

**AGU Bridge Program Application**  
**California Institute of Technology**  
**Division of Geological and Planetary Sciences**  
October 15, 2020

## **1. Department Overview**

In the Division of Geological and Planetary Sciences (GPS), faculty and students study the earth and other planets to understand their origin, composition, and development. Our approach relies on fundamental science and on interdisciplinary collaborations with colleagues from across Caltech, as well as at the U.S. Geological Survey and NASA's Jet Propulsion Laboratory. A key strength of the GPS Division is the seamless integration of both earth and planetary sciences within one division, providing a unique perspective on our world and our universe, enabling researchers to apply lessons learned from the earth's geological past to the study of other planets throughout the solar system, and vice versa. Ever since the division's beginnings in 1926, its researchers and faculty have worked at the forefront of their fields advancing our understanding of subjects spanning earthquake mechanics, geochronology, evolution, climate science, atmospheric chemistry, and the origin of planetary surfaces and atmospheres.

Currently, GPS offers programs of study and research in [geobiology](#), [geochemistry](#), [geology](#), [geophysics](#), and [planetary science](#). The GPS Division is also the academic home for the [Environmental Science and Engineering \(ESE\) program](#) — an interdisciplinary graduate degree program in which most faculty have appointments in GPS. Graduate students in the ESE program follow the same trajectory as their GPS peers and the current GPS Academic Officer (Andy Thompson) is an ESE faculty member. Therefore, we request that both the GPS and ESE programs be included in this Bridge application. GPS's academic environment supports close collaboration between faculty and students, allows for interdisciplinary studies within and between divisions, and provides a curriculum that attracts graduate students with backgrounds in applied mathematics, biology, chemistry, engineering, and physics in addition to those that have focused on the earth sciences as undergraduates.

The GPS Division is committed to cultivating an environment that enables all of its members to thrive and realize their full potential, irrespective of individual backgrounds and circumstances. The Division recognizes that diversity has many dimensions, including race, religion, ethnicity, origins, gender, sexuality, age, socioeconomic status, and disability. We hold that the range of perspectives and values that arise from our diversity is a source of creativity and innovation and is therefore integral to our continued academic excellence. To help address the challenges of increasing diversity and fostering an inclusive climate, the GPS faculty has formed a standing committee dedicated to Diversity, Equity, and Inclusion (DEI) and an endowed fund to support its activities. We recognize a need to improve practices with regard to recruiting strong underrepresented graduate students to our program and we have identified engagement with AGU's Bridge Program as one of the critical means for achieving these goals.

## **2. Faculty Engagement**

The GPS faculty are committed to improving our recruitment and support of URM students in the Division. We have recently made a concrete statement about our priorities by creating a dedicated endowment to support diversity efforts. This endowment was funded by voluntary contributions of monetary resources from the discretionary accounts of GPS faculty, who collectively raised \$400,000 during the past summer. This included individual contributions from junior, senior and emeritus faculty. Additionally, each of the GPS Division's major centers (Caltech Center for Comparative Planetary Evolution (3CPE), Linde Center for Global Environmental Science, and the Seismological Laboratory) contributed funds that were matched by the GPS Division, bringing our current total to \$700,000. This support will be managed as an endowed fund that will provide a budget of \$35,000 each year, in

perpetuity. This DEI Fund reflects the faculty's deep commitment to the future of diversity, equity and inclusion. As an endowed fund, with an annual payout to manage, we will both have a resource for generations to come, and it ensures we will not forget the intention of the fund after the current moment, with its passions, have subsided. It will be there every year to remind us of its importance.

The Bridge application requests a list of specific faculty members who are committed to the Bridge program, and their activities. Faculty serving in key roles related to diversity, inclusivity, and mentorship are listed below, but we stress that the faculty as a whole are engaging in relevant activities. For instance, this fall we have dedicated a faculty meeting to implicit bias training, led by the Caltech Center for Inclusion and Diversity (CCID), in the lead-up to our admissions cycle. The following faculty members have contributed significant time and resources to improve the recruitment, mentoring and support of our URM students and postdoctoral researchers: John Grotzinger (GPS Division Chair, manager of DEI Fund); Paul Asimow (Chair of the DEI Committee; GPS lead for FUTURE Ignited program); Andy Thompson (Academic Officer, Bridge application lead); Jennifer Jackson (Chair of Qualifying Exam Core Committee); Jess Adkins (Chair of the Resnick Sustainability Institute's diversity initiative; Resnick lead for FUTURE Ignited program); Katherine de Kleer, Victoria Orphan, Mark Simons, Francois Tissot (DEI Committee members); Bethany Ehlmann, Christian Frankenberg, Mike Lamb, George Rossmann, Alex Sessions, Zhongwen Zhan (Academic Committee members); Paul Weinberg (Executive Officer Linde Center); Mike Brown (Executive Officer 3CPE); Mike Gurnis (Executive Officer Seismological Laboratory).

### **3. Mentoring Activities**

The GPS Division uses a number of different approaches to ensure the well-being of our students, which includes their academic and financial support, the quality of their research program, and their potential for future advancement in the field. Within the GPS division, mentoring takes place formally between students and their research advisors and informally between postdocs and graduate students.

Outside of GPS, we strongly encourage our students to take advantage of the excellent programming available through the Institute. Specific mentoring programs include the [Caltech Center for Inclusion and Diversity's](#) (CCID) Women Mentoring Women, Compass Mentoring, and Graduate Summer Research Institute programs. The CCID also sponsors numerous affinity groups for underrepresented students including Techers of Color, Black Ladies Association at Caltech, and PRISM. We also encourage students to participate in programs and training from the Center for Teaching, Learning and Outreach (CTLO), the CCID, the Hixon Writing Center, the Caltech Y, and the Student Wellness Services. These trainings and programs range from topics like writing skills and public speaking, to science policy and outreach, to short courses on queer identities and creating inclusive spaces in science, to mental health awareness and suicide prevention workshops. Our students and faculty are already very engaged with these programs with nearly all GPS graduate students participating in at least one of the aforementioned activities and with increasingly more faculty participating in programs through the CCID or CTLO.

### **4. Admission Practices**

The GPS Division typically receives close to 200 applications to its graduate program each year. Students must select an academic option (geobiology, geochemistry, geology, geophysics, and planetary science), but applications are often viewed by multiple options. The ESE program receives roughly 120 applications per year. Critically, students are not admitted into specific laboratory groups or by individual faculty; the entire faculty has the opportunity to view and comment on all applications. The initial assessment of the applications happens at the option level. For each option, the faculty in that option will view all of the incoming applications; many of our faculty have affiliations with more than one option. A current exception is in ESE, where it is not feasible to have all of the faculty members reading more than 100 applications. In previous years, two to three faculty members would read all of the applications and

make a first cut, reducing the applications by a factor of two. Although we feel confident that students in this first cut would not have been competitive for the ~10 spots in the ESE program, we realize that this approach could lead to scenarios in which individual bias creeps into the selection process. For the 2020-21 application cycle, we plan to distribute applications to the ESE faculty by subject matter such that applications are seen by roughly half of the ESE faculty during the first round. We have also removed the GRE requirement for the 2020-21 application cycle and will address future use of the GRE in a faculty meeting later this year.

Each option holds a meeting where candidates and mentoring opportunities are discussed. This is the primary stage where we consider the diversity of the applicant pool and the composition of our incoming class. We tend to make twice the number of offers we intend to admit. After each option has finished deliberating on admission offers, a separate meeting of the Division's Academic Committee (AC) occurs; the AC consists of a representative from each option and the Division's Academic Officer. At the AC meeting, we discuss the distribution of first-year fellowships. Over the past three years, all incoming first-year graduate students have been supported by a fellowship, either through the Division, the Institute, or external fellowships such as NSF or NDSEG.

Our first-year fellowships are a key component of attracting students to Caltech's graduate program. The fellowships provide a degree of academic freedom as students are not tied to a particular adviser or lab upon starting. We also encourage students to explore research options broadly, which is primarily accomplished through first-year research propositions (described below). Two years ago, we extended the first-year fellowships to a fifth term (through fall of the second year), to ensure that there was time between the completion of the qualifying examination (held in September before the start of fall term) and a final decision on joining a research group.

The new DEI Fund will enable us to offer, beginning in 2021, several first-year Diversity Fellowships to eligible applicants. These supplemental fellowships will be offered at the time of admission through recommendations from the AC and discussion among the faculty. We continue to seek ways to improve our recruitment and admissions process and we are working closely with the CCID to adopt best practices. For example, we have scheduled a Division-wide faculty training session on implicit bias that will be guided by the CCID during the fall term before the start of the admissions cycle. We have also ramped up our presence at URM-focused professional society meetings (e.g. SACNAS and ABRCMS) to broaden our graduate student recruitment.

## **5. Advising and Induction**

Upon matriculation, graduate students participate in the Institute's week-long orientation program (two weeks for international students). The programming prepares students for everything from handling finances to serving as a teaching assistant (TA) for courses (though students in GPS and ESE are not required to TA until their second year). Sessions with all student services branches of the Institute introduce students to the programs described in the Mentoring section and panels with current students introduce them to life at Caltech. At the end of the week, orientation activities specific to GPS and ESE are led in small groups by each Option Manager to introduce students to the curriculum, expectations for research, and the process of the qualifying exams.

The academic adviser is responsible for the student's academic welfare, which may involve but is not limited to selecting courses, preparation for the qualifying examination, fulfilling the requirements of candidacy, and identifying potentially productive collaborations within the Division, when appropriate. For all incoming students, the option representative acts as the initial academic adviser during the first term. An official academic adviser, who is not the thesis advisor, is assigned at the start of the second term. This appointed adviser will continue as a mentor with broad responsibility for a student's academic welfare throughout the graduate program. After passing the qualifying examination, students have a term

to finalize decisions on a primary thesis adviser (or advisers); the thesis adviser normally provides a graduate research assistantship and research mentorship.

The GPS Division has a philosophy that students should be empowered to carry out research from the start of the graduate school careers. Therefore, our qualifying exam requirements focus on two research projects (“propositions”), carried out under the supervision of two separate advisers. We encourage our students to interact broadly with the GPS faculty before selecting these projects and this provides an opportunity to build multiple mentoring relationships within the Division.

Before the end of the second year, students will consult with their academic adviser and thesis adviser to select a Thesis Advisory Committee (TAC). The TAC is composed of at least four division faculty, including the academic adviser. If the research topic warrants, key specialists from outside the division may be asked to join as advisers. At each TAC meeting, the student provides a progress report and then receives input from a group of mentors that complements their regular interaction with their primary thesis adviser. Students are required to meet with their TAC at least once per year. When the student and advisers have determined a realistic date for completion of the thesis dissertation, the TAC evolves into the thesis examining committee.

The Division is committed to preparing students for work after graduate school, both within academia and beyond. For the past two years, we have worked with Dr. Robin Javier, a STEM Communication Specialist on campus, who has organized presentation workshops for our graduate students. Starting this year, we plan to establish a GPS graduate student research symposium during which third-year graduate students will present AGU-style presentations to the Division. The goal is to increase opportunities for giving talks to broad audiences. Dr. Javier will hold a workshop prior to the symposium and provide individual, formal feedback to each presenter following the symposium. We have also created a new course to enable students to receive academic credit for supervised outreach and mentoring activities whereby they mutually benefit their own training in teaching, public understanding of science, and the breadth of the scientific enterprise.

## 6. Progress Monitoring

During **Year 1** students must complete required course work and complete two research propositions. First-year qualifying exams are typically completed in September, before the start of fall term. The format of the qualifying exam is two research presentations. The duration of the presentation is 15 minutes, followed by a comprehensive discussion of the research motivation and progress. The emphasis of the qualifying exam is not on results, but rather on understanding the literature, defining a relevant and testable hypothesis, and outlining a set of suitable numerical/laboratory/field experiments. In recent years, we have worked to improve student expectations and assessment transparency of the qualifying exam. We have developed a rubric that is distributed to the students prior to the examination that provides clear statements on how the students will be assessed. While rubric scores are not formally used to determine the exam outcome, the Chair of our Core Committee, Jennifer Jackson, analyzed rubric scores from the past two years and found that they accurately reflect exam success without any obvious bias (acknowledging a small sample size). Rubric scores are not shared with students, but students are encouraged to request specific feedback from their committee members based on the questions in the rubric. Over the past six years, the success rate of the qualifying exam has been 94.2%.

During **Year 2**, students must choose a primary thesis adviser(s) and form their TAC. The first TAC meeting must be completed by the end of spring term. During **Year 3**, students continue research progress; advancement towards candidacy must be completed by the spring of the third year. A TAC meeting (or for some options a candidacy meeting) must occur during the course of the year. For **Year 4 through graduation** students continue progress towards completion of thesis with a requirement for annual TAC meetings. Most students defend their thesis in less than six years (Division average is 5.5 years).

## 7. Data and Demographics

The following table provides information for the past three years on admissions into our GPS and ESE graduate programs.

	Applications received			Offers of Admissions			Enrolled		
	Total	URM	%	Total	URM	%	Total	URM	%
<b>ESE</b>	340	14	4%	43	3	7%	21	2	10%
<b>GPS</b>	620	48	8%	89	8	9%	52	3	6%

## 8. Equity and Inclusion Efforts

To address the challenges of increasing diversity and fostering an inclusive climate, the GPS faculty has formed a standing committee dedicated to Diversity, Equity, and Inclusion (DEI), as well as an endowed fund to support its activities. In addition to the faculty members listed in section 2, the DEI Committee includes undergraduate and graduate student, postdoc, and staff representation. The standing committee is charged with reviewing institutional processes and making recommendations to the faculty that promote inclusivity and diversity within the Division. The DEI Committee will also provide recommendations on how to best spend available resources for a broad variety of activities involving outreach, inreach, WAVE fellows, recruiting, and more. The entire Division community is encouraged to submit ideas to the DEI Committee for their consideration and meeting notes are made publicly available.

Over the past six months, GPS has held two Town Halls, open to all members of the Division, to address issues pertaining to diversity and inclusivity at the Division, Institute and national level. The most recent Town Hall addressed ongoing campus discussion around the renaming of buildings and Caltech's historical legacy of support for eugenics research. For the meetings, the Division sought advice from leaders at the CCID, and our URM students were given leadership roles in guiding these discussions. We continue to disseminate information to the Division through the [DEI Committee website](#).

To recognize our graduate students' commitment to outreach activities and to highlight the importance of these efforts in growing diversity in the geosciences, we now offer our graduates course credit for their outreach activities. We encourage students to work with the CTLO to design their outreach efforts and we are developing ways for disseminating outreach opportunities throughout the Division. We will recognize those students that, over the course of their graduate career, engage in a prolonged commitment to outreach by awarding a Certificate of Outreach in the Geosciences on their transcript. Last year we awarded our first annual student prize for exceptional commitment and effort in outreach.

In the fall of 2020, GPS will participate in Caltech's FUTURE Ignited program. The goal of FUTURE Ignited is to diversify STEM with students of color who will go on to become strong graduate students and scientific leaders in their respective fields. This year's online/virtual conference will provide insight into the life of a graduate student, how to prepare a successful graduate school application, and introduce you to the exciting research opportunities at Caltech. Participants will have an opportunity to engage in science discussions with current graduate students of color and faculty on topics ranging from challenges, research topics, building community, the application process, and more.

Finally, we have made efforts across the Division to increase the representation of outside invited seminar speakers. This will (i) bring more scientists to campus who can serve as role models for our students of color, (ii) provide more opportunities for early career scientists from underrepresented backgrounds to share their work with us, and (iii) showcase potential future faculty colleagues.