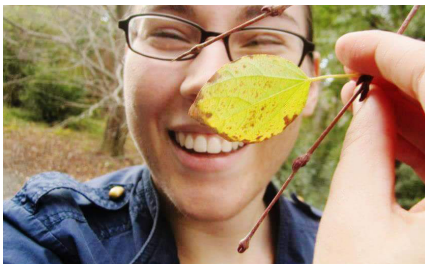
Pacific Union College

BIOLOGY

DEPARTMENT NEWSLETTER



GREETINGS

There has been a lot going on behind the scenes this academic year. We added specimens to the Hansen Collection and installed several animal mounts in classrooms and labs throughout Clark Hall. There are new benches, museum display cabinets, and wall art on first and third floors. The biggest project we've tackled is the program review, which is a chance for our department to take an honest look at itself and note what we do well and what we need to improve. We've learned a lot about ourselves and are excited to move into the future with a renewed vision of who we are.

As usual, we hope this newsletter finds you happy and healthy!

Enjoy!

Issue 13 | Spring 2016

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The Biology Newsletter is also posted as an e-newsletter at **puc.edu/biology**. Subscribe to the e-newsletter at the link above.

DEPARTMENT HIGHLIGHTS

BIOLOGY LAB COORDINATOR

Amber Davidson is the current lab coordinator.

We are pleased to introduce Amber Davidson, our newest lab coordinator. Amber graduated in June 2015 with a B.S. in Biology, A.S. in Music, and Honors. In just a few months she has organized the microbiology prep room, storage closet, physiology storeroom, and genetics lab. She has also helped quite a bit with the update of several Clark Hall museum collections and general improvements to décor and seating on first and third floors.

Stephanie Larson, our previous lab coordinator, is now in the biomedical program at LLUSM. She is doing well and keeping busy! We miss her smiling face and infectious laugh and wish the very best for her as she continues her medical studies.

Since 2008, we have had six different lab coordinators and they have all done a fantastic job. It's rewarding to see their transition from student to staff member and then to watch them go on to great futures. Alyssa Zima was the lab coordinator in 2010-11 and went on to LLUSP where she earned her PharmD in May 2015. In fact, she visited PUC recently for the annual Career Day event.

RECENT GRADUATES

We had 15 students graduate from our department in June 2015. This includes eleven Biology B.S., three Environmental Studies B.S., and one Biology B.A. degrees.

Pictured from L to R: (back row) Backil Sung, Bryan Ness, Jackie Lopez, John Duncan, Kristine Maxam, Robin Vance, and Floyd Hayes; (front row) David Negrete, Vilaivan Yang, Lacy Koktavy, Queenie Vo, Andrea Santos, Aimee Wyrick; and (kneeling in front) Larry Bhattacharjee. Graduates not pictured: Lelyn Castelo, Amber Davidson, Nick Do, Lily Hufmann, Hannah Kwon, Brandon Painter, Jamie Wittwer, and Patrick Yun.

ALUMNI VISITS

A number of our recent graduates have visited campus in the last year to give seminars, guest lectures, and visit with current students.

Haruka Ito ('13) visited last May and presented a lecture and lab on medicinal plants to the Flowering Plants class. Students learned about properties and biochemistry of a number of several local plants. They also had a chance to taste teas and other liquid concoctions made from berries, leaves, and stems. She also spoke with students about her life since graduating from PUC in 2013 and graduate school. She advised students to follow the path they are interested in even if it's not the traditional pre-professional track.

Dustin Baumbach ('11) visited last November and lectured to both Conservation Biology and Geology classes. Dustin is currently working on his Ph.D. and is well-versed in Geographic Information Systems (GIS) since he uses this platform to help track sea turtles he studies in Honduras. He presented "Introduction to GIS" to both classes and allowed students to learn some of the basics of Arc-GIS during the lab sessions. This was the first time a specific GIS unit was included in the curricula and the hope is to make this a permanent addition.

Brian Lee ('11) visited in late January and gave two presentations. Brian spent three years in the Peace Corps in Rwanda. He spent his first two years as a science teacher in Kapila where he taught over 500 students each week! His last year was spent training park rangers the field techniques used for ongoing gorilla research. He talked about his experience in Rwanda and discussed the benefits he gained from serving in the Peace Corps. Brian told students to decide on a future that will make them happy and to follow it for the right reasons. In Biology Seminar, students learned about the research Brian was involved in and the threats gorillas face.

Dr. Ben Koo ('08) and his wife **Madeline (Kang) Koo ('08)** visited in early February and met with the Pre-Med/Pre-Dent Club. The hour-long conversation included Dr. Koo talking about his experience as a PUC Biology major, at LLUSM, and now as a 4th-year neurology resident. Dr. Koo took questions from the audience throughout. He advised students to carefully consider their motivation for medicine because it takes a sincere commitment to finish medical school and it is easy to "burn out." Dr. Koo consistently pointed out to the audience it is important to maintain perspective and balance in life.

Mindy Nelson ('12) and **Dr. Alyssa Zima ('10)** attended the annual PUC Career Day event held in early March. Mindy will finish veterinary school in just a few weeks and spoke with those students interested in

veterinary medicine. Alyssa is finishing a year of residency at Sutter Health in the East Bay, California. She spoke with students interested in pharmacy school. Pre-vet and pre-pharm are very attractive professional programs and a growing number of our majors choose to pursue these careers. We are especially fortunate to have alumni like Mindy and Alyssa willing to come back to campus and give their advice to our students.

CLARK HALL UPDATES

Over winter break the first and third floor were transformed. Several upholstered benches were placed in key areas where students can now relax as they wait for lab to begin. Glass cabinets were filled with items of biological and geological interest. These changes enhance our department and we hope by seeing these items, students engage with biology outside of the classroom.

We have added several new specimens to the Hansen Collection in the last few months. This includes 10 specimens donated by Mrs. Barbara Barnett, widow of Dr. Gary Barnett. Dr. Barnett was an avid big-game hunter and the collection includes a full-mount baboon! The donation was coordinated by her cousin-in-law Dr. Lorne Glaim, PUC Professor Emeritus of History. A huge thanks to Dr. Hayes who drove to Oregon to pick up these animals and transported them back to Angwin.

Mr. Marius van Zyl recently donated several lion specimens to the collection. These include a wall-mount, flat skin, and two full-mounts. The full mounts are two male lions on their hind legs and displayed together as if they are fighting. The lions were collected in South Africa in the early 1980s. A huge thanks goes to PUC alum Dr. Bill Abildgaard who first connected with Mr. van Zyl and then arranged for the donation to PUC.

FACULTY DEVELOPMENT

The following are two examples of how the department of biology faculty connect their students with the outdoors.

STUDY TOURS AND RESEARCH IN FIELD BIOLOGY AT PUC

BY FLOYD HAYES

In addition to providing a stellar education for students seeking careers in the health sciences, our department of biology also strives to provide outstanding opportunities for students who wish to pursue a career in organismal biology. To fulfill the desires of some of our students to study the ecosystems of exotic locations, in 2012 I created Field Biology, a 3-credit course requiring a dozen lectures and an extended field trip (10-11 days) to study the natural ecosystems of a particular region. During spring break of 2012 I took students on a study tour of Trinidad and Tobago, where we studied a variety of terrestrial and marine ecosystems. The highlights of the trip were watching giant leatherback turtles laying their eggs on a beach, seeing spectacled caimans and scarlet ibises while exploring a mangrove swamp by motorboat, and snorkeling at several coral reefs.

During each spring break since 2013 I have taken students to Amazonian Brazil, where we study a variety of tropical terrestrial and freshwater aquatic ecosystems while volunteering with a missions project organized by our PUC missions coordinator, Fabio Maia. The highlights include catching spectacled caimans, seeing toucans, monkeys and sloths, and swimming with pink river dolphins. Typically we get up early each morning to go for a hike, then we spend several hours working with other students on community development projects. During the trips we have been conducting research on the use of "floating meadows" (mats of floating vegetation) by birds, which will eventually be written up for submission to a scientific journal.

In 2014 the Field Biology course was also offered during the summer, when Dr. Scott Herbert and I took students on a study tour of Alaska. The highlight was a a nine hour cruise in Kenai Fjords National Park, where we saw thousands of marine birds, including two species of puffins, and dozens of marine mammals, including sea otters, humpback whales, and orcas. We also watched huge chunks of ice calve off a glacier and crash into the ocean. Other highlights included watching salmon spawn, observing several large mammals such as brown bear, moose, caribou, and dall's sheep, and seeing Mt. Denali. This summer we will be returning to Alaska with an improved itinerary, which will include watching salmon leaping up waterfalls and hopefully watching bears catch the salmon.

In addition to teaching Field Biology, I also have taken a few students on research trips to exotic locations during the summer. The students obtain academic credit for their research projects. In 2011 students Dustin Baumbach and Doug Weidemann accompanied me to Panama, where we studied the variation and hybridization of green herons and striated herons. A research article was subsequently published in North American Birds. In 2014 student Brandon Painter traveled with me to Kosrae, Micronesia, where we studied the ectosymbiotic hosts of the giant sea anemone. A manuscript has been accepted by Animal Systematics, Evolution and Diversity. And in 2015 students Cody Holthouse and Dylan Turner joined me on a trip to Roatán, Honduras, where we studied the crustaceans associating with six species of sea urchins. A manuscript has been submitted to Crustacean Research. This summer students Emily Castellanos and Erika Thalman will be joining me on a trip to Paraguay, where we will study the systematic relationship of two species of

tinamous.

Closer to home, I have spent the last six summers studying the breeding biology of two fish-eating birds, the Clark's grebe and western grebe, on nearby Clear Lake, about an hour's drive from PUC. The project has been generously funded by the National Oceanic and Atmospheric Administration, National Fish and Wildlife Federation, and National Audubon Society, and will be funded for another two summers of field work. One or two students are hired to work with me each summer as we survey breeding colonies by canoe or motorboat, and set up motion-activated cameras to record behavioral activities by grebes and predation events at floating nests. Most of the students obtain academic credit for research or an internship. Several manuscripts are being prepared for submission to scientific journals.

And finally, here on our beloved campus, this past academic year several students have helped me study the abundance and activity patterns of mammals in our "back forty," based on motion-activated cameras set up in different habitats. So far we have recorded 11 native species of mammals, including a mountain lion and a surprising northern river otter, plus a feral wild boar. The project provides an excellent opportunity for students to obtain academic credit for research without having to travel far from the campus.

COMMUNITY PARTNERSHIPS AND SERVICE-LEARNING

BY AIMEE WYRICK

Since March of 2011 students in my classes and I have partnered with several groups to enhance native ecology and restore local habitats in Napa County. Most every quarter students in at least one class spend 2.5 or more hours pulling invasive plants, planting native seeds or seedlings, and/or establishing native plant cuttings. Most of the work has been in partnership with the Land Trust of Napa County at the Linda Falls Preserve. Other work has also been done at the Wantrup Wildlife Sanctuary and Wildlake-Dunn Ranch properties. Students have also worked with the Bureau of Reclamation along the shores of Lake Berryessa and at the Lake Berryessa Visitor Center. Finally, we have participated in several projects with Tuleyome Napa to restore a highly impacted Berryessa shoreline.

I teach a number of field-based courses in which students learn about ecology and conservation. In these classes, an outing to remove invasive plants and/or restore impacted habitat is a natural fit. Most of the time the experience puts into practice what they have learned in class. This is the case for Conservation Biology lab, Home Greenhouse Gardening, Flowering Plants, and Biological Foundations. Other outings are organized as simple volunteer work parties. I estimate during the 2014-15 academic year students in my classes have volunteered over 240 hours in partnership with one of the three groups at four different locations and we are set to do as much if not more in 2015-16.

I have a great working relationship with the staff of the Land Trust of Napa County and we have developed a very successful program at the Linda Falls Preserve, just a 5-minute walk from campus, that meets a spectrum of conservation and restoration goals: invasive plant species removal, establishment of native cuttings collected from the preserve, and reintroduction of native plants.

I am currently working with Tuleyome Napa whose mission is "Protecting the wild heritage and agricultural heritage of the Northern Inner Coast Range and Western Sacramento Valley for existing and future generations" to develop a more strategic approach to their conservation work. This organization has a unique site that is just a 30 minute drive from campus. The work done here is high-impact to the community because the site is visible to anyone driving over the Pope Creek bridge. This project was also the first one I was involved with in March 2011 along with the Biology Club. This work allows students to see the progress made over time, even when they may only be there for a few hours.

PUC's location in Napa County makes these fantastic opportunities possible. I tell my students all the time: it's incredible to learn and do biology in Napa County, one of the most biodiverse parts of the world. We just go out the door and there we have an exciting world to explore. The things that we've done happen elsewhere, but here you don't have to go far.

Students in these classes are gaining practical skills and practical knowledge for bettering our world. Doing these sorts of environmental or ecological projects has long-term impacts and improve the local setting here and now in our backyard! As I often say, you don't have to get on a plane or cross an ocean to make a difference.

STUDENT RESEARCH & INTERNSHIP REPORTS

WHO ARE YOU?

Sophia Kwon spent many hours analyzing video footage of rattlesnake strikes.

My name is Sophia Kwon and I am a senior biology major. I plan on attending medical school and eventually, I hope to work as a pediatric cardiologist.

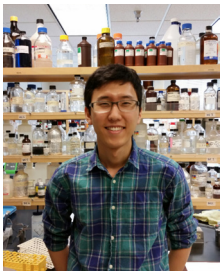
What did you do?
I participated in a research that studied the habituation of rattlesnakes. I was responsible for watching and writing down observations of behavioral traits as well as the duration of bite time for each snake. This involved frame by frame analysis of the trial run videos originally created by PUC alum Matthew Cosensci.

When and where did you do this work?
My research was conducted during spring 2015 at PUC under the guidance of Dr. Scott Herbert.

What did you learn?
I learned research is comprised of many dedicated people working toward a common goal. I also learned although at times research can be tedious, completing the task at hand is a very rewarding experience. In my case, I watched many hours of trial runs frame by frame in order to analyze the details of a snake bite. Seeing a correlation between habituation and snake behavior in the videos was a hugely satisfying experience. Lastly, I learned it is possible to face your fears through exposure, as I was previously extremely scared of snakes.

How did your experience at PUC help prepare you?
Although I had originally taken a major in biology in hopes of going into the health field, the department of biology at PUC has opened my eyes to how interesting the study of life is. Taking classes such as Vertebrate Biology and Field Biology prepared me to deal with both snakes and animal research, respectively.

WHO ARE YOU?



Chris Park studied the effects on C. elegans behavioral and neural function.

My name is Chris Park and I finished my Biology degree in March. I plan to go to medical school.

What did you do?
I conducted a study to see if food overconsumption alters behavioral or neuronal function. I used *C. elegans* (a nematode worm) for this experiment by growing them in four different food concentrations of *E. coli* OP50. After placing age-synchronized nematode worms in each media and growing them to a specific developmental stage, I measured the body weight of the worms to identify the overeating effect. Using a chemotaxis assay with diacetyl as the chemoattractant, I observed how far the worms moved due to the attractant and recorded the chemotaxis index for each group for further analysis.

When and where did you do this work?
I did research during the summer of 2015 at PUC under the guidance of Dr. Sung.

What did you learn?
I learned doing research requires a lot of effort, patience, and even small amounts of luck. I learned you have to be productive and be able to stick to a strict schedule. In research, almost everything I do needs to be backed up by published, reliable sources so finding and reading them consistently is a necessity. Also, research is very difficult in that a lot of things can go wrong in every step. I had to make sure to remember and write down all the little mistakes I made and prevent them from happening again.

How did your experience at PUC help prepare you?
Intro to Research Methods was really helpful because it helped me to learn how to set up a research experiment. Genetics was useful because I learned how to use a lot of the lab equipment in class which were needed for my research. Chemistry classes were also useful since I used many reagents and techniques learned from those classes.

WHO ARE YOU?

Raechel Opsahl used camera traps to census mammals that occur in the forest east of the PUC campus.

I am Raechel Opsahl and I finished my Biology degree in December. I will start medical school at LLUSM later this year.

What did you do?
I assisted Dr. Hayes in research involving the analysis of the spatial and temporal activity of wild mammals in the Howell Mountain area of PUC using camera traps. I was responsible for recording the data collected by the cameras (species of mammal, day/night, hour of day, and ridge/valley/spring), as well as making weekly trips to check on the cameras and exchange fresh SD memory cards, and occasionally fresh batteries.

When and where did you do this work?
My research took place during the fall of 2015 at PUC.

What did you learn?
I learned how time consuming and tedious research could be. However, I also experienced the satisfaction of determining trends from the data that are consistent with research done by other professional scientists. The process of conducting research also gave me a new perspective of just how long it takes to accumulate adequate amounts of data. I look forward to the continuation of this research project through its integration into the Vertebrate Biology class.

How did your experience at PUC help prepare you?
As a biology major, I have taken three elective classes from Dr. Hayes and was acquainted with the process of collecting and analyzing data. By taking Intro to Research Methods from Dr. Ness, I knew how to collect reputable literature sources to compare data with.

WHO ARE YOU?

Cody Holthouse conducts SCUBA surveys of crustaceans and sea urchin co-occurrence.

My name is Cody Holthouse, a senior biology major. I will attend graduate school at Utah State University and study insects.

What did you do?
I had the pleasure of traveling to Roatan, Honduras, this past September with Dr. Hayes and fellow student Dylan Turner to do research on sea urchins and crustaceans. The focus of our research was on whether decapod crustaceans preferred to associate with the longest-spined species of sea urchin, *Diadema antillarum*. Collection of data included several different snorkeling sites in

which we counted each urchin, noting whether a crustacean was present or not for each urchin.

When and where did you do this work?
Our laboratory and living quarters resembled the tree house from Swiss Family Robinson. It was located along the shore of West End.

What did you learn?
After collecting our data and taking our final tally, we found a relatively low rate of eight species of decapod crustaceans associating with six species of sea urchins. Our hypothesis that decapod crustaceans would prefer the longest-spined species of urchin, *Diadema antillarum*, was statistically significant, with 10.8 percent hosting a crustacean and no more than 1.7 percent of the other species hosting a crustacean. One thing I distinctly remember about this research trip was how novel it was to be collecting data that could potentially influence the marine science community, to realize that my actions could, and were, making a difference within the study of sea urchins.

How did your experience at PUC help prepare you?
Being a biology student has exposed me to several classes like Animal Behavior, Vertebrate Biology, Ecology, Intro to Research Methods, and many others. These classes were enjoyable when I took them, but what had once been information on paper or whiteboard, became a part of my vocabulary on the trip. My laboratory experience in Ecology had prepared me to efficiently count and collect data in the field. My time in Research Methods with Dr. Ness helped me better implement statistical analysis of our data after we returned home and writing a research paper. Not only were these classes helpful, but also the guidance of teachers (like Dr. Hayes on this trip), continue to be extremely instrumental in my understanding of the many different aspects of research.

WHO ARE YOU?

Kristine Maxam records the number of individual plants (Plagiobothrys strictus) in the sample..

I am Kristine Maxam, I graduated with my Environmental Studies B.S. in 2015. I am a Utility Forester for PG&E's vegetation management department and I inspect power lines to ensure vegetation compliance to eliminate tree related power outages and fires.

What did you do?
I did research with Dr. Wyrick on *Plagiobothrys strictus,* the endangered Calistoga popcorn flower. This research included a population survey and photo monitoring of this species flowering, individual abundance and density estimates, soil samples, and observations of the plant's pollinators.

When and where did you do this work?
My research was conducted during my junior and senior years (2014-2015) during the spring quarter at the Old Gliderport in Calistoga.

What did you learn?
I learned research and the scientific process takes a lot more time than I thought it would. I spent many hours in front of my computer researching the Calistoga popcorn flower and other related species to learn more about the conditions that provide for the best growth. Most of the information I learned about the flower came from observation. What was very exciting was to find some of the flowers had four or five petals, three variations of color on the inside, and some grew to be very tall while most seemed to be no more than 7 cm.

How did your experience at PUC help prepare you?
I was able to improve my plant identification skills in my Flowering Plants class which helped me to complete the plant census at the Gliderport quickly. Also the Geology class helped familiarize me with the volcanic soil conditions of the area and geothermal hotsprings that influence this species.

WHO ARE YOU?

Dylan Turner studied two grebe species that nest on Clear Lake.

I am Dylan Turner, a junior environmental studies major. Once I graduate from PUC, I plan on going on to graduate school.

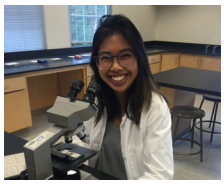
What did you do?
I assisted Dr. Hayes with a research project studying the breeding populations of western grebe (*Aechmophorus occidentalis*) and Clark's grebe (*A. clarkia*) at Clear Lake. Once a week we searched for nesting grebes by canoe and documented the number of nests, along with any eggs and chicks we saw. We also observed the nests for predation, searched for mixed pairs of grebes hybridizing, and noted which species of vertebrates also used the nests for purposes other than breeding. In addition, we used motion-activated cameras to monitor activities at nests. I examined thousands of photos looking for interesting events, such as courtship, mating, egg laying, and predation.

When and where did you do this work?
This internship was conducted on Clear Lake, in northern California, during the summer of 2015 (June-September).

What did you learn?
Classroom lectures are most definitely important and provide necessary learning. However, they can only provide so much, and the research I did clearly showed me this. The field studies used practical methods to quickly identify species and study their biology, and the idea that anything (or nothing) can happen in an instant are a few of the highlights.

How did your experience at PUC help prepare you?
As an environmental studies major I have taken several classes that prepared me well. Vertebrate Biology gave me the information needed to identify different species of birds and mammals. In addition, Ecology gave me the knowledge about different ecosystems, in which information about lakes was useful. By taking several other courses of different biological/environmental focuses, a "database" of information is achieved, and can be applied to different situations in novel ways.

WHO ARE YOU?



Natalia Gallo participated in research to examine the effects of soil mineral content on tissues in an effort to better understand podoconiosis.

My name is Natalia Gallo and I am a junior biology major. I plan to go on to medical school.

What did you do?
I assisted with research that studied the cause of podoconiosis, which is a disease of the lymph vessels of the lower extremities and is caused by chronic exposure to irritant soils, specifically in Ethiopia. I was responsible for preparing samples of soils from Ethiopia to undergo XRD analysis.

When and where did you do this work?
My research internship was for three months during summer 2015 at Loma Linda University in California working for Earth and Biological Sciences doctoral student Jamey Cooper.

What did you learn?
There are many new aspects of research I learned throughout the summer. Research is about repetitive work in the long term can help to figure out why the problem is occurring. Another aspect of research is thinking; thinking about why the certain experiment is not working and how can I get it to work.

How did your experience at PUC help prepare you?
As a biology major, I have taken classes that require a lab such as Biological Foundations as well as General Chemistry. While taking the lab portion of these classes, I learned to be precise and accurate with the preparation of the experiment, which resulted in quality research outcomes.

WHO ARE YOU?

Joseph Park tested the effects of rattlesnake venom on crickets.

My name is Joseph Park, and I am a senior biology major. I plan on getting my master's in public health and doctor of veterinary medicine.

What did you do?
I was involved in a research study on the efficacy of a potential new treatment for rattlesnake venom. I was primarily involved in the first stages of the study using live crickets as the model organism. My partners and I would inject crickets with the treatment solution and the rattlesnake venom in varying dosages.

When and where did you do this work?
My internship was at Loma Linda University with Dr. William K. Hayes for two months in the summer of 2015.

What did you learn?
The biggest lesson I learned was how incredibly creative and persistent one needs to be in order to pursue research at any level. Much of the time we spent discussing new ideas on research that could be done with other venomous animals, and the impact our predictions could make on medicine or technology. The work itself was monotonous but rewarding in its own right thanks to the camaraderie and final tally of the results.

How did your experience at PUC help prepare you?
The best experiences I had help prepare me for this internship were Vertebrate Biology, Animal Behavior, and as an animal caretaker here at PUC. These classes gave me the proper background to handle and learn about various animals and insects directly. Intro to Research Methods was a huge help in the initial design of experiments. Finally, Organic Chemistry also came in handy to calculate proper dosages.

COMING EVENTS IN SUMMER 2016

English Teacher Workshop (June 27-30, Albion Retreat and Learning Center): A new one-credit education workshop for junior-high and secondary English teachers. To learn more and to register for the class go to **puc.edu/summer-teacher**. Send your questions to **albionacademics@puc.edu**

Field Biology and Ecology (July 11-27, PUC campus and Alaska): Several lectures will be presented on campus. This is followed by a 10-day excursion to Alaska.

PacificQuest (July 17-22, PUC campus): PQ 2016 presents classes and activities centered on STEM curricula. Academically outstanding students who will complete grade 6, 7, or 8 by the start of the program should apply. To learn more go to **puc.edu/pacificquest.**

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