

SCRIPPS INSTITUTION OF OCEANOGRAPHY
Interdisciplinary Program
IGERT
Integrative Graduate Education and Research Training
GLOBAL CHANGE, MARINE ECOSYSTEMS AND SOCIETY
Student & Faculty Handbook
version 04/23/2010

1. Program Overview

The Interdisciplinary Project is a cross-departmental Ph.D. program that includes faculty from UCSD, as well as adjunct faculty from other partner universities, NGOs, and government agencies. The educational themes of the program are laid out in a founding NSF Integrative Graduate Education and Research Traineeship (IGERT) award to SIO “Global Change, Marine Ecosystems and Society” IGERT (http://cmbc.ucsd.edu/Interdisciplinary_PhD/).

Our program links the physical science of global change with its environmental and social consequences, and develops strategies for policy, decision-making, and communication to address the challenges brought by the massive environmental change forecast for the next century.

NSF funding is provided through the American Reinvestment and Recovery Act (ARRA). Additional funds from various sources add value to the project and we intend to continue the program after NSF funds are exhausted.

2. Vision and Goals

Effective marine conservation and the implications of global change demand interdisciplinary understanding in a period of rapid transformation of marine ecosystems. In response to this need, our Interdisciplinary Program is intended to combine disciplinary strength with training in communication, team work, economics, and public policy related to global change and marine ecosystems—all tools needed to have an impact on societal views of environmental change.

Our goal is to train professionals to understand the full dimensions of this changing landscape for the betterment of society and the natural world. We intend to prepare students for a wide variety of careers, from academics to policy, legislative work, as well as public education and advocacy.

Our vision is to make this program fully sustainable beyond the 5 year NSF funding and maintain a diversified interdisciplinary student body encouraging participation from women and under-represented groups.

3. Fellows and Associates

Students receiving stipends from the IGERT project are considered IGERT Fellows. Students who do not receive NSF IGERT stipends but have submitted an IGERT essay and are participating in IGERT classes and activities including IGERT surveys and other trainee reporting requirements are considered IGERT associates. IGERT courses and events are open to all interested UCSD graduate students. All are welcome to participate in the program and attend IGERT courses and events regardless of funding source or status as an IGERT participant.

3.1 Funding - IGERT Funding

IGERT fellows are paid the NSF required stipend rate of \$30,000 per year. The typical IGERT award is for 1 or 2 years. In addition, NSF provides up to \$10,500 for costs of education (tuition and fees). Additional fees are to be paid by the student's department. The NSF IGERT program discourages supporting students in fractions of a year so awards will run for full year increments. Students are not allowed under NSF rules to hold other fellowships, RA-ships or TA-ships while supported by IGERT.

3.2 Funding - Diversity Awards

To increase campus diversity and enhance the quality of the educational experience UCSD Office of Graduate Studies (OGS) offers the San Diego Fellowship Program. OGS has designated one two-year Fellowship each year in support of this IGERT program. San Diego Fellowships are for diversity candidates (broadly defined) only. SIO's Center for Marine Biodiversity and Conservation (CMBC) supplements these awards to the NSF level in support of our commitment to diversity and through the generosity of our donors.

3.3 Funding – Out-year and Levels of Support

It is the responsibility of the IGERT trainee and his/her mentor to identify funding for the trainee when not supported by IGERT. It should be noted that stipends for other forms of funding are typically below the IGERT stipend rate, so the trainee should plan accordingly. Trainees are advised to consult early with the graduate program director in their academic department to discuss departmental sources of support and other funding opportunities.

4. Student Responsibilities

Regardless of funding once a student is named an IGERT participant that student assumes specific responsibilities during their tenure as a graduate student at UCSD.

4.1 Biographical Statements/Website

Each participating student should submit a biographical statement and photo for the CMBC website. For format please see examples: <http://cmbc.ucsd.edu/People/Students/franck/> <http://cmbc.ucsd.edu/People/Students/aburto/>). Past experience shows that these bios are useful for potential employers, journalists and potential collaborators, and fellow students in addition to potential donors. Your bios and photographs will also be used (with your edits and permission) on the IGERT.org web site that advertizes our IGERT project and links our project with other IGERTs around the country and the SIO development office for fund raising purposes. You can also post videos or other information on your page for the IGERT.org site.

4.2 Diversity outreach

NSF and the University of California has a strong interest in expanding the reach of the Interdisciplinary Program and other academic programs to a wide group of students underserved by the university. These include students from minority backgrounds, students with disabilities and economically disadvantaged students. We would like you to participate in outreach activities to traditionally under-represented students through participation in presentations to undergraduates at schools with large diverse populations, hosting or mentoring students in undergraduate summer research programs for diversity undergraduate students

(such as U.C. STARS), or mentorship programs (e.g., MSPHD). Some events to consider:

- 1) SACNAS (Society for Advancing Chicanos/Hispanics & Native Americans in Science) annual conference
- 2) California Forum for Diversity in Graduate Education
- 3) Local minority serving institutions such as California State university – Los Angeles, San Diego Fullerton and San Marcos – and local community colleges
- 4) Diversity events at professional conferences (e.g. American Society of Limnology and Oceanography)

Although IGERT specifically prohibits use of funds for conference attendance, NSF has approved limited funds for specific diversity outreach activities. Additional outreach funding is available through the SIO department and OGS

4.3 Mentoring /Shadow Committees

The Center for Marine Biodiversity and Conservation's MAS program follows the IGERT training on a one-year fast track. When IGERT students begin training in the summer session, they will meet students with a more diverse range of experiences than the typical PhD student. Many of the MAS students have not been in academia for several years. For this reason, we encourage you to participate in a mentorship program for the MAS students as you advance in the PhD program. Mentors are expected to help the MAS students develop their Capstone research projects, guide master's students in academic excellence, and act as an informal advisor on academic matters. *A participating Ph.D. student could serve on the Capstone committee and receive academic credit, research support, or partial stipend support for the year. Doctoral students who mentor an MAS student, can receive up to \$500 for conference or research funding from the MAS program.*

4.4 Donor Outreach

Students who receive support from donors may be asked to meet with donors and potential donors and development office staff to discuss your research and your experiences in the program. Experience with donor-based fund-raising is an important skill and we encourage students to participate.

5. Program Requirements

Each student in the IGERT program has a "primary department" at UCSD, where the student is pursuing a Ph.D. degree. The IGERT program creates a layer of structure on top of the requirements of the primary department. Thus, the student must complete the IGERT requirements in addition to all of the requirements of his/her primary department (some may overlap).

The objectives of the IGERT program can be summarized in one statement: The students should develop significant interdisciplinary expertise in the program's thematic areas, and their dissertations should contribute to the literature in this regard. The requirements of the program can be divided into three main categories: (1) composition of Ph.D. committees, (2) course work, and (3) group research. The remainder of this section gives details on these requirements, followed by a description of related activities and opportunities for internships and grants through the program.

5.1 Doctoral Committee Requirements

Every Ph.D. student at UCSD must have a doctoral committee that includes at least two UC faculty or adjunct faculty members (see partial list in section 7 below) from outside of the student's primary department and who "represent academic specialties that differ from the student's chosen specialty." Typically, the doctoral committee includes at least three faculty members from the student's primary department, and one of these serves as the student's *main thesis advisor*. (Consult the Academic Senate policies for allowed variations.)

The IGERT program requires that at least one of the outside members of the Ph.D. committee be a UC faculty member who (a) represents a discipline other than that of the student's primary department, and (b) participates in the IGERT program. Here "participates" means that this faculty member will provide guidance to ensure that the student develops sufficient interdisciplinary expertise, and will help evaluate the student's progress. Hereinafter, this faculty member is referred to as the *secondary emphasis thesis advisor*.

Furthermore, unless the IGERT Program Steering Committee makes an exception, Ph.D. students from SIO are expected to have secondary emphasis thesis advisors who are faculty in the Social Science Division or Humanities Division, whereas social science and humanities students are expected to have advisors from SIO. Each student is expected to meet with his/her secondary emphasis advisor at least twice per year.

Students are encouraged to choose a primary thesis advisor by the end of their first year of IGERT funding. Switching advisors after the first year is possible and typically requires agreement of the new thesis advisor and commitment of funding to the student. Students are encouraged to establish relationships with prospective thesis advisors and secondary thesis advisors by taking the courses offered by the faculty members of interest, working in a professor's research group on a project, and by meeting directly with the faculty members. IGERT funding can help cement an advisee/advisor relationship by defraying costs normally borne by the advisor for student support. Hence, it is useful to negotiate with potential advisors at the start of one's IGERT funding rather than at its conclusion.

Although there are variations across departments, students are encouraged to begin research early in their academic careers, with the goal of developing a thesis proposal and advancing to candidacy (completing the C.Phil. examination) by the end of the third year in a Ph.D. program. The optimal timing of a student's entrance into the IGERT program depends on the course requirements of the student's primary department and thus may vary across departments. For example, the Economics Department's Ph.D. program has over one year of required "core sequence" courses, along with elective requirements, so economics students would typically seek to enter the IGERT program in the third year (and not later than the fourth year) of the Economics Ph.D. program. Students are not typically able to receive University funding after six years in the Ph.D. program and so should plan on completing their thesis research in this time frame.

A faculty member who serves as a student's main thesis advisor or secondary advisor should: (a) allow the student to take the required IGERT Program courses, (b) annually provide a short summary of the student's academic progress to the IGERT

Program office, and (c) serve as a member of the IGERT Program Steering Committee or subcommittee (typically a one year commitment) at some point during the student's tenure as a UCSD graduate student. Advisors are also encouraged to participate in offering courses that enhance the IGERT Program's curriculum.

5.2 Coursework

The IGERT Program has the following course requirements (which all students in the program must complete):

(a) SIO295/295L (16 units – Summer only) *Global Change, Marine Ecosystems and Society*. This nine-week course offers new elements to match the focus of the IGERT project: 1) discussion of the physical sciences and biological marine sciences relevant to global change, 2) global change issues seen from the perspective of the social sciences, 3) sections on negotiation, decision making, ethics, and law, and 4) informal communications and group projects. This course must be taken for credit in the student's first summer in the Program.

(b) SIO 296 (2 units) *IGERT Forum*. This course is a bi-weekly, 2-hour student-led "IGERT Lab Meeting" that will permit students to regularly interact with each other, discuss their research plans and outcomes, read, discuss, and present position papers and research literature, as well as plan and discuss the results of internships, group interdisciplinary projects and international research programs. The course is offered every quarter. It is, above all, intended to foster a sense of community among the IGERT students, help develop collaborations between students in different fields, and provide regular feedback to IGERT faculty on what is or is not working in the IGERT project. Each IGERT student is responsible for organizing this course, including speakers and topics, for at least 1 quarter. The course must be taken for credit twice per year while the IGERT program funds the student.

(c) Two or more courses in a single discipline — called the *secondary field* — that are chosen by the student and approved by the student's secondary thesis advisor. The secondary field must be in a discipline other than that of the student's primary department, so that it demonstrates the development of interdisciplinary expertise. This requirement is satisfied by enrolling, and obtaining a grade of at least "B-," in the selected courses, which may constitute a sequence or a selection of core or elective courses. Undergraduate and graduate courses are both allowed. The student's secondary thesis advisor must approve that the selected courses satisfy the secondary field requirement. The courses may be taken before the student's secondary thesis advisor has been identified; still, the secondary thesis advisor must certify that the courses taken satisfy the requirement. *See Appendix D for sample courses.*

Students are welcome and encouraged to take additional interdisciplinary courses as their schedules allow. Below are descriptions of additional courses developed or planned in conjunction with the IGERT Program; these are electives and not required (separate from requirements a-c above).

Interdisciplinary Research Project Design

This course, taught by faculty from UCSD's Rady School of Management and SIO, is intended to give students the leadership and management ability to run research programs in modern academic research environments, non-governmental

organizations, and business. The class addresses essential business skills needed to implement solutions to global change and discusses the design of interdisciplinary research programs, roles of team members, team building strategies, leadership, negotiation skills, risk management, research ethics, project budgeting, fund-raising, and communication strategies. Discussions will include case studies related to the global change theme, and the execution of research projects designed by the students. The course is intended to expose students to the business approach to the opportunities presented by global change that are rarely, if ever, discussed in most academic research programs.

ECON266 (4 units – Fall) *Natural Resource Economics*. This course introduces students to standard economic principles and models for understanding and analyzing human uses of both exhaustible and renewable natural resources. Topics include problems arising from common property resources, including such global commons as the high seas and the atmosphere. We discuss difficulties of designing efficient economic policies for the extremely long term (viz. climate change) and in the presence of large uncertainties. Regulations, including innovative “cap and trade” markets and “externality taxes” (e.g. “carbon tax”) are examined. Game theory models of negotiation and bargaining are developed and used to explore international environmental agreements to govern and manage global common resources. Three motivating applications relevant to this IGERT program are carried throughout the course – the economics of climate change, fisheries management, and the conservation of endangered marine species.

SIO286 (4 units) *Science, Conflict and Policy* (Elective course, Oreskes). This new lecture and seminar course will address the social, cultural, and political challenges to turning scientific knowledge into effective policy action. Scientists generally presume that the solution to environmental problems is to “get the science right.” Still, even when pertinent science is well established, there are many obstacles to its implementation. Science can also be used as a “tool” to extend political controversy and conflict and delay policy action. This course examines the recent history of science in the context of social policy, with an emphasis on the conditions under which scientific knowledge has formed an effective basis for policy in the 20th century. Topics will include the origins of science advising in the U.S. federal government; contrasts between the U.S. and other national and international contexts; the role of the media in stoking conflict; specific case studies such as DDT, fisheries, and climate change; and recent theoretical work on science and the state.

SIO286 (4 units) *Marine Environmental Law* (Elective course, Mengerink). This course will alternate with “Science, Conflict and Policy” and will address domestic and international laws and policies covering a range of topics including fisheries management, coastal development, land-based sources of marine pollution, marine protected areas, and resource extraction. It will include review of laws including the Coastal Zone Management Act, National Marine Sanctuaries Act, the Law of the Sea, the London Dumping Convention, and multilateral fisheries conventions, among others.

SIO286 (4 units) *Marine Science, Economics and Policy* (Elective course, Levin). Multiple themes, include sea level rise, CO₂ in the ocean, acidification, warming etc.

SIO290 (4 units) *Communicating Ocean Sciences* (Elective course, Sims, Franks-SIO). This course is an elective for IGERT students interested in science education for the public and K-8 students. The class, developed by NSF-supported California COSEE,

teaches inquiry-based instructional strategies for communicating the science and excitement of oceanography to K-8 students and teachers in local schools. The course stresses helping scientists to more effectively communicate their subject with the goals of steering some science majors into teaching professions and creating a greater awareness among scientists about the need for outreach.

5.3 Group Research

The IGERT Program requires that the students engage in some group research. This is defined broadly to include instances in which a given student obtains significant feedback from another student from a different field (preferably in the first student's secondary field), and the output of this interaction is evident in the student's dissertation as contributing to the interdisciplinary component. Typically, this kind of collaboration is expected to take place through the IGERT Forum. Furthermore, the student's main advisor and secondary thesis advisor are expected to confirm that the student has fulfilled this requirement.

Another example of group research is when two or more students in the IGERT Program work together on a project, leading to an interdisciplinary position paper or publishable technical paper. The projects may be presented at an IGERT symposium, posted on the SIO/IGERT website, and ideally submitted for publication.

Group research projects may also develop from courses. SIO286 typically incorporates a group project. This project may be expanded to include other disciplines not considered in the class and broaden or impact the results presented in the original class project.

Group research should address the research themes set out in the IGERT proposal: "Integrate research currently conducted on global change (climate drivers, ecosystem impacts, societal impacts, and impacts on belief systems and communications) to address problems posed by global change in a new and innovative way." The overarching question addressed in the proposal is: *How will global change affect the physical and biological environment and how will these ecosystem changes affect society?* Four main study regions are priorities: (1) the Line Islands in the Central Pacific, (2) the Eastern Pacific, (3) the Gulf of California and (4) the Antarctic.

5.4 Related Activities and Support

5.4.1 Mini-grants

The Mini-grant program provides funds to support any aspect of a student's individual research program or a group project, including materials and supplies for research, travel, publication charges, and costs for field assistance such as dive buddies. These funds cannot be used for conference travel or participation. Grants are typically \$3,000. Funds are available through a competitive granting process using short NSF-style proposals that are reviewed and granted by the IGERT Program Steering Committee. Examples of past successful Mini-grants are available on the IGERT Program Web site. The IGERT Program Steering Committee may ask for clarification, revisions or re-submission of Mini-grant proposals. Students are not guaranteed grant support, but the steering committee aims to provide at least modest support to every deserving student. Furthermore, normally a student would obtain no more than one mini-grant during his/her time in the program. Proposals are

accepted and reviewed three times each year, coinciding with the academic-year quarters (Fall, Winter, Spring). The deadline for mini-grant applications is the last day of classes in each quarter, as designated in the UCSD academic calendar. Instructions for preparing and submitting Mini-grant proposals are given in Appendix B and http://cmbc.ucsd.edu/Education/Interdisciplinary_PhD/Training_Program/mini-grant/

5.4.2 Internships

Every IGERT fellow is expected to participate in an Internship. This can be carried out with a domestic or international partner, outside of academia, to broaden the tools and experience that a student brings to his/her dissertation work and expand beyond the core discipline. The objective is to introduce the student to topics and organizations that he/she would be unlikely to encounter without the aid of an organized internship that is funded by the Program. Internships will typically involve several weeks to several months of work with a partner organization that expands the scope of the student's research. Examples include introducing the student to a novel aspect of research, gaining insights from policymakers, engaging in advocacy on the fringes of the thesis work, and providing information about alternative career paths. (See *examples & contacts in Appendix E*)

Students in the IGERT Program may apply for internship support in the same manner (and with the same deadlines) as required for mini-grant applications. Internship support is not guaranteed. In the case of an accepted internship proposal, the IGERT Program will typically pay for normal travel and living expenses, or will partner with the internship organization to cover these costs (\$6,000 maximum). Instructions for preparing and submitting Internship proposals are given in Appendix C and http://cmbc.ucsd.edu/Education/Interdisciplinary_PhD/Training_Program/Internships

5.4.3 Reporting

Students in the IGERT Program are required to complete the annual IGERT Survey, which is normally due in May of each year or when requested by NSF.

Please submit via email to pdockry@ucsd.edu a single .doc file addressing each of the following categories (use each as a subheading) for the annual report to NSF.

- (a) Publications - list full citation (include all authors)
- (b) Book Chapters
- (c) Conference Publications (Name of the conference and dates, title of publication or poster)
- (d) Conference Presentations (Name of the conference, date of presentation, title of presentation)
- (e) Outreach (includes Op-Eds, TV, Radio, Newspaper) & public (or school) presentations. Include title of presentation or article, media, and date of activity.

(f) Research and/or Educational achievement or finding and why it is important

(g) IGERT Highlights w/photos – to address an NSF Strategic Goal as described below.

Discovery: Foster research that will advance the frontiers of knowledge, emphasizing areas of greatest opportunity and potential benefit and establishing the Nation as a global leader in fundamental transformational science and engineering.

Learning: Cultivate a world-class, broadly inclusive science and engineering workforce and expand the scientific literacy of all citizens.

Research Infrastructure: Build the Nation's research capability through critical investments in advanced instrumentation, facilities, cyber infrastructure, and experimental tools.

Highlights may be up to 6,000 characters to describe the achievement, with photos, and another 6,000 characters to discuss how this would address the NSF goal.

Sample highlights can be found at:

<http://www.igert.org/highlights/111>

<http://www.igert.org/highlights/112>

Students are also required to submit information online. IGERT will provide each student with a username and password at the appropriate time.

5.4.4 Evaluation

Evaluation is a key element to insure that the IGERT-Program trainees are progressing well in both their departmental Ph.D. programs and the IGERT Program. Evaluation is performed mainly through each student's *Trainee T Competency and Outcome Journal*. Working with project evaluators, all IGERT affiliated students are required to complete the T Competency exercise upon program entry and maintain an outcome journal. These instruments are used to help students with goal setting and to evaluate progress over time.

5.4.5 Annual Re-Orientation Meeting

The re-orientation meeting is a time to reflect on program progress. The meeting is held in August or September. The agenda includes formal evaluation exercises and group discussion on changes to the program and issues that need to be addressed by the Steering Committee or subcommittees. Participation is required.

6. IGERT Committees

Executive Committee

PI and Co-PIs on the IGERT grant serve as the executive committee. The committee makes any time sensitive decisions required for the program's successful implementation insuring that those decisions reflect the program's visions and goals. Committee members may

make decisions via teleconference or email when meetings are impossible. Members serve on the IGERT Steering Committee and attend all Steering Committee meetings.

Members:

Dick Norris, PI

Lisa Levin, Co-PI

Lisa Ballance, Co-PI

Naomi Oreskes, Co-PI

Joel Watson, Co-PI

Faculty Steering Committee

The 10 member IGERT Steering Committee meets two to three times each year. Membership consists of those faculty and researchers who are truly engaged in the project and it's vision. A commitment to serve on the committee is a minimum of one year

Members serve in subcommittees in one-year rotations to review student's IGERT mini-grant & internship proposals. These reviews are conducted via email with each member providing comments or feedback to the student on the proposal, along with a yes or no vote with a majority rules decision.

Meeting schedule

February/March (2 meetings): A meeting for student selection is held on the Friday afternoon following SIO's Open house. Committee members review applicants and attend the IGERT symposium prior to the meeting. A separate meeting is held to review applicants from UCSD departments who provide similar presentations. Committee members may not participate in Fellowship discussions or voting if they have a student being considered for support.

August/September for the re-orientation meetings to reflect on program progress.

October (if necessary) to discuss program changes and issues that arise in the re-orientation meetings, and to confirm membership on the steering committee and subcommittees

Current members in addition to the Executive Committee include:

Andrew Dickson

Kathryn Mengerink

Sarah Mesnick

Joel Norris

Mark Ohman

Lynn Russell

Lisa Shaffer

Jennifer Smith

David Woodruff

Vic Vacquier

Student Steering Committee

The student steering committee is a student-organized group from the previous and current IGERT. The committee members insure that students are meeting their commitment to lead and coordinate the IGERT forum, help draft and update this handbook, and serve with faculty on subcommittees. Two student members are selected to serve on the IGERT Steering Committee sharing reports from those meetings with other students, help organize open house activities and host PhD candidates, voice concerns to the Faculty Steering

Committee.

Current members

Lauren Franck

Ben Fissell

Alison Fleming

Melissa Garren

Summer Martin

7. Participating Departments and Organizations

UCSD Scripps Institution of Oceanography

Birch Aquarium at Scripps

UCSD Department of Economics

UCSD Department of Anthropology

UCSD Rady School of Management

UCSD International Relations and Pacific Studies

UCSD Department of Biology

UCSD History and Science Studies

UCSD Department of Sociology

UCSD Political Science Department

NOAA Fisheries, Southwest Fisheries Science Center

Environmental Law Institute (ELI)

UCSD Sustainability Solutions Institute

Faculty Contacts and Expertise

Geosciences: **Richard Norris** (PI, paleoclimate and marine biodiversity, NRC Chair of “Lessons for Future Climate from Deep Time”, interim Associate Director of UCSD’s Sustainability Solutions Institute), **Jeremy Jackson** (Director CMBC, marine ecology and human impacts on marine ecosystems), **Neal Driscoll** (sea level, coastal processes), **Helen Fricker** (glacial processes and sea level), **Wolf Berger** (climate and biological implications of sea level change)

Climate: **Ralph Keeling** (climate and atmospheric gases, Associate Director, Sustainability Solutions Institute, Director SIO’s CO₂ monitoring program), **Art Miller** (California Current LTER), **Jeff Severinghaus** (climate variability, Director, SIO Climate-Ocean-Atmosphere Program), **Chris Charles** (climate variability) **Bruce Cornuelle** (ocean acoustics, large scale circulation; Director, UCSD Climate Institute)

Biology & Integrative Oceanography: **Lisa Levin** (Co-PI, marine ecology and restoration, acidification impacts), **Phil Hastings** (marine vertebrates, Gulf of California research), **Mark Ohman** (California Current Ecosystem LTER, plankton ecology), **Jennifer Smith** (coral ecology & climate impacts), **Stuart Sandin** (marine ecology of atolls), **George Sugihara** (theoretical ecology, climate change, fisheries, economics), **Jim Leichter** (environmental variability, coastal habitats), **Sharon Franks** (Outreach/Communications in Support of Research and Education, Educational Program Evaluation)

Chemistry: **Andrew Dickson** (ocean CO₂ chemistry), **Kathy Barbeau** (marine dissolved metals, iron fertilization), **Lihini Aluwihare** (marine organic compounds)

Birch Aquarium at Scripps: **Cheryl Peach** (education & public outreach)

UCSD - Social Sciences, Humanities, and Professional Schools—Economics: **Joel Watson** (Co-PI, Chair, Department of Economics, contracts and institutions), **Ted Groves** (natural resource economics, international agreements), **Richard Carson** (environmental economics), **Mark Jacobsen** (economics of energy markets, environmental economics), **David Miller** (cooperation with limited information), **Eli Berman** (technical change and the environment)

History & Science Studies: **Naomi Oreskes** (Co-PI, NRC member on use of models in regulatory decision-making, risk assessment of climate shifts, Provost of 6th College)

Sociology: **Steven Epstein** (sociology of science and scientific knowledge)

Political Science: **Clark Gibson** (politics of common property, administrative structures and political decision making)

Rady School of Management: **Clark Jordan** (project management; Assistant Dean, UCSD Rady School); **David Schkade** (environmental resource valuation, decision making processes, risk assessment of climate shifts)

Sustainability Solutions Institute: **Lisa Shaffer** (sustainability, public policy), **Paul Linden** (Chair, Dept of Mechanical & Aerospace Engineering; Director, Sustainability Solutions Institute)

International Relations and Pacific Studies: **Peter Cowhey** (international relations) **Junjie Zhang** (econometric modeling of complex life histories, fisheries management evaluations), **Josh Graff-Zivin** (environment/public health/development economics), **Craig McIntosh** (development economics, program evaluation)

Biological Sciences: **D. Woodruff** (biological and societal implications of sea level rise), **Walter Jetz** (global scale ecological patterns)

NOAA - Fisheries/Southwest Fisheries Science Center (SWFSC) — **Lisa Ballance** (Co-PI; climate change in tropical oceans and ecosystem management), **Jay Barlow** (ecological modeling, climate change in tropical oceans), **Dale Squires** (fisheries economics) **Sarah Mesnick** (behavioral adaptations)

Environmental Law Institute (ELI)— **Kathryn Mengerink** (natural resource law, environmental agreements)

8. Resources and Websites

IGERT.org

<http://www.igert.org>

SIO IGERT Website

http://cmbc.ucsd.edu/Education/Interdisciplinary_PhD/

SIO Graduate Student Handbook

http://scrippseducation.ucsd.edu/Graduate_Students/Current_Students/Student_Handbook/

UCSD Graduate Student Handbook

<http://ogs.ucsd.edu/StudentAffairs/handbook/Pages/default.aspx>

9. Other guidance and questions:

Please acknowledge all IGERT related publications involving research conducted while you were a graduate student (during and after your IGERT support years). Appropriate acknowledgement: "supported by NSF IGERT Grant #0903551"

Any faculty member, researcher, staff, or student who cannot find the answer to their question in this handbook should contact Penny Dockry, IGERT Administrator for guidance.

10. Appendices

Appendix A – White Papers

Appendix B – Mini-Grants

Appendix C – Internships

Appendix D - Sample Course list

Appendix E – Internship samples and contacts

White papers on Marine Conservation and Global Change

CMBC will make it a priority to raise funds for student-faculty interdisciplinary collaborations to study emerging issues at the interface between science and policy in global change and marine ecosystems. These "White papers on Marine Conservation and Global Change" are intended to draw researchers in different disciplines together to integrate research results, and directly place the most current research directly in the hands of the legislative staff, agencies, and decision makers who should be aware of the information. Hence, a major function of the proposed multidisciplinary collaborative teams of faculty and students is to make presentations of their solutions-based results to the appropriate decision-maker groups.

Each team would have 4-6 students (the size of that year's IGERT class) and 2 faculty advisors. Each group would have ~9 months to 1 year to conduct the study. The students group is expected to identify the issue to be studied, identify faculty advisors, and propose a design of the project. The IGERT advisory committee who are at liberty to propose changes in the project design will review proposals. Research topics must focus on an emerging area of concern within the general area of global change impacts on the marine environment and marine conservation. We are not interested in working on established areas of study; instead we want policy makers to be made aware of the latest cutting edge research.

Our funding goal is to provide the interdisciplinary team with a budget of ~\$30k to complete the project. A budget is required for each project proposal. Potential uses of the funds include (but are not limited to): (1) summer salary or a research fund for professors involved in the project to promote buy-in by the faculty, (2) travel either for team members to conduct research or invite experts to visit the interdisciplinary team for consultation and report writing, (3) workshop expenses to gather information or write parts of the report, and (4) publicity of the resulting report including website development, graphic production of a glossy publication, travel to agencies or press event to publicize the group's findings.

Mini-grants serve to promote high quality research and to provide students with experience in the practical side of research - proposal writing. You are encouraged to write and submit proposals for funding in areas related to global change, marine ecosystems and society. This funding can be used to supplement a current project or to engage in a new project. Team or group submissions are encouraged.

The topic of the proposal need not be related to the student's dissertation.

Two or more students may team up and generate a joint proposal on shared research. Awardees must prepare a report of their results and may be asked to provide an oral presentation on the project. Relevant IGERT faculty will work with interested students to convert their proposal into a larger proposal to a standard funding agency.

Eligibility: Students must be an IGERT Fellow or IGERT Associate at UCSD or SIO and not be expected to graduate for at least 6 months.

Proposal Contents: Cover page should contain: project title, your name, department, email id, phone number, academic advisor, email id of academic advisor, total amount requested. Maximum of 3 pages, single-spaced, 12-point times font, 1" margins (figure, equations, and references are included in this limit; however the budget and cover page are not.).

Content should include:

- Project overview or Introduction
- Research objectives or Hypotheses
- Methods
- Relationship to IGERT objectives
- Deliverables
- Relationship to thesis research

- Timeline
- 1 page budget and budget justification (maximum \$3,000)
- Literature cited

Due date:

Proposals may be submitted at any time
Proposals will be read and reviewed by the IGERT Steering Committee
Applicants will be notified of the award within 10 days of submitting a proposal, if possible.

PADI Foundation funding is available for IGERT associates conducting (scuba) dive intensive projects.

IGERT scholars are required to participate in an internship at another academic institution, a governmental or non-governmental organization or industry. The program is flexible concerning the timing and duration and location of these internships in recognition of the differing career goals of each student.

The motivation behind these internships is several-fold. First, time spent at a different institution can provide students with a unique opportunity to experience a new intellectual environment. Even when students are working on a continuation of the same project, they will have the chance to interact with people who will offer new perspectives. Second, many of these internships will be available at institutions that offer expertise complementary to that available at SIO. Thus, students will have the opportunity for training in a broader array of areas relevant to the IGERT theme than would be possible at any single institution. Third, these internships will provide perspectives on career opportunities and may help establish valuable professional contacts. Research internships in industry will provide professional training, experience with diverse and exposure to non-academic career options.

In most cases, these research internships will develop naturally from existing collaborations between SIO and UCSD faculty and those at host institutions. In general, we anticipate that these internships will take place once a student has advanced to candidacy and is underway with their thesis work (i.e. sometime after their second year in residence). It is the responsibility of the student and the faculty advisor to make arrangements for these internships. These arrangements must be approved by the IGERT steering committee.

Internships should be outlined in a brief proposal stating the objective and describing the project, location, dates and budget estimate. It should be detailed enough to provide some scientific questions or hypotheses to guide the work or provide a framework for the efforts along with some specific goals. Funding may not exceed \$6,000 including travel cost, per diem and costs for lab fees and supplies. Fees and supplies must be detailed in the budget.

Students are required to submit a brief report on the results of their internship experience within 30 days of return.

Suggested Format:

Date of Proposal
Student Name
Curricular Group
Email, phone
Advisor Name & email
Internship Institution - Name & Location
Institution advisor/contact
Internship Objective
Internship Description
Timeline
Budget

IGERT HANDBOOK Appendix D – Sample Course list

Sample courses to Satisfy the secondary field requirement

Below are courses from various departments/academic areas that would be considered to satisfy the secondary field requirement. This list is suggestive rather than definitive. A student's secondary thesis advisor has the authority to determine whether any given pair of courses (or more) shall satisfy the requirement.

Communication (Written, Oral, or Visual)

LIGN 176: Language of Politics and Advertising
COGN 20: Introduction to Communication
COGN 21: Methods of Media Production
COSF 100: Introduction to Communication as a Social Force
COCU 100: Introduction to Communication and Culture
COHI 100: Introduction to Communication and Human Information Processing
COGN 150: Senior Seminar in Communication

Education/Pedagogy

EDS 233A: Topics in Education Research and Design
CHEM 96: Introduction to Teaching Science
EDS 39: Practicum in Science and Mathematics Teaching/Learning
CHEM 187: Teaching and Learning Science
CHEM 188: Capstone Seminar in Science

Political Science

Many courses in several different areas would qualify – American politics, comparative politics, international relations, political theory, public law, public policy, etc.

Law

PHIL 168: Philosophy of Law (Philosophy Department)
SOC1 140: Sociology of Law (Sociology Department))
ENVR 110: Environmental Law (Environmental Studies Program)
HISC 131: Science, Technology, and Law (History Department)

Philosophy/Sociology of Science

PHIL 148: Philosophy and the Environment
PHIL 145: Philosophy of Science
PHIL 147: Philosophy of Biology
Soc/G 234: Intellectual Foundation of the Study of Science, Technology, and
Medicine Soc/G 249: Technology and the Human

Economics, Management

Highly relevant undergraduate courses (some have prerequisites and/or require mathematics training)

Econ 132: Energy Economics
Econ 133: International Environmental Agreements
Econ 144: Economics of Conservation
Econ 145: Economics of Ocean Resources, Econ 145

Moderately relevant undergraduate courses

Econ 109: Game Theory
Econ 107: Economic Regulation and Antitrust Policy
Econ 116: Economic Development
Econ 117: Economic Growth
Econ 130: Public Policy
Econ 151, 152: Public Economics: Expenditures I and II
Econ 155: Political Economics

Highly relevant graduate (Ph.D. level) courses, which require more extensive mathematics training.

Econ 266: Economics of Natural Resources
Econ 281: Special Topics in Economics

Moderately relevant graduate courses

Econ 231: Public Economics: Government Expenditure
Econ 237: Political Economy: Microeconomic Perspective
Econ 240: Economic Development
Econ 241: Microeconomics of Development

Highly relevant courses offered by IR/PS (masters-level courses)

IRGN 457: Cost Benefit Analysis
IRGN 458: International Environmental Policy and Politics
IRGN 459: Conflict Resolution of Environmental Issues
IRGN 487: Applied Environmental Economics
IRGN 456: Program Design and Evaluation
IRGN 413: Corporate Strategy and the Environment
IRGN 439: Policy Evaluation
IRGN 453: Sustainable Development

Moderately relevant graduate courses offered by IR/PS

IRGN 407: Policy Implementation Process
IRGN 417: Microfinance
IRGN 429: The Globalization of Production
IRGN 437: Policy Design
IRGN 448: Civil Society and Development
IRGN 451: Economic Development

Relevant courses from the Rady School of Management

MGT 202: Research for Marketing Decisions
MGT 203: Consumer Behavior
MGT 204: Marketing Communications
MGT 229: Topics in International Business
MGT 250: Biotechnology Industry, Structure, and Strategy
MGT 271: Technology Strategy

History of Science/Science Studies (Cross-listed)

OGR 225A, HIGR 238, PHIL 209A, SOCG 255A: Introduction to Science Studies
COGR 225B, HIGR 239, PHIL 209B, SOCG 255B: Seminar in Science Studies
COGR 225C, HIGR 240, PHIL 209C, SOCG 255C: Colloquium in Science Studies
COGR 225D, HIGR 241, PHIL 209D, SOCG 255D: Adv Approaches to Science Studies
HIGR 235: Science, Empire, and Exploration

HIGR 236A-B: Seminar in History of Science
HIGR 242: Topics in the History of Earth and Life Sciences
HIGR 243: Historical Scholarship in Technology
HISC 160/260: Historical Approaches to the Study of Science
HISC 162/262: Problems in the History of Science and Religion
HISC 163/263: History, Science, and Politics of Climate Change
HISC 164/264: Topics in the History of the Physical Sciences
HISC 165/265: Topics in Twentieth-Century Science and Culture
HISC 167/267: Gender and Science
HISC 170/270: Topics in the History of Science and Technology

Marine Science:

SIO280: Biological Oceanography
SIO286: Marine Science & Policy
SIO210: Physical Oceanography
SIO240: Marine Geology
SIO243: Marine Paleoecology
SIO255: Paleobiology and History of Life
SIO277: Deep Sea Biology
SIO201: Geological Record of Climate Change
SIO206: Land Surface Hydrology
SIO260: Marine Chemistry
SIO270: Pelagic Ecology
SIO271: Marine Zooplankton
SIO275A: Benthic Ecology
SIO280: Biological Oceanography
SIO282: Phytoplankton Diversity
SIO290: Marine Biology
SIO294: Biology of Fishes

IGERT Handbook Appendix E – Internship examples and contacts

Internships contacts:

University of California – Washington Center

Projects: Government agency internships

Contact: Joseph McGhee, Washington Representative IGCC, joseph.mcghee@ucsd.edu
(202)974-6295

http://www.ucdc.edu/students/science_opportunities.cfm

World Wildlife Fund Science Internships

Projects: Vary each year

Contact: Helen Fox (202)-778-9793 Helen.Fox@WWFUS.org

EcoAdapt

Projects: Climate related topics vary each year

Contact: Lara Hansen (202)390-0141 lara@ecoadapt.org

Environmental Law Institute (ELI)

Project: designing sustainable approaches to international marine problems

Contact: Kathryn Mengerink (mengerink@eli.org) 858-822-5821

COPAS – Center for Oceanography Research (Concepcion, Chile)

Project: Paleoceanography, biogeochemical cycling in the eastern S. Pacific

Contact: Carina Lange, clange@udec.cl

<http://www.copas.udec.cl>

Smithsonian Tropical Research Institute

Project: marine and terrestrial research in areas of global change and policy

Contact: Eldredge Bermingham bermingham@si.edu

Rady School of Management

Projects:

Contact:

International Relations and Pacific Studies (IR/PS)

Project: International economics, Public policy, nonprofit management

Contact:

Internship past project examples:

Nature Conservancy

Project: Conservation policy and climate change... drafting policy papers.

Contact: Peter Kareiva - In Seattle: (206)406-2249 pkareiva@tnc.org

<http://www.nature.org/tncscience/scientists/misc/kareiva.html>

The USA National Phenology Network

USANPN is a collection of universities, government agencies, and non-profit organizations dedicated to monitoring how climate change is affecting the phenology of plants and animals throughout the United States.

Contact: Abe Miller-Rushing – In Tuscon (520)622-0363

abe@wildlife.org<http://www.usanpn.org/about>

International Union for Conservation of Nature (IUCN)

Project: Coauthor a report on Climate change i.e. ocean's role in regulating climate coastal ecosystem vulnerabilities to climate change, adaptation strategies.

Contact: Tom Laughlin (Global marine Program) tlaughlin@iucn.org

Oceana – South America

Project: Synthesize existing reports on shark fisheries in Chile

Contact: Alex Munoz (Munoz@ocean.org)
<http://na.oceana.org/en/about-us/what-we-do>

Beijer International Institute of Ecological Economics

Project: Ecosystems and economic studies

Contact: Karl-Goran Maler & Anne-Sophie Crepin
beijer@beijer.kva.se

Vanuatu Cultural Center

Project: Biodiversity Database management for conservation policy

Contact: Ralph Regenvanu (Ralph.Regenvanu@vanuatuculture.org)