Courtney Anderson
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To the MBARI internship review committee,

I am excited to be applying to this internship again. When I first applied three years ago, I was just starting my engineering journey. Now I am six months away from finishing my master's degree in mechanical engineering from Stanford University. I have sought out experience in both marine biology and engineering at Stanford, hoping to one day combine these interests in my career. I come to this internship application now with new experiences in research and engineering that I believe will help create a successful internship for both myself and MBARI.

I have slowly discovered my goal to become an ocean engineer over time through several experiences. I originally began my undergraduate degree studying marine biology. After a summer of conducting molecular coral biology research, I decided that I needed more creativity in my day to day work. I took a few engineering classes and realized they were a natural fit for me because of my inclination towards math and creative projects. This realization compelled me to create my own major, called marine bioinspired design, which combined mechanical engineering and marine biology. During this time, I started working in the environmental fluid mechanics lab at Stanford, assisting a PhD student who was studying fluid dynamics around corals. I was her hench-woman, printing 3D corals, machining random parts, and operating a 90 ft wave current flume. It was then that I got the idea I could use engineering to do research.

Over the next few years, while conducting research through many Stanford programs, I discovered that I am most interested in the methods and technology used to do research. For instance, I am currently working on a research paper to investigate methods used to calculate fish biomass from visual transect surveys. In another project this past summer, I developed a new method to measure low resolution seafloor rugosity during the scientific diving field course at Hopkins Marine Station. I was able to extract gyroscope data from the embedded sensors in the GoPros that we used for benthic video transects. Using knowledge I gained from a sensor class I took last spring (A), I used the data to determine the normalized rotation experienced in the video, which I found can be used as a proxy for seafloor rugosity. These recent experiences investigating and creating research methods have been extremely enriching. I see engineering as a pathway to creating new research methods, as engineers can create technology to enable researchers to answer new questions.

I'm eager to intern at MBARI, a renowned hub for ocean engineering and research, because what y'all do aligns well with my personal interests. I believe this internship would get me one step closer to my goal of becoming an ocean engineer simply because the project I would like to work on seems like what I would like to do in my career. I am most interested in the autonomous coastal profiling float project with Gene Massion. This project combines mechanical and mechatronic expertise with a chance to understand what is happening biologically and oceanographically along our California coast. I find myself curious about the design challenge of the coastal ocean, with its wave energy, abundant biology, and crisscrossing current flows. This project also aligns well with my experience in mechanical design, sensor integration, and oceanography. I have taken relevant project classes, including mechanical design (A-), Stanford at Sea (A), and mechatronics (A-) and by the end of the school year I will have completed three graduate level robotics courses.

In addition to these academic experiences, I interned last year for six months at Tidal, an aquaculture company. During my internship I designed two pieces of equipment to be deployed in high energy, coastal ecosystems. This experience gave me real world practice with ocean conditions and how they affect engineering choices. I learned how to design and then test structures to withstand dynamic ocean loads and how to choose materials to resist corrosion. I also improved at SolidWorks, the iterative design process, and at allocating my time to meet deadlines. This background experience in mechanical design for coastal equipment and my academic background in electronics make me feel prepared to create a successful and educational experience for both myself and Gene Massion's group.

I find myself being drawn back to MBARI because of the inspiring work y'all do. I see this internship as a crucial step in my journey towards becoming a research-oriented ocean engineer. I seek this learning opportunity because while I have worked on many engineering and ocean research projects, I still lack experience in integrating these fields. Specifically, I would like to work on mechatronic systems for ocean going equipment. If not the CPF project, I am also interested in the scalable marine robotics project with Dr. Giancarlo Troni. I would like to develop my ocean engineering skills so that I have the technical ability to make other ocean devices in the future.

Thank you for considering my application,
Courtney Anderson

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EXPERIENCE & LEADERSHIP

Mechanical Engineering Department/ ME 80 Teaching Assistant
September 2023 - present, Stanford, CA

- Teach students the principles of mechanical failure, including stress, strain, torsion. Host office hours, grade homeworks, hold review sessions
- Courtney is "helpful, available, smart" and "makes things very clear and checks that you understand" (quotes from student course reviews)

Ocean Summer Camp / Camp Director and Instructor - Self Employed
January 2023 - August 2023, took place August 7-9 in Coppell, TX

- Invent and teach curriculum to excite 5th-7th grade students about the ocean
- Budget for and advertise the camp - see camp details here
- "I've had some great teachers, but Miss Courtney may be the best." - student

Graduate School of Education Makery / Makery Mentor
April 2023 - June 2023, Stanford, CA

- Brainstorm with makers to bring their project ideas to life.
- Fix broken machines and write beginner friendly machine tutorials
- Assist with 3D printing, laser cutting, sewing, embroidery, sticker making

Tidal at X, the moonshot factory / Ocean Hardware Designer
July 2022 - December 2022, 6 months, Mountain View, CA

- Designed equipment for use in extreme ocean conditions - managed two designs from their first sketches to their final manufacturing at quantity
- Led communications with external consultants and vendors
- Formulated safety calculations for Tidal's aquaculture hardware system

Environmental Fluid Mechanics Lab / Engineering Assistant
September 2021 - March 2022, 7 months, Stanford, CA

- Assisted with doctorate research investigating fluid flow through coral reefs
- Utilized CAD, 3D printing, rapid prototyping, and industrial machining to solve experimental problems

Woods Hole Oceanographic Institution / Student Engineer
June 2021 - August 2021, Summer Internship, Remote

- Designed a functional microplastic filter prototype inspired by manta ray gill filters. See my final research poster here

STEMed Labs/ Ocean Science Teacher
February 2021 - November 2021, 10 months, Remote

- Created and taught an interactive 8 week course in oceanography and marine biology to ~25 grade school students online three times

EDUCATION

Stanford University / Mechanical Engineering M.S.
January 2023 – June 2024, Present

Robotics and mechatronics (GPA 3.97)

Stanford University / Marine Bioinspired Design B.S.
September 2018 – March 2023

Course work includes mechanical engineering, oceanography, marine biology, energy science (GPA 3.94)

Stanford @ SEA / Sea Education Association
March 2022 – June 2022

Sailed aboard the Robert C. Seamans to Palmyra Atoll, repeated historical reef transects to investigate the effectiveness of large scale marine protected areas. Currently working to publish findings (12/23)

Palau Program / Stanford BOSP
June 2022 - July 2023

Studied reef recovery after typhoon Bopha using photogrammetry and ADCPs at the Palau International Coral Reef Center

SKILLS

CAD Software – Solidworks and Fusion 360

Excellent storyteller and sketch artist

Lathe, mill, power tools, sand casting, etc.

PUBLICATIONS

Virtual Human Interaction Lab/ Stanford University Collaborative Tasks in Immersive Virtual Reality Increase Learning. Queiroz, A. C. M., McGivney, E., Liu, S. X., Anderson, C. O., Beams, B., DeVeaux, C., Frazier, K., Han, E., Miller, M. R., Petersen, X. S., Woolsey, E. S., Hancock, J., Bailenson, J. N. (2023).

Sophomore College / Marine Biology & Electrical Engineering Assistant
September 2023 and 2021, 3 weeks each, Monterey and Stanford, CA

- Organized logistics, funding, field trips, class activities for 15 students
- Helped students visualize, scope, and execute their project ideas

Stanford Athletics Advisory Committee/ Co-president of Sustainability
June 2020 – August 2021, 1 year and 2 months, Stanford, CA

- Devised, promoted, and conducted a Stanford course, Sustainability in Athletics, which has been reinstalled twice since its original creation
- Initiated two recycled gear programs, donating three carloads of unused athletic gear to a local nonprofit
- Initiated conversations with Nike CSO about packaging waste

Stanford's Ocean Society / President & Financial Officer
September 2019 - June 2021, 2 years, Stanford CA

- Hosted beach clean ups, guest speakers, documentary and trivia nights
- Secured club funds, including the arts grant for our annual oceans art show

Dr. Pringle's Coral Bleaching Lab / Research Assistant
May 2020—January 2021, 5 months, Stanford, CA

- Identified key coral biomineralization proteins using bioinformatics
- Conducted coral bleaching experiments and found that hydrogen peroxide and ZnO sunscreen were not sufficient to bleach anemones
- See my final research poster here

EXTRACURRICULARS

Scuba Diving AAUS certified scientific diver, 69 dives completed

Independent Filmmaking

Stanford Women's Lacrosse Team/ DI Varsity Athlete Balanced 20+ hour weeks with a rigorous academic schedule; 2 years

Stanford | Doerr
School of Sustainability

Hopkins Marine Station

January 20, 2024

Monterey Bay Aquarium Research Institute

To the internship review committee:

I am writing this letter in exceptional support of Courtney Anderson's application for the MBARI summer internship program. I have only known Courtney for about six months, but she is one of the most talented (top 5%) and friendly students I have encountered over the past five years at Hopkins Marine Station. Courtney was a student at Hopkins Marine Station in Summer 2023, where she took my course Ecology and Conservation of Kelp Forest Communities (grade: A). In this five week course, students dive 1-2x in the morning and then participate in lecture and lab sessions in the afternoon. Courtney also visited Hopkins this fall to help with a day of diving. Though I have known Courtney for only a short time, I can share some observations that suggest she will thrive at MBARI.

Students in the kelp course complete independent projects on a topic of their choosing. Courtney applied her previous coursework on sensors to create a new approach to a fundamental question – how can we measure the topographic complexity of the seafloor? Courtney realized that the videographic surveys that my students and I have been conducting along the Monterey Peninsula had a hidden dataset, thanks to the gyroscope within the GoPro. She completed a short but compelling project that demonstrated a correlation between gyroscope data and in situ estimates of rugosity. We will collect more data this year with the aim of writing a manuscript.

The above linked video not only demonstrates her intellectual creativity, but also her aesthetic and talent for scientific communication. Related to communication, I was impressed to learn that Courtney designed and taught a 3-day summer ocean camp for middle-schoolers – in Texas. I had never seen anyone, let alone a college student, single-handedly create an academic experience that also involved financial logistics. In Courtney's retelling of her camp, her camp was full (15 students) and the students clearly enjoyed the experience. Courtney is approachable, curious, and doesn't take herself too seriously – traits that lend themselves to being a good educator.

The final anecdote I will share is Courtney's ability to bring specialists together and create synergies for the benefit a classroom. First, as a student in my kelp forest ecology, Courtney invited Dr. George Matsumoto from MBARI to share his experiences a blue-water diver and taxonomist of pelagic invertebrates. I would not have made this connection without Courtney, and the students and I really enjoyed the new perspective on science George shared. Second, Courtney was the TA for a different class and invited me to give a presentation on the natural history of our local shores, and participate in an overnight camping trip to Big Sur. Again, without her, I would probably never have received an invitation to participate from the course instructor (despite my demonstrated interest over the past five years!).

From this short time that I have had the privilege of working with Courtney, I can attest that any program that integrates field skills, coding, creativity, and the ocean in a team setting would benefit from her contributions. Her

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resume offers the additional pieces of evidence that I cannot provide, particularly related to her engineering expertise. Please contact me if you have further questions.

Sincerely,

Robin Elahi, PhD
Lecturer
Hopkins Marine Station
Stanford University

Stanford | Doerr
School of Sustainability

Oceans Department

February 26, 2024

To Whom It May Concern:

Please accept my letter of recommendation of behalf of Courtney Anderson for MBARI's Summer Internship Program.

I have known Courtney since April 2022 when she was a student in my Stanford@SEA course. In this course, students spend five weeks at Hopkins Marine Station taking courses in oceanography, nautical science and maritime studies while designing their own research project. The following five weeks are spent at sea aboard a sailing vessel where students collect data and write-up their projects while also being members of the crew. Courtney was the top student in the class, a class filled with the best of the very best students at Stanford across a variety of departments. Additionally, she has been working since August 2023 as a research intern working with myself and Dr. Barbara Block on the project she had started during the class.

Courtney is currently working on a project looking at the presence of inverted trophic biomass pyramids on a remote Pacific island. She discovered that there is a large error in the calculations of previously published manuscripts that would significantly change our interpretation of marine communitites are structured (i.e., they are not inverted!). Given this substantial and widespread finding, I anticipate that the manuscript she is preparing will be submitted to a top journal during the Spring quarter, with her as the first author. However, Courtney's true passion lies at the intersection of engineering and oceanography, hence her motivation to apply for this program.

Courtney is incredibly independent and able to move a project forward with little guidance. She is an active communicator and is able to clearly ask for the support she needs. Courtney's coding skills are amongst the best I've seen in at his career stage. She decided to learn R for this project and was generating new functions and packages within 10 weeks. Courtney is also an excellent team member, willing to step up to ensure that the science goals of our research expedition were met. Aboard the ship, she was often the first to volunteer to help and was willing to do pretty much anything to get the job done. Courtney will really benefit from participating in the MBARI's Summer Internship Program and doing a project that combines her engineering background with her oceanographic knowledge.

I have supervised over 50 students throughout my academic career. If selected to the program, I am certain that Courtney would represent one of the best, if not the best student to come through the program. I expect that, when the time comes, Courtney will be one of the top applicants to ocean engineering graduate programs. I would love to steal her away for my own lab, but I have a feeling that she may be poached by a marine technology company before she ever gets to applying for a PhD.

I highly recommend Courtney to MBARI's Summer Internship Program. She would be an incredibly valuable addition to your program and is an absolute joy to work with. If you have any questions, please do not hesitate to reach out to me.

Sincerely,

Dr. Camille Pagniello, PhD
past: Postdoctoral Fellow, Hopkins Marine Station, Stanford University
now: SOEST Early Career Fellow and Assistant Researcher, University of Hawai'i at Manoa
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