and
sea lions. By combining video and kinematic data, this tag design serves as an important tool for understanding the biomechanics and behavioral ecology of large aquatic vertebrates.

111 USE OF MEDIUM DURATION HIGH-RESOLUTION ARCHIVAL TAGS TO EXAMINE WHALE BEHAVIOR AND RESPONSE TO NAVY SONAR AND OTHER HUMAN ACTIVITIES

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Suction-cup attached multi-sensor archival tags have provided key insights into the underwater behavior of whales and their responses to human activities including mid-frequency Navy sonar in the SOCAL-Behavioral Response Study. We used short darts to achieve longer durations of attachment to blue and humpback whales and allow high-resolution monitoring of behavior over periods of days to weeks. Primary tags consisted of multiple sensors made by different companies that incorporated: 1) TDR-10 sensor (depth, temperature, light, and Fastloc GPS), 2) SPOT 5 or 6 satellite transmitter to indicate when the tag was off and location, 3) high sample rate 3D accelerometer, magnetometer, and gyroscope capable of detecting finer scale movement kinematics as well as vibrations from calling animal, and 4) VHF transmitter to allow final homing for recovery. Durations of attachments on blue whales were longer than for humpback whales, and generally lasted 1-3 weeks. These longer durations of attachment provided high quality data spanning both day and night and covering a variety of behaviors including the deepest dives recorded for blue whales. They also provided a longer period to monitor potential exposure to Navy sonar and interactions with ships and shipping lanes. Whales sometimes moved long distances during the deployment and posed challenges and sometimes higher expense for recovery.

112* FIN WHALE TRACKS OFFSHORE OF SOUTHERN CALIFORNIA FROM PASSIVE ACOUSTIC MONITORING


Fin whales (Balaenoptera physalus) produce a stereotyped low frequency call (15-30 Hz) that can be detected at great range, and that is largely the same for different regions around the globe. These 20 Hz fin whale calls were localized and tracked using a kilometer-scale array of four passive acoustic recorders at approximately 800m depth, northwest of San Clemente Island in the Southern California Bight for four continuous weeks during late fall of 2007. A total of 3824 calls were localized over the 4-week period. The average estimated source level for the localized calls was 202.77 ± 0.09 dB re 1 μPa2 at 1 m, peak to peak. Source levels were estimated from the received levels and corrected for transmission loss using the equation 20*log10(Range[m]). There are instances of multiple individuals calling simultaneously, as well as several bouts of fin whale song in the data. Call source level along with calling behavior provides important parameters required for population density estimation from passive acoustic recorders. The source levels of fin whale calls will also help future predictions of how these whales are impacted by anthropogenic noise. Furthermore, acoustically tracked fin whales potentially provide insight into their ecology and behavior.

113*FP EPIDEMIOLOGICAL MODELS TO CONTROL THE SPREAD OF INFORMATION IN MARINE MAMMALS

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Socially transmitted wildlife behaviors that create human-wildlife conflict are an emerging problem for conservation efforts that also provide a unique opportunity to apply principles of infectious disease control to wildlife management. As an example, California sea lions (Zalophus californianus) have
learned to exploit concentrations of migratory adult salmonids below the fish ladders at Bonneville Dam impeding endangered salmonid recovery. Proliferation of this foraging behavior in the sea lion population has resulted in a controversial culling program of individual sea lions at the dam, but the impact of such culling remains unclear. To evaluate the effectiveness of current and alternative culling strategies, we used network-based diffusion analysis on a long-term dataset to demonstrate that social transmission is implicated in the increase in dam foraging behavior and then studied different culling strategies within an epidemiological model of the behavioral transmission data. We show that current levels of lethal control have substantially reduced the rate of social transmission, but failed to effectively reduce overall sea lion recruitment. We show that implementation of culling efforts earlier could have substantially reduced the extent of behavioral transmission and, ultimately, resulted in fewer animals being culled. Taken together, our results suggest that epidemiological analyses offer a promising tool to understand and control socially transmissible behaviors.

114  THE PARADOX OF THE WHALE GUT MICROBIOME: BALEEN WHALES HOST A UNIQUE BACTERIAL COMMUNITY WITH SIMILARITIES TO BOTH CARNIVORES AND HERBIVORES

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The gut microbiome has been shown to impact many aspects of health, digestion, and obesity. As species evolve to live in new environments, eat different diets, or catch their food in a new manner, their gut microbes can either help or hinder their host’s evolutionary transition. Generally, the microbiome reflects an animal’s diet — the gut communities of terrestrial carnivores and herbivores are distinct in their functions, allowing each type of animal to carry out distinct functions related to the relative pressures of their diet. Whales represent one of the most dramatic evolutionary transitions among mammas – they are descended from terrestrial herbivores (related to hippopotamuses and ruminants), yet eat an entirely carnivorous diet of small crustaceans and fish. Using high-throughput genetic sequencing techniques, we have characterized the whale gut microbiome for the first time, allowing us to investigate its relationship to whales’ ancestors and the possible role it has played in their dramatic evolution. We find that the whale gut microbiome shows a remarkable fusion between functions characteristic of terrestrial carnivores’ and terrestrial herbivores’ gut communities — an unprecedented combination of disparate microbiome services that may allow whales to digest the chitinous exoskeletons of their animal prey in much the same way that terrestrial ruminants digest plant matter.

115  HUMAN DISTURBANCE ON CALIFORNIA SEA LIONS (ZALOPHUS CALIFORNIANUS) OFF DANA POINT, CALIFORNIA

I. Lee, L.L. Stelle, H. Thiltgen. Department of Biology, University of Redlands

California sea lions (Zalophus californianus) frequently haul out of the water to rest, but many of these sites are in close proximity to human activity. To determine if vessel traffic acts as a disturbance, sea lions hauled out on a buoy near Dana Point Harbor, CA. were studied. Sea lion behaviors were observed using a spotting scope from the harbor jetty approximately 0.5 miles from the buoy. Scan-instantaneous sampling at one minute intervals were used to record the number of sea lions and their behaviors (laying, head up, standing, moving, or vocalizing) which were then classified into activity states (active, alert, inactive). Simultaneously another observer used continuous sampling to record vessel presence, type, speed, and proximity. During 200 minutes, a total of 67 boats were observed, the majority were sailboats (31%), speedboats (25%), and fishing boats (24%) and passed within an estimated 100 ft. radius for an average of 23 seconds each. Based on 1048 sea lion behaviors, there was a significant increase in Active ($\chi^2=8.6$ $p=0.003$) and Alert ($\chi^2=9.3$ $p=0.002$) activity in the presence of vessels compared to when no vessels were nearby. A reduction in time spent resting could cause energetic stress, especially in times of reduced prey availability. These findings will be shared with local boaters and may contribute to the development of guidelines for sustainable viewing practices.
PHOTO ID OF OFFSHORE BOTTLENOSE DOLPHINS (TURSIOPS TRUNCATUS) IN SOUTHERN CALIFORNIA USING DARWIN

E. M. Walters, T. Camper, L.L. Stelle. Department of Biology, University of Redlands

Photo Identification is a minimally invasive method and one of the most frequently used tools to measure marine mammal population size and determine other ecological parameters. Photo ID is useful for monitoring bottlenose dolphins (Tursiops truncatus) and the Southern California population has been the focus of many studies. However, past research has focused on coastal bottlenose dolphins, and not much is known about the offshore ecotype. This study used DARWIN software to facilitate the process of adding to an existing photo ID catalog of offshore bottlenose dolphins. Surveys were conducted from April 2012 to March 2016 in the Southern California bight, on boats departing from Dana Point, Long Beach, Newport Harbor, San Pedro, and Catalina Island. Photos were taken of the dolphins’ dorsal fins in order to identify individuals based on notches. The fins were digitally traced and matched using DARWIN, then added to the photo ID catalog of the population. GPS data was uploaded to ArcGIS to create maps of the surveys that were used to locate any dolphin resightings. A total of 315 dolphins are currently in the catalog with only four animals resighted, suggesting that the population is likely much larger than the current catalog with a large home range. An average pod size of 28.6 offshore dolphins was observed compared to an average of 19.8 coastal dolphins per pod in San Diego (Defran and Weller 1999). This study provides a foundation to improve our understanding of Southern California’s offshore bottlenose dolphin populations, and evaluates the effectiveness of using automatic matching software to facilitate photo ID studies.

FIRST REPORT OF ISOLATED SOFT OSTEOCYTES FROM NANOTYRANNUS VERTEBRA AND METATARSAL BONES COLLECTED AT HELL CREEK FORMATION, JORDAN, MT

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Previously, I reported on the isolation and examination of soft bone osteocyte cells from adult Triceratops collected at Hell Creek, (2014 SCAS Annual Meeting) and from adult Triceratops condyle and frill (2015 SCAS Annual Meeting) also recovered at Hell Creek in Glendive MT. In this study, I will report for the first time on the presence of soft bone osteocytes from Nanotyrannus lancensis vertebra and metatarsal bones collected in August 2015 at Jordan, MT, (Hell Creek Formation). A single tooth was also recovered. This rare dinosaur is known from two skeletons and a skull found at different digs within the Hell Creek and has caused no small amount of taxonomic controversy, due to relationships with T. rex. Processing for soft tissues yielded large numbers of soft bone cells, which were analyzed morphologically under light and electron microscopy. Vertebra and metatarsal cells averaged 14 microns in length and 8 microns in width and featured filipodia with secondary and tertiary branching. These cells are half the size of Triceratops cells previously reported, suggesting that this particular Nanotyrannus was a juvenile. Organelle-like microstructures were observed within cells but were not analyzed. It is maintained that soft osteocytes in dinosaur remains are the norm in fossiliferous deposits.

USING SPECIES HABITAT MODELS TO ANALYZE THE INTERACTION BETWEEN THE WESTERN GRAY SQUIRREL AND THE EASTERN FOX SQUIRREL IN CALIFORNIA

R. Garcia, A.E. Muchlinski, H.L. Qiu. California State University Los Angeles

Providing an accurate and detailed description of the distribution of a species within a defined geographic area can be a challenge. Past distribution maps have been dependent on museum specimens, and individual sightings and are not frequently revised. In this study, we describe a new method for establishing the current and historical range of a native and introduced species of tree squirrel in California using species habitat modeling software (Maxent). The method involves the collection of location data from wildlife rehabilitation facilities, universities, a personalized smartphone application,
and citizen records. We provide geographic range for the Eastern Fox Squirrel (Sciurus niger) and the Western Gray Squirrel (Sciurus griseus) in California. Large sample sizes over a specified geographic area allow for detailed mapping of the distribution of each species. In addition, assessments related to habitat use and future range expansion will be made using GIS software (ArcGIS). Current data show two large populations of S. niger within California. The first population extends north, south, and east of San Francisco while the second population extends north, south, and east of Los Angeles, with other small established populations. The native S. griseus is diminishing in quantity and moving away from urban areas that S. niger now dominates. Preliminary data analysis of the distribution shows a high correlation with land cover type and impervious surfaces.

119* SQUIRREL CSI: WHO ARE YOU? A GENETIC ANALYSIS OF A WESTERN GRAY SQUIRREL POPULATION IN SOUTHERN CALIFORNIA

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Griffith Park (GP), Los Angeles, is home to a population of Western gray squirrels (Sciurus griseus) (WGSs) who are at risk for extinction due to factors such as habitat fragmentation, potential competition with the Eastern fox squirrel (Sciurus niger), and other anthropogenic disturbances. In order to assess the WGS population for conservation purposes, genetic diversity was estimated for the population in GP and then compared to that of four other populations of WGSs in the Los Angeles area: the Santa Monica Mountains (SMMs), Monrovia Canyon (MVC), Bonelli Park (BP), and Rancho Santa Ana Botanic Gardens (RSABG). Hairtubes were constructed and then deployed in all five regions to collect hair samples of WGSs. A total of 116 samples, 87 from GP, were obtained from five populations in eight samples sites. DNA was extracted from hair samples and mtDNA analysis showed the presence of 4 unique haplotypes in the five populations. Nine base-pair differences were found between the most common haplotype in GP and the only haplotype found in the SMMs. That haplotype in GP was also found in MCP, RSABG, and BP indicating that historic gene flow existed to the east of GP and that the potential source population for WGSs in GP came from local mountains to the east instead of the assumed SMMs to the west. Twelve microsatellite loci were genotyped and revealed low heterozygosity within the population of WGSs in GP, confirming the vulnerability of the population to extinction and the need for its management.

120* CHANGES IN THE DISTRIBUTION OF THE EASTERN GRAY SQUIRREL, SCIRUS CAROLINENSIS, IN CALIFORNIA FROM 1900-2014 WITH PROJECTIONS OF ITS FUTURE RANGE

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The main goals of this study were to map the current distribution of the Eastern Gray Squirrel in California as of 2015 and to project the potential future geographic range of this invasive species. Location data were obtained from museum specimens, wildlife rehabilitation centers, a roadkill database, and research-grade citizen observations. Location points were mapped using ArcGIS software. A population of Eastern Gray Squirrels is located from San Francisco south to areas around Gilroy and Santa Cruz. This population is positioned to expand north along the eastern side of San Francisco Bay. An isolated population now exists in and around Monterey. Within the past several decades the species became established north of the Golden Gate Bridge, and a population now exists from Marin City north to Santa Rosa. A population which was introduced to Sacramento has spread mostly to the west, south, and east of the city. The species is now present as far west as Davis, as far east as Placerville, and as far south as Elk Grove. Another population introduced to Bellota has spread west to Stockton and east to the foothills of the Sierra Nevada Mountains. Maxent ecological niche modeling software and remote sensing data were used to project future range expansion by this species within California.
121* POPLAR TREE BIOMECHANICS VARIES WITH POSITION WITHIN A TREE

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Few studies have examined how plant functional traits vary within trees, even though the requirements of different tissues and organs within large organisms may vary greatly depending on their intra-organismal position. I investigated if biomechanical properties and water transport efficiency changed at different positions within poplar trees (Populus trichocarpa). Modulus of elasticity (MOE; N mm$^{-2}$) and modulus of rupture (MOR; N mm$^{-2}$) using a 4-point bending test were used to quantify biomechanics. Maximum xylem specific conductivity (Ks) measured using a low pressure volumetric flow rate apparatus was used as an estimate of hydraulic efficiency. We sampled juvenile poplar trees that were approximately 5 m in height and growing in an on-campus common garden. Shoot biomechanics were measured for smaller branches of differing diameters (3.28–12.56 mm) and also at meter increments, starting at 0.5 m height from tree base, to examine the biomechanics of older and wider tissues (up to 70 mm in diameter). Hydraulic conductivity was measured at 1.5, 2.5 and 3.5 m heights from tree base. As shoots decreased in diameter, their woody tissue became both stiffer (higher MOE) and stronger (higher MOR). Both MOE and MOR exhibited up to a 4-fold change depending on sampling position within the shoot. Hydraulic conductivity was greatest within basal wood sampled from the tree trunk/bole compared to smaller branches. Poplar wood changes dramatically in both biomechanical and hydraulic properties depending on tree position. This has important implications in understanding the structure function of whole trees.

122 REGIONAL PERSPECTIVE ON TRASH AND DEBRIS FROM RIVERS TO THE SEA IN SOUTHERN CALIFORNIA

S.L. Moore$^1$, M.A. Sutula$^1$, K. Schiff$^1$, T. VonBitner$^2$, G. Lattin$^3$. $^1$Southern California Coastal Water Research Project; $^2$Amec Foster Wheeler; $^3$Algalita Education and Marine Research

Trash and debris in the aquatic environment is a concern for environmental managers as they look to control and manage the amount entering the environment. In Southern California, debris surveys have shown debris to occur in different habitats; however, a regional survey has never been done to examine debris over multiple habitats. The Southern California Bight (SMB) Regional Monitoring Program (1994-2013) is a partnership of many to address management questions of regional importance. Bight 2013 was the first survey to focus on debris from a regional perspective. The primary goal of this study was to assess the extent and magnitude of trash/debris in southern California, from wadeable streams to marine habitats, answering three primary questions: 1) What are the quantities and types of debris in marine and estuarine sediments and epibenthos? 2) What are the quantities and types of trash in riverine channels? and 3) What is the prevalence of debris in nearshore demersal and pelagic fish? In the epibenthos, anthropogenic debris was found one-third of the time, and typically in small amounts (1-10 items). Trash was most ubiquitous in riverine systems across all southern California land uses, with the urban land use having the most coverage (90-100%). Ingested debris was found to be low in fish (<1%). In both the epibenthic and riverine habitats, plastic was the most common type of debris.

123*F EVIDENCE FOR NEGATIVE EFFECTS OF DROUGHT TO BAETIS SP. (SMALL MINNOW MAYFLY) ABUNDANCE IN A SOUTHERN CALIFORNIA STREAM

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Benthic macroinvertebrate (BMI) sampling was conducted at two sites in Topanga Creek from 2003-2014. During this period, Southern California experienced extreme drought conditions (US Drought Monitor 2014). Examining trends in species composition over this period allows for a relatively long-term analysis of potential effects of drought on BMI communities. The Southern California Coastal Index of Biotic Integrity (SCC-IBI; Ode 2007) was applied to BMI samples from Topanga Creek to measure the effects of drought on quantitative biotic integrity. The following trends regarding the BMI community of
Topanga Creek emerged during the course of this study: 1) Wet year rainfall in Topanga Creek Watershed positively correlated to relative and per sq. ft. springtime abundance of *Baetis* sp. (small minnow mayfly), relative abundance of *Simulium* sp. (buffalo fly) up to 31” rain, and negatively correlated to relative abundance of *Chironomidae* n.d. (midge fly), 2) percent algae cover in April and May positively correlated to abundance per sq. ft. *Baetis* sp. and *Simulium* sp., and 3) multiple regression analysis revealed a negative relationship between *Chironomid* n.d. and *Baetis* sp. abundance. BMI are an important food source for endangered steelhead trout and other native aquatic and terrestrial insectivorous species of special concern; significant changes to the BMI community could have trophic repercussions for these and other wildlife. Long-term monitoring is important for tracking the influence of changes in climatic conditions on BMI community.

124 ESTIMATING TWO DECADES OF FLOW DATA WITH THREE YEAR HYDROLOGIC MODELS

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Hydrologic models can be useful for predicting changes in flow regime as a factor of watershed characteristics or alteration, but calibrating these models relies on the availability of recorded flow data over a target temporal range. In order to assess the accuracy of predicting flow for an extending range of data, USGS hourly discharge data were used to develop HEC-HMS hydrologic models of Southern California watersheds, which were calibrated for a three year period then used to predict 23 years of flow. A three year calibration period (water year 2005 to 2007) was selected based on the representation of a wet, normal and dry year, from 1990 to 2010 in the South Coast Region of California. The parameters used to calibrate HEC-HMS models for a three year period produced 23 year models with acceptable Nash-Sutcliffe efficiency. Temporal resolution was also a factor in model accuracy, as hourly precipitation data yielded models with significantly higher Nash-Sutcliffe efficiency than those produced using daily precipitation data. Incomplete flow records can make it difficult to understand the long term variability in the flow regime of a watershed. Long term flow data can be estimated using HEC-HMS models calibrated with shorter data sets, given that hourly precipitation data are available for the long term period and short term models are representative of long term trends in precipitation.

125 A SURVEY OF ANGLERS TO ASSESS FISH CONSUMPTION FROM SAN DIEGO BAY

S.L. Moore, S.J. Steinberg, P. Smith. Southern California Coastal Water Research Project

Nationwide concern by public health agencies and the public that fish caught and consumed by recreational anglers may contain chemical contaminants that pose risks to human health. San Diego Bay is the third largest protected natural bay and one of the five largest ports in California. It is a major receiving water body for the San Diego Bay Watershed with over one million residents. The potential for contamination exists from many sources including numerous urban and industrial discharges. In 2013, the Office of Environmental Health Hazard Assessment (OEHHA) with the California Environmental Protection Agency released Health Advisory and Guidelines for Eating Fish from San Diego Bay; however, little is known about the actual consumption patterns of anglers in the bay. The last study was completed by the Environmental Health Coalition in 2005 and limited to pier anglers. We conducted a year-long consumption survey of pier, shoreline and boating anglers in and around the Bay. Our goal is to improve understanding of the types and amount of fish caught and consumed and associated risk to human health. Preliminary results indicate many anglers come from lower-income neighborhoods and identify primarily as Caucasian and Latino. More than half of those surveyed fish once a week or more. However, the majority (90%) of anglers do not eat the fish they catch. The findings from this study will provide valuable information to public health agencies regarding actual consumption rates for San Diego Bay to better informing decision-making and policy appropriate to the local context.
The Titus Canyon Local Fauna (TCLF) of Death Valley National Park, California, occurs in the variegated facies of the Titus Canyon Formation (TCF). It comprises seventeen extinct land mammal genera and species, including the ischyromyid Quadratomus gigans, the aplodontid cf. Prosciurus sp. indet., the cylindrodontid Pseudocylindrodon texanus, the hyaenodontid Hyaenodon (Neohyaenodon) horridus, the amphicyonid Daphoenictis n. sp. A, the equid Mesohippus westoni, the endemic monoty pic brontotheriid Protitanops curryi, the helaletid Colodon stovalli, the rhinocerotids Teletaceras mortivallis, Penetrigonias dakotensis, and Trigonias osborni, a camelid?, the agriochoerids Eomeryx transmontanus and Agriochoerus n. sp. A, the protoceratid Pseudoprotoceras semicinctus (includes Poabromylus robustus), and the leptomerycids Hendryomeryx defordi and “Leptomeryx” blacki. Five of the species (P. curryi, T. mortivallis, E. transmontanus, P. robustus, “L.” blacki) are based on type specimens from the TCF. Ten species (Q. gigans, P. texanus, D. n. sp. A, M. westoni, C. stovalli, T. mortivallis, P. dakotensis, E. transmontanus, A. n. sp. A, H. defordi) are shared with the early late Duchesnean Porvenir Local Fauna (PLF) of western Texas. The PLF occurs in the lower part of the Chambers Tuff Formation (CTF), 0–113 meters above the underlying Buckshot Ignimbrite (BI). The BI is 37.680–38.288 million years (Ma) old, based on 40 argon/39 argon age determinations recalculated using a revised determination of 28.201 Ma for Fish Canyon Tuff sanidine. The PLF spans two successive magnetozones assigned to Chrons C17r–C17n.3n. Magnetostratigraphic data suggest the PLF and, by correlation, the TCLF are ca. 38.159 to a bit over 38.333 Ma old.

NEW RECORDS OF FRESHWATER BONY FISHES FROM THE LATE Miocene–PLIOCENE BOUSE FORMATION OF SOUTHEASTERN CALIFORNIA AND WESTERN ARIZONA

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The late Miocene–Pliocene Bouse Formation (BF) occurs as scattered outcrops in the lower Colorado River (CR) drainage and adjacent basins from southern Nevada to Cibola, Arizona (AZ). Well log data indicate the BF is present in the subsurface near and south of Yuma, AZ. Earlier interpretations based on marine fossils from the Cibola and Parker areas of AZ and the Blythe and surrounding areas of California (CA) suggested that sediments constituting the BF were deposited in a subsiding basin that opened at the southern end to the Gulf of California. However, recent investigations indicate the sediments were deposited in a chain of lakes that occupied basins named, from north to south and oldest to youngest, Lake Cottonwood (5.6 million years [Ma] ago), Lake Mojave, Lake Havasu, and Lake Blythe (4.8 Ma ago). The lakes did not exist at the same time, but were filled successively and eventually drained by the CR, which reached the Gulf of California about 4.8 Ma ago. Recent collections from the BF basal marl in southeastern CA and western AZ yielded new fossil records of bony fishes. A locality in Chemehuevi Wash (Lake Havasu) near Needles, CA, yielded remains of Rhinichthys (dace), Gila (chub), and Mylocheilus (peamouth). A locality near Cibola (Lake Blythe) yielded remains of Gila cypha (humpback chub). Today, Mylocheilus is found in the Snake, Willamette, and Columbia Rivers of the Pacific Northwest. The presence of Mylocheilus confirms earlier suggestions of a past hydrologic connection between the CR and Snake River drainages.
128* PERVERSIVE PLASTICS: A NEW CHALLENGE FOR CRABS AND OUR SANDY BEACH ECOSYSTEM

D.A. Horn, C. Steele, S. Anderson. California State University, Channel Islands

Sandy beaches cover ~ 75% of the world’s shorelines, 60-90% of the shorelines of Southern California counties and are fundamental to most coastal economies and cultures. The sand crab (Emerita analoga) is found intertidally upon almost every Californian sandy beach, and so an excellent potential sentinel of ecosystem change across shorelines in a wide geographic area. Given the rise of plastic pollution across our seas and coasts over recent decades, there is a high likelihood plastics are entering marine food webs and impacting coastal ecosystem. We have recently demonstrated microplastics (particles or fibers <5mm) are now common across our beach sands and experimentally demonstrated E. analoga ingest microplastics under controlled laboratory condition. Most disturbingly, we have now confirmed background levels of microplastics within the bodies of adult E. analoga from beaches across southern California. We sampled sand crabs populations from San Diego to Northern San Francisco county beaches to test for the presence of microplastics. The ubiquity of this contamination makes ascertaining the effects upon sand crabs and their associated food webs difficult as there appears to be no areas free from plastic exposure and contamination.

129* TRENDS IN MARINE DEBRIS IN VENTURA COUNTY: CHANGES OVER THE LAST 30 YEARS ON MAINLAND AND CHANNEL ISLANDS BEACHES

M. Miller. California State University, Channel Islands

The persistence of plastics in marine ecosystems, as well as the outright physical hazards that marine debris poses to wildlife, is an issue of global concern. The Santa Barbara Channel is home to a variety of factors fostering marine debris accumulation. In this study, I documented the consistent presence of marine debris along both undeveloped coastlines on the Channel Islands (4 on Santa Rosa, 3 on Santa Cruz Islands in fall 2015 and spring 2016) and on mainland beaches in Ventura County (6 in fall 2015 and winter 2016). Debris from all surveyed beaches was cataloged, weighed, and measured to compare seasonal variation in debris abundance and composition. My Santa Rosa Island beaches were part of a 1989-1993 NMFS funded marine debris survey and so allowed me to document a clear increase in debris on our beaches over the past three decades, including an influx of derelict fishing gear. Mainland beaches also show a similar pattern of marine debris composition relative to the islands. The proportion of derelict fishing gear on the island has increased from ~5% of marine debris in fall of 1990 to ~26% of marine debris by fall 2015. Marine debris on the mainland and on the islands is dominated by foam and hard plastic fragments under 2cm in length.

130 IMPACTS OF MICROPLASTIC DEBRIS IN SANDY BEACH ECOSYSTEMS

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Marine debris has been observed in all of the world’s oceans, and washes ashore onto beaches worldwide. Marine debris poses a significant risk to inhabitants of coastal ecosystems as they may become entangled in, or ingest anthropogenic debris. Plastics are a significant component of marine debris, and of particular concern is the propensity of plastics to attract pollutants and to degrade into ever-smaller fragments. Sandy beach infauna and their onshore and nearshore predators are at risk of ingesting microplastic pollution. We have documented the abundance of microplastic pollution on beaches in a number of tropical and temperate sandy beach ecosystems around the world. We quantified and classified microplastic (<5mm) particles and fibers in the swash zone and strandline areas, and have found microplastics in these zones on the vast majority of beaches sampled. This is likely a global issue which requires urgent action to identify and reduce anthropogenic sources of plastic pollution, and to study its environmental effects.
INTERFERENCE BY LARGE INEDIBLE PARTICLES REDUCES CLEARANCE RATES OF ECHINODERM LARVAE

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Many marine invertebrate larvae must feed in the plankton to complete development. The amount of time larvae spend in the plankton (planktonic larval duration, or PLD) can affect ecological and evolutionary processes like dispersal and gene flow. In feeding larvae, one factor that may affect PLD is the rate at which larvae capture food particles. Larval feeding rates are commonly measured in suspensions of edible particles, but natural plankton also contains large particles that cannot be ingested (e.g., dinoflagellates and diatoms). Hansen et al. (1991) demonstrated that feeding rates of copepodites and veligers were lower in the presence of high concentrations (1,000 - 20,000·ml⁻¹) of large inedible particles. Whether such particles affect feeding by other larvae is not known. We hypothesized that the presence of large inedible particles would reduce feeding rates of echinoderm larvae. Larvae of two asteroids and three echinoids were permitted to feed on 6 µm beads alone or in the presence of large inedible beads at concentrations of 25, 50, 100 or 500·ml⁻¹. For all five species, clearance rates on 6 µm beads were reduced by ~50% in treatments including large inedible beads at 100 or 500·ml⁻¹. In the presence of such particles, larvae may alter their swimming behavior or engage in particle rejection behavior; both activities might reduce the time larvae would otherwise spend feeding. These results suggest that the feeding performance of larvae in nature may depend not only on the amount of available food, but also on the concentration of non-food particles.

LONG-TERM STABILITY OF FISH COMMUNITIES IN SAN DIEGO BAY

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Long-term ecological studies are necessary for understanding the stability of community assemblages over time and in response to varying climatic conditions, such as El Niño events or global climate change. San Diego Bay is an important estuarine habitat that hosts a wide variety of fish species, including some indigenous to southern California. For the past 20 years, standing stock of fishes in San Diego Bay have been sampled during April and July at three habitat types (intertidal, nearshore, and channel) within four locations in the bay to characterize community structure and diversity over space and time. Temperature and salinity were also measured at each location. Species richness, Shannon-Wiener diversity, and species evenness were evaluated to determine whether there were notable changes over the 20 year time period, and were divided by year, month, location, and habitat type. Ecological distance based on Bray-Curtis dissimilarity was calculated in the same manner. SIMPER was used to determine fish species contributing most to dissimilarity between sites. Community diversity measures fluctuated over time but showed no consistent trends. Ecological distance between points was driven primarily by habitat type, forming notable clusters that encompassed all sampling years. The changes in community structure following strong El Niño years are of particular interest; greater numbers of pelagic fish were observed in the bay following the years 1997-8, and further samples will be taken in April to determine whether this trend continues.

AGE STRUCTURE AND GROWTH RATES OF VERMILION ROCKFISH (SEBASTES MINIATUS) ALONG CALIFORNIA COAST

B.J. Peña, L.G. Allen. Department of Biology, California State University Northridge

Inaccurate life histories can be detrimental to stock assessments and management which may lead to erroneous estimates of population size. These false estimates can lead to overexploitation of a population decreasing their size structure, reproductive output and genetic diversity. Among recreational rockfish species, the vermilion rockfish (Sebastes miniatus) is one of the most commonly caught in southern California. Vermilion rockfish populations have declined in size and age in southern California since the
1980s due to fishing pressure. They show low genetic connectivity along their distribution suggesting a presence of subpopulations in regions containing biogeographic barriers. Unfortunately, a discovery of a deeper-living cryptic species confounds past assessments. This presence of a cryptic species can complicate current management strategies. This study will investigate and clarify the age and growth data of the true vermilion rockfish in California focusing on regions containing subpopulations. We will compare populations from four sites along California: Cape Mendocino, Monterey Bay, Santa Barbara, and the Los Angeles Region (LAR). After sampling two sites, we found smaller individuals in LAR than Santa Barbara. Growth curves between these two sites differ visually but needs more investigation. Further exploitation of vermilion rockfish could reduce genetic diversity and shift demographics of this species. If differences in age and growth rates differ between sites, regional-scale management may help ensure the persistence of healthy and sustainable populations of vermilion rockfish.

134*F EFFECTS OF ESTUARY OPENING ON POPULATION CONNECTIVITY OF CALIFORNIA KILLIFISH (FUNDULUS PARVIPINNIS)

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Estuaries support high diversity and provide habitat for many fish species. Fish populations in estuaries may become isolated due to reduced numbers and sizes of estuaries, which increases distance between suitable habitats. California killifish, Fundulus parvipinnis, is a small fish endemic to southern California and Baja California estuaries. Individuals rarely enter the open ocean and migration between estuaries is rare. My research tests the hypotheses that (1) estuary closure (fully-open or seasonally-closing) affects connectivity of California killifish populations and (2) population structure of California killifish increases through isolation by distance. I predict that California killifish populations will exhibit less connectivity among seasonally-closing estuaries than fully-open estuaries, and that increasing distance between populations reduces the connectivity. Connectivity helps maintain gene flow among localities of populations to ensure survival of the species despite continued coastal development.

135*F PHYSIOLOGICAL EFFECTS OF ANGLING AND HANDLING STRESS ON SOUTHERN CALIFORNIA KELP BASS, PARALABRAX CLATHRATUS

C. McGarigal, C.G. Lowe. Department of Biological Sciences, California State University Long Beach

Catch and release is a common regulatory strategy in the management of gamefish species, including kelp bass (Paralabrax clathratus), yet the consequences of capture-related stresses on physiology and behavior are species-specific and remain largely unknown. Quantifying the physiological and behavioral impacts of catch and release will aid in managing the economic and ecologically valuable kelp bass fishery in southern California. Blood samples were collected from kelp bass caught on hook and line in Catalina Island Marine Life Reserve and used to quantify stress hormones and metabolic biomarker levels. To establish baseline biomarker levels blood samples were collected in < 3 min from time individuals were hooked. Angled fish were held in coolers for either 10, 15, or 20 min before blood sampling to experimentally determine the effects of angling and holding stresses on biomarker elevation. Glucose and lactate levels were significantly higher in experimental samples than baseline samples and increased significantly with holding duration, which reflects the time it takes for circulating cortisol to influence glucose levels and for lactate buildup in muscle to reach the blood. Recaptured fish were rapidly sampled to assess recovery after varying days at liberty (1-34 d) and in < 24 hr post-release both biomarker levels had returned to baseline. Neither biomarker correlated strongly with angling or handling times, which may be due to lack of sufficient fight duration (22 ± 0.0001 s) and air exposure (50 ± 0.0005 s). Cortisol analysis is ongoing and behavioral responses will be evaluated summer 2016.
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AN INTEGRATED LAB-ON-A-CHIP DEVICE INCORPORATING NOVEL MICROPUMPS, MICROVALVES, AND AN ACOUSTIC MICROMIXER FOR DISEASE DIAGNOSTICS

Benjamin Liu¹, H. Liu². ¹Arcadia High School; ²RD Bio Sciences, Inc.

RNA-based viruses and bacteria have been sources of large-scale epidemics and pandemics, most notably Ebola, SARS, influenza, hepatitis C, HIV, and The Zika Virus. Normal detection of these biological agents requires multiple lab processes, and manual handling and specialized training to perform processes – including sample cell lysing and nucleic acids (RNA/DNA) purification, measuring/mixing reagents, amplifying RNA/DNA, consecutive sample transportation, and analyzing results. These steps are tedious, expensive, and susceptible to sample contamination. In this project, an inexpensive method was developed to integrate and automate the whole RNA based infectious disease detection process from sample to answer in a single small Lab-on-a-Chip microfluidic device.

This device incorporates three new engineering techniques: 1) acoustic microstreaming-based micromixers to enhance mixing of biological samples for magnetic RNA binding captures; 2) electrolysis-based micropumps to control fluidic movement; 3) wax valves to manipulate fluid distribution and facilitate RNA separation for amplification, fluorescent-tagging, and analysis. A mathematical theory was developed to optimize acoustic micromixing and acoustic enhancement techniques reduced mixing time from 6 hours to 10 sec, the electrolysis-based micropumping (NaCl-based) to produce pure hydrogen gas to push liquid on the chip was successfully demonstrated and characterized, and both normally open and normally closed wax microvalves for fluidic manipulation were also successfully demonstrated. The integrated, self-contained device took raw samples from a clinical specimen (e.g., urine) with no preparation steps and automatically performed sample-to-answer genetic analysis for sexual transmitted disease (Chlamydia trachomatis) detection: yielding high potential in diagnosis of all RNA-based viral and bacterial diseases.

ROLE OF FLAVINS IN UNIQUE GROWTH CHARACTERISTICS OF SHEWANELLA ONEIDENSIS MR-1 CELLS GROWN IN THE PRESENCE OF GRAPHITE FELT

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Shewanella oneidensis MR-1 is a Gram-negative facultative anaerobic bacterium that can carry out extracellular electron transfer and reduce insoluble substrates like metal oxides and electrodes of microbial fuel cells. Microbial fuel cells (MFCs) are a promising technology for alternative energy that utilize microbes to generate electricity and break down waste products. To optimize the potential of MFCs, it is necessary to understand the interactions of microbes with electrode materials used in MFCs. When S. oneidensis MR-1 was grown in a test tube with M1 minimal medium and graphite felt, it grew about 10-fold more in the felt than the surrounding planktonic medium. This phenomenon was termed the "interstitial felt effect." The interstitial felt effect was delayed by a day in a bacterial flavin exporter (Bfe) mutant strain of S. oneidensis MR-1. The goal of this study is to complement the bfe mutant strain of S. oneidensis MR-1 with a wild type copy of the gene, to confirm its role in the interstitial felt effect phenomenon.

DNA SEQUENCE VARIANTS THAT CORRELATE WITH CANINE SKULL SHAPE AND HUMAN BRAIN CANCER

C. Horowitz², D. Weisenberger², A. Patel¹. ¹Crossroads School for Arts & Sciences; ²Canine Genomics

Glioblastoma (GBM) is the most common form of human brain cancer affecting 22,000 people every year. The survival time for patients with GBM is only 12-15 months past diagnosis. Human brain cancer represents a huge health concern. Interestingly, humans and canines have much in common both genetically and behaviorally, and therefore, canines make powerful model organisms to better understand human disease. The brachycephalic species of dogs (dogs with flat faces and short skulls) display a
stronger disposition to GBM, while dolichocephalic species of dogs (dogs with long faces and long skulls) develop meningiomas. An analysis of brachycephalic breeds suggests DNA sequence changes may influence canine skull formation. Our hypothesis is that those genes showing sequence differences may be linked to both canine and human brain cancers. To address this, we identified several genes showing DNA sequence changes in brachycephalic dogs. Moreover, we are currently validating these sequence differences collected from cheek swabs of various brachycephalic and dolichocephalic breeds. Specifically, we are using Polymerase Chain Reaction (PCR) to amplify regions of interest and then sequence these regions to determine the genotype of each canine sample. Our sequence data will likely shed light on the link between DNA sequence change in brachycephaly and canine skull formation. The data will serve to confirm published work and then will be further tested to see if these genes show alterations in brain tumors.

139* CONTACT ORDER AND ITS APPLICATION ON THE HYDROPHOBIC-POLAR LATTICE MODEL FOR PROTEIN FOLDING THROUGH ANT COLONY OPTIMIZATION

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This paper proposes a method to resolve a critical issue encountered in computational protein folding research. Because the native structure determines a protein’s function, finding the native structure allows us to understand better protein folding related diseases. Experimental determination of the native structure requires production of pure protein crystals followed by crystallographic methods. This process is extremely challenging. Thus, computational techniques have been developed to predict a protein’s structure in order to understand a protein’s function at the atomic level. A simplified but important folding model is called the lattice model, where amino acids are considered to be either hydrophobic or polar beads that fold onto a lattice grid. This simplification has been studied extensively and has been extremely helpful in extracting the essential principles of different protein properties. However, multiple computational solutions could exist and would cause uncertainty in the determination of the native conformation. My research is an attempt to reduce meaningless solutions by considering a topological property called relative contact order. Results have been validated by comparison to structures determined by crystallography. I found that by considering the relative contact order as a property of the folding process, the lattice model better approximates the native folding conformation than the ordinary lattice model.

140* THE ROLE OF MIR133B IN SPINAL CORD RECOVERY FOLLOWING A CERVICAL CONTUSION IN MICE

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Previous studies have shown that microRNAs (mRNAs), endogenous short non-coding RNA molecules, play an important role in post-transcriptional gene regulation and participate in physiological and pathological conditions such as spinal cord injury (SCI). Several reports in literature have indicated that alterations in miRNAs expression following a SCI lead to increased inflammation and oxidative stress and reduced capacity of axon re-growth. Among them, miRNA-133b appears to have an essential role in axon regeneration. In the present study we investigated the role of miR133b in spinal cord recovery by using a cervical contusion at the 5th cervical level as an animal model for spinal cord injury in mice. 24hr post-injury mice received the miR133b delivery via tail vein injection for 3 consecutive days one dose per day. The control group received miR-negative control. To determine the miR133b expression and activity the spinal cord and brain from each group were collected before and 1, 3 and 7 days post-injury. Changes in mRNA and protein expression were evaluated by qPCR and western blot analysis. Our results indicate that intravenous delivery of miR133b 24hr post-SCI is efficient in inhibiting some of the target genes known to reduce the cell growth as well as the protein expression when compared to control group. Later
time points after miR133b intravenous delivery will be important for assessing the role of miR133b in motor function outcome post-SCI.

141 RESEARCH ON ALZHEIMER’S USING NON-NEGATIVE MATRIX FACTORIZATION

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Alzheimer’s is a chronic neurodegenerative disease, that over time slowly degrades a patient’s brain. Alzheimer’s disease (AD) is one of the leading causes of dementia and affects about 48 million people worldwide. Here we study gene expression in the brains of Alzheimer’s patients and compare these to normal individuals. We analyze the data using nonnegative matrix factorization of expression profiles from 11 different people. Nonnegative matrix factorization factors the data into two different matrices: one matrix with dimension of the number of factors x number of genes and another matrix that is 11 x the number of factors. Using the matrix that contains all genes, I create a heat map which displays the factor weights across the individuals. Using these heat maps, I search for factors that differentiate Alzheimer’s patients from normal patients. These factors are then interpreted based on their gene weights, and their differences determine what aspects of the brain are affected by Alzheimer’s.

142* THE SUMO E3 LIGASE PIAS1 INTERACTS WITH HUNTINGTIN IN THE NUCLEUS

R. Li, L. Thompson, E. Morozko.

Huntington’s Disease (HD) is a neurodegenerative genetic disorder caused by a mutation within the huntingtin (HTT) gene on the 4th chromosome that ultimately leads to rapid mental decline and severe motor impairments. The HTT mutation presents as CAG trinucleotide repeats that translate into polyglutamate chains, resulting in the toxic misfolding and accumulation of mutant huntingtin protein (mHTT). SUMOylation is a post-translational modifier of HTT and increased SUMOylation is associated with accumulated mHTT. PIAS1 is an E3 ligase of the SUMOylation process. Previous experiments in the lab of Dr. Leslie Thompson at UCI have shown that PIAS1 interacts with and SUMOylates HTT, and increasing PIAS1 expression results in a greater accumulation of mHTT. Little is known, however, about where in the cell PIAS1 and HTT interact and the role of SUMOylation in HD pathogenesis. Therefore, the goal of this experiment was to further characterize the PIAS1 and HTT interaction. Using a nuclear-cytosolic fractionation protocol, protein from HeLa cell lysates was divided, quantified, and identified. A co-immunoprecipitation using an antibody to PIAS1 was used to capture PIAS1 interacting partners in the nuclear and cytosolic fractions and western blots were then used to determine the identity of precipitated proteins. The results indicated that PIAS1 interacts with HTT predominantly within the nuclear fraction. While PIAS1 precipitated both wild-type and mHTT within the nuclear fraction, a small amount of only mHTT was detected within the cytosolic fraction. This experiment suggests that PIAS1 may play a role in modulating mHTT toxicity, specifically within the nucleus.

143* STUDENT ELECTRONIC CIGARETTES CULTURE AND USE IN A SANTA MONICA HIGH SCHOOL; A PUBLIC CASE STUDY AND SURVEY

H. Nasseri, A. Patel. Crossroads School for Arts & Sciences

Electronic Cigarettes (vapes) have become increasingly popular and accessible among teens. The 2014 National Youth Tobacco Survey showed that current e-cigarette use among high school students increased from 4.5 percent in 2013 to 13.4 percent in 2014. Also alarming is that loopholes in current California law permit teens under the age of 18 to use e-cigarettes, but not purchase them. Notably, minimal research on the long term effects of e-cigarettes use has been published. The goal of this research was to create a case study out of Crossroads High School in Santa Monica investigating why and when High School students vape. Three focus groups of seven students were interviewed to get a sense of vape
culture at the school and among teens. After collecting information from the discussions in the focus groups and evaluating recent vaping research, a survey was developed and distributed to 500 students, ranging from 9-12 grade. Questions in the survey included: gender, grade, GPA, vaping usage, tobacco usage, cannabis usage etc. Initial results from the focus group survey indicate that over 40% of had tried vaping. In addition, a majority of the students believed that there are no negative side effects to vaping. The main survey, which will be sent to all students, is currently in review with the Crossroads Internal Review Board (IRB) panel. This survey will reflect the true nature of vaping culture at a California independent high school.

144 UTILIZING NON-INVASIVE TECHNOLOGY TO MEASURE UNTETHERED RESPIRATORY AND CARDIAC PATTERNS OF REPTILES IN NON-LABORATORY ENVIRONMENTS

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Elevated metabolic demands are associated with large increases in respiratory rate (RR) and heart rate (HR). RR measurements of laboratory reptiles typically require video radiography and/or sealed masks, often involving manual timing processes by the observer. Additionally, HR measurements typically require electrodes wired to laboratory machines to detect the electrocardiogram (ECG). The tethered nature of the recording equipment may influence and restrict normal movement and behavior, leading to biased data. The purpose of this project is to develop a relatively low cost, wireless respiratory and ECG monitoring system. This system will eliminate the tethering involved with current methods and significantly reduce the cost and any “observer effect.” Preliminary experiments use the savannah monitor Varanus exanthematicus, due to their unique respiratory and cardiovascular systems. For RR, conductive rubber cord was used as a stretch sensor to measure the expansion of the subject’s lungs. In addition to RR, this cord could be used to measure the extent to which the animal’s body cavity expands and contracts while breathing. The RR and amount of expansion reveal lung capacity and size. For HR, off-the-shelf ECG components were used, and preliminary experiments show HR recorded by this prototype match the HR taken with medical ECG machines. All components were connected using an Arduino microprocessor with Bluetooth communications and GPS for less than $150. Ultimate goals include integration of environmental sensors to provide background for RR and HR data, such as temperature, light, and accelerometer sensors.

145* EFFECT OF RETINOIC ACID ON THE EXPRESSION OF CD141 AND REGULATION OF T-SUPPRESSOR CELLS IN THE LUNG MUCOSA

C. Nguyen¹, A. Agrawal². ¹Marina High School; ²Institute for Immunology, University of California Irvine

The main function of dendritic cells (DCs) cells, is to process antigen material, present it on the cell surface, and communicate with T-cells, acting as a messenger between adaptive and innate immune systems. DCs play a significant role in the maintenance of central and peripheral tolerance that prevents autoimmunity or allergy. Retinoic acid (Vitamin A) is usually already present in the lung mucosa and is known to regulate immune functions and reduce the symptoms of infectious disease. In our research, we have found that retinoic acid, a form of Vitamin A, in an in vitro environment causes filtered DCs to express CD141 in greater quantities. CD141(+) was then seen to have upregulated T suppressor cells, which prevent reactions to harmless antigens and induce immune tolerance. Frozen sections of normal lung samples will be immunostained to detect levels of CD141(+) in dendritic cells already present, in order to determine if retinoic acid will affect the inducing of T suppressor cells and immune tolerance. If established, a connection between CD141(+) and T suppressor cells will allow development of treatments for allergies, autoimmunity, and inflammation.
AN ENTRÖCHEMICAL WATER HEATER

L. Lin¹, S. Kazadi, X. Ye². ¹Walnut High School; ²Jisan Research Institute

Entröchemical systems are systems capable of generating internal thermal gradients through internal water movements which simultaneously transfer heat of vaporization between internal water reservoirs. These systems move to a chemical equilibrium state that generates and maintains a thermal gradient. Entröchemical thermal batteries (ETB) can be constructed which extend the thermal gradient of a single cell through an additive process. Such system can deliver useful work. Additionally, solutions used therein may be recharged passively using environmental heat. We describe the design and function of a bench-scale water heater capable of heating a small water reservoir. The system is powered by an ETB. We characterize its function utilizing ETBs of one and three cells. We calculate a peak wattage of 99.17 W for a single cell system and a peak wattage of 72.39 W across a three-cell array. The limited change in wattage across an array compared to a single cell indicates that the overall wattage is dominated by single-cell performance rather than dynamics introduced by the array.

INVESTIGATING THE ROLE OF THE CIRCADIAN CLOCK IN TOLL-LIKE RECEPTOR 7 INDUCED INFLAMMATORY ACTIVITY

C.J. Huang¹, E. Van Spyk², B. Andersen². ¹Walnut High School; ²Department of Biological Sciences, University of California Irvine

The circadian rhythm is known to coordinate many aspects of physiology, but its role in immune regulation within the skin is unclear. In order to test whether the circadian clock plays important role in inflammation responses in the skin, we treated the skin of mice lacking Bmal1, a core clock gene, with an immunomodulator and Toll-like receptor 7 (TLR7) agonist, IMQ, for 24 hours, 3 days and 5 days at varying concentrations. To measure inflammatory activity within the keratinocyte compartment of the skin, we looked at epidermis width as well as 5-Ethynyl-2’-deoxyuridine (EdU) incorporation in the interfollicular epidermis. We found that by day 3 of 5% IMQ treatment, the epidermal width is increased by 3 days of 5% IMQ treatment, measured by hematoxylin and eosin staining. One dose of 1% IMQ for 24 hours in both wild type (wt) and Bmal1 knockouts (Bmal1/-) resulted in a pause in the cell cycle indicated by less EdU incorporation. By 5 days of 1% IMQ treatment, the proportion of EdU+ cells within the interfollicular epidermis was elevated to the same extent in Bmal1/- and wt mice, indicating no defect in the response of Bmal1/- to hyperproliferative stimuli. Our results show that Bmal1 is not necessary for pro-inflammatory epidermal hyperplasia observed after TLR7 pathway signaling activation in mouse skin. These findings are important for understanding the relationship between the circadian clock and skin biology, especially the skin’s ability to respond to activating signals from the environment.

CORRELATION BETWEEN TOTAL POSITIVE MATRICES AND PLANAR NETWORKS

C. Wong, G. Karaali. Pomona College

A matrix is totally positive if each of its minors are positive. The connections between totally positive matrices and planar networks, which are defined as acyclic planar directed graphs of nodes that are evenly split between n sources and n sinks, have been investigated in the literature, especially in the context of Poisson algebraic geometry and quantum matrix algebra. In this paper we begin with a careful study of totally positive matrices, and we prove several of their fundamental algebraic properties. Next we introduce Le diagrams, that is, arrays of 0s and 1s satisfying the following condition: if there is a 0 in a given square then either each square to the left is also filled with 0 or each square above is also filled with 0. Finally, using all of the above, we explore the correspondence between totally positive matrices and planar networks. We provide basic definitions and several examples to clarify the exposition.
**149* CAFFEINE EXTRACTION IN COFFEE AND OVER-THE-COUNTER DRUGS**

**J. Nunez, K. Flynn, M. Galloway**

Caffeine has contributed to the effectiveness of pharmaceutical drugs. The objective of my experiment was to isolate and analyze caffeine in coffee as well as over-the-counter drugs including Excedrin. The first extraction process was a traditional methylene chloride procedure (“Isolation and Identification of Caffeine Crystals”). This traditional extraction process proved unsuccessful. A second extraction process based on an environmentally-friendly, greener isopropyl alcohol extraction was tried (Murray and Hansey 1995; Hampp 1996). The original procedure was modified to fit the equipment available (multiple extractions). In addition, sodium chloride as well as calcium hydroxide were used to maximize the solubility of the extracted caffeine in the extracting solvent. Small amounts of crystalline solids were obtained from the coffee and Excedrin extracts. These solids were analyzed by infrared spectroscopy. Based on the qualitative data that was obtained, two IR absorptions at 1702 cm$^{-1}$ and 1662 cm$^{-1}$ characteristic of the carbonyl functional group found in caffeine were noted. Attempts to harvest sufficient crystalline caffeine from the extraction process to run other supporting tests for caffeine such as melting point or proton NMR proved unsuccessful. Further refinements to the greener isopropyl alcohol extraction are in progress.

**150* EXAMINING A NEW METHOD FOR THE DISCOVERY OF HYPOTHETICAL EXOTIC PARTICLES**

**J. Park, D. Whiteson. University of California Los Angeles Community School; Department of Physics and Astronomy, University of Los Angeles Irvine**

This research seeks to explore a new method for the discovery of new hypothetical particles. Studying data collected from collisions of particles at high energies offer the possibility to discover new states of matter, which could help scientist map the fundamental nature of the universe. The Large Hadron Collider, at CERN in Geneva, currently has the highest energy available, colliding protons at 13 TeV (teraelectronvolts). It produces tens of petabytes of data every year and physicists are combining through this data searching for possible evidence of new particles. In many cases, however, these new exotic particles may be invisible to the detectors that capture the particle collisions. Agashe et al (Phys. Rev. D88 2013 5, 057701) have proposed a novel method to investigate for these nearly imperceptible particles, by analyzing the energy peaks from other easily detectable particles. The data is produced using MadGraph5_aMC@NLO, a program that randomly generates an event from the Large Hadron Collider, and its different energy levels are analyzed through ROOT, a data analysis tool from CERN.

**151 INVESTIGATING THE ROLE OF TWO NEW GENES POTENTIALLY INVOLVED IN LIPID METABOLISM**

**U. Tan¹, J. Burke², J. Yaghoubian², S. Fuchs², M. Peterfy³. ¹Walnut High School; ²Western University of Health Sciences, College of Osteopathic Medicine of the Pacific; ³Cedars-Sinai Medical Center**

The purpose of this project is to observe the function of SPTY2D1 (suppressor of TY, domain containing 1) and TM6SF2 (transmembrane 6 superfamily member 2) in mice. Genetic studies in patients have identified isoforms of these genes associated with abnormal lipid and other metabolic profiles. As the detailed functions of these proteins are still unknown, we are studying the effects of the downregulation of these genes in mouse models. The mouse strains we are studying were created by inserting a new piece of DNA in the genome to disrupt the normal function of each gene. The resulting effect is to inactivate the corresponding gene interrupting the normal production of the protein. These two strains of mice are bred. To identify the mice with the proper genotype, ear piece biopsies are collected and genomic DNA is extracted. The identification of the mutation is done by PCR with specific primers amplifying the region of the genes and analyzed by estimating their sizes in an agarose gel after electrophoresis. The initial phenotypic characterization of these mice is to determine if mice unable to express the protein, called knock-out (KO), have a different body weight and growth (snout to anus length) compared to unmodified,
wild type (WT), animals. While both strain KO animals have a decrease in the body weight compared to matched WT controls, only SPTY2D1-KO have a decreased body mass index (BMI). TM6SF2-KO and control WT have similar BMI due to a reduction in length responsible for the lesser weight measured.

**152**  HYBRID MULTI-WALLED CARBON NANOTUBE TiO2 ELECTRODE MATERIAL FOR NEXT GENERATION ENERGY STORAGES.

S. Marler, J. Li. Sherman E. Burroughs High School

Current supercapacitors present several distinct limitations that severely inhibit the efficiency, power, and electrical capacitance of energy storage devices. Supercapacitors present an exciting prospect that has countless applications in renewable energy storage and modern day electronic devices. In recent years the exciting development of carbon nanotubes (CNTs) has presented an advantage in electrode development. CNTs, however beneficial for their increased electrode surface area, have severe limitations regarding conductivity and electrode density. Creating a nanocomposite hybrid out of a transition metal-oxide and carbon nanotube array would help with the current limitations of the modern supercapacitor. TiO2 was chosen for its common occurrence in everyday materials and promising capacitance levels. A multi-walled carbon nanotube array was grown on a SiO2 precursor via CCVD. The transition metal oxide was then deposited via RF Sputtering methods to a MWCNT array. Recharge tests and characterization were conducted using scanning capacitance microscopy (SCM). While these tests are preliminary, this novel hybrid electrode represents an exciting prospect for the future of the efficiency of electrochemical energy storage as well as an advance towards a future of providing inexpensive energy storage solutions around the world.

**153**  SENSORY GATING, BLINK RATES, AND SYMPTOMS IN BIPOLAR DISORDER AND SCHIZOPHRENIA

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As a result of symptom similarities between schizophrenia (SZ) and bipolar disorder (BP), it can be difficult to distinguish and diagnose between these mental illnesses using standard clinical criteria. To garner a more quantitative and objective approach, the purpose of this study was to analyze differences in sensory gating and blink rates between control (n=72), SZ ((n= 78) (46 schizoaffective (SZA), 32 paranoid SZ (SZP))), and BP (n= 58) patient groups and correlate these measures to symptom severity. Past studies provide evidence that elevated blink rate and abnormal sensory gating may be linked to dopamine levels and impaired brain inhibitory function in SZ and BP. Normal sensory gating occurs when the peak amplitude of a positive evoked brain potential at about 50ms (P50) is reduced (“gated” or inhibited) to the second click compared to the first. Using a paired click paradigm and electroencephalography (EEG), the patient groups had significantly impaired P50 sensory gating compared to controls, with the SZA group being the most impaired. Significant differences in blink rates between control and patient groups were also found. Furthermore, significant correlations between physiological indices, measures of psychological pain, positive and negative symptoms, and suicidality were found. Patterns in correlations suggested notable differences between the SZP and SZA group. Therefore, results suggest that sensory gating and blink rates may be objective trait markers for SZ and BP, and clinicians may be closer to a more quantitative approach for diagnosing BP and types of SZ, thus leading to more effective treatment.
FABRICATION AND EVALUATION OF THE USE OF DRY ELECTRODES IN A LONG-TERM WIRELESS HEART MONITORING SYSTEM

M.G. Tang, M. Khine, Michael Chu. Department of Biomedical Engineering, University of California Irvine

This study examined the feasibility of making a long-term wireless ECG system using dry Au electrodes. Conventionally, ECG measurements are taken using wet Ag/AgCl electrodes, but there are several disadvantages such as signal drift over time and skin irritation, only allowing for short-term monitoring. Dry electrodes can overcome these issues, although they can be more susceptible to noise. The project consisted of three parts: electrode fabrication, hardware interface, and software data processing/analysis. Flexible Au dry electrodes were fabricated in Polydimethylsiloxane (PDMS). The hardware interface consisted of an amplifier, an Arduino microcontroller, and a Bluetooth interface to a computer. Software code was written jointly in the Arduino platform and in MATLAB to allow for real-time data acquisition, display, and analysis. Measurements were made to compare the flexible Au electrode against a commercial standard. The ECG signal from the dry electrode system showed a PQRST waveform as expected from a typical ECG. However, the signal quality was dependent on the amount of pressure against the skin. Furthermore, calculation of the variance and the Fast Fourier Transform of the signal showed that the Au electrodes had more noise compared to the wet electrodes, but the PQRST waveform was still distinguishable. Further optimization can be performed to increase contact of the electrodes with the skin and reducing external noise in the system. Such improvements will help enhance performance making dry electrodes more feasible in a long-term wireless heart monitoring system.

ENTANGLING TIME-BIN QUBITS USING AN OPTICAL SWITCH: LASER ATTENUATION AND MACH-ZEHNDER INTERFEROMETER CONSTRUCTION

J. Choi, Y. Li, C.W. Wong. Oxford Academy

Quantum mechanics is an extremely relevant topic of the day as it is being used in technology to increase the speed of information processing and to improve the security of cryptographic systems. These advancements largely involve the process of entangling qubits, which are basic units of quantum information (quantum bits). While polarization entanglement has been utilized frequently in current optics research, time-bin entanglement remains more in theory and has not been as thoroughly explored. A long-term, multi-stage experiment was planned out with the purpose of verifying the theoretical set-up by attempting to generate entangled time-bin qubits in real-time. The stages of the experiment included pulse laser attenuation to a single photon, photon pair generation, time-bin qubit preparation, time-bin qubit entanglement with a switch, and measurement. Thus far, the first stage has been completed, and the second and third are in progress. Possible errors due to dB loss and varying dark count may occur during this first stage. In addition, an M-Z interferometer was built to test the functionality of the phase modulator, which is to be used in the fourth stage. Due to the high loss in this first part of the experiment, a pump laser will most likely be used rather than a fiber laser for photon pair generation, the second part, as well as for the remainder of the experiment.

THE EFFICACY OF TOPOISOMERASE I SUMO-INHIBITING COMPOUNDS IN SENSITIZING CELLS TO CAMPTOTHECIN

A. Abing, Y. Liu, M. Li. Beckman Research Institute

To determine the translational potential of novel small molecules in combination with the DNA Topoisomerase I (TOP1) poison, camptothecin (CPT), the crystal violet method was employed to quantify cell proliferation rates in treated cultures of the 293T cell line. 293T cells, derived from the human embryonic kidney, were treated with different concentrations of the cyroprotectant, dimethylsulfoxide (DMSO), CPT, and novel small molecules. Each compound was surveyed for 48 and 72-hour periods. TOP1 is the only currently known target of CPT; CPT has been developed as a chemotherapeutic drug due to its ability to enhance covalent trapping of TOP1 onto DNA by preventing
completion of its topoisomerase reaction. Although efficacious in killing various types of cancers, employed dosages of TOP1 poisons also produce potentially lethal side effects. However, recent studies have discovered that TOP1 is catalytically suppressed specifically at the highly transcribed regions by SUMO modifications at its K391 and K436 residues. The resulting increase in TOP1 trapped on the DNA subsequently sensitizes human cells to the effects of TOP1 poisons. Here we show a preliminary screening of novel small molecules that have been developed to block K391/K436 SUMOylation in order to hypersensitize cells to TOP1 poisons. In doing so, we have identified a candidate compound to be further tested as a cancer chemotherapeutic agent in combinational therapy.
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