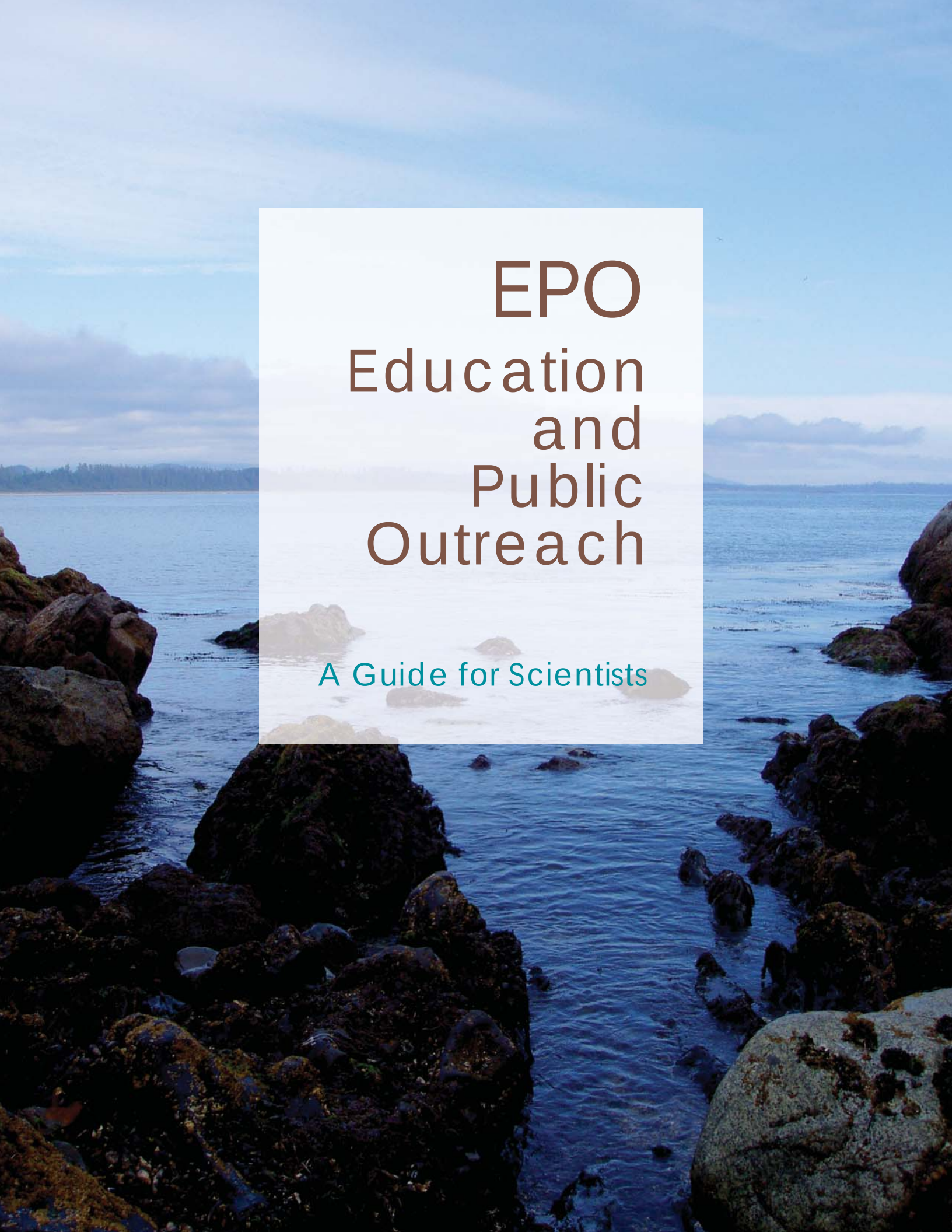

# EPO

## Education and Public Outreach

### A Guide for Scientists

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*Education: The teaching and learning of knowledge, skills, and cultural beliefs through formal (in school) or informal (self-directed) activities.*

*Public Outreach: Activities that generate awareness and interest and may also support education.*

# Introduction

This guide provides basic information for scientists who wish to engage in education and public outreach (EPO) activities. Engaging in EPO can be an excellent way to address funding agencies' requirements that proponents articulate the broader societal value of their research. Whether or not you happen to be preparing a proposal, this guide can help you recognize and contribute to high-quality EPO.

In this guide, EPO refers broadly to efforts to increase awareness and understanding of science. Audiences targeted can include students, teachers, children, adults, and just about any conceivable subset of these (e.g., economically disadvantaged youth, adult education instructors, museum visitors, parents, newspaper readers, high school students). The guide reflects our experiences in ocean sciences EPO, however, the strategies presented are readily applicable to scientists in other disciplines.

Throughout the guide we emphasize the benefits of scientist-educator partnerships. Effective partnerships result when ideas are shared, each partner's expertise is respected, and both scientist and educator work toward the common goal of delivering high-quality products and services to the intended audience. Although it is not necessary for scientists and educators to become experts in each other's fields, it is desirable for each to learn enough of the other's domain to be able to appreciate and discuss the viewpoints and constraints characterizing each discipline.

By working with EPO partners, scientists gain access to professionals who have expertise in translating research approaches and results into programs, exhibits, and other resources. Educators benefit from scientists' expertise, and products or programs resulting from the partnership can reach diverse student, teacher, and public audiences. Scientists who prefer to embark on more independent efforts may be especially interested in the section, "Communicating Effectively."

## Most High-Quality EPO Project Plans:

1. Have specific, clearly stated goals that are both ambitious and realistic.
2. Identify an appropriate audience, and address the needs of that audience.
3. Identify outcomes that are measurable.
4. Include a timeframe for accomplishing objectives.
5. Leverage or build on other EPO efforts rather than duplicate existing resources.
6. Involve professionals with appropriate scientific, technical, and pedagogical expertise.
7. Include a budget and funds to sufficiently complete the proposed work.
8. Include plans for sufficient staffing.
9. Create something of enduring value.
10. Include a plan to evaluate the success of the project.

# Tips for Preparing EPO Proposals

*Proposal preparation is often done under the constraint of limited time. These tips may be useful to those preparing the EPO portion of a research proposal.*

### Start early, ideally a month or more before your proposal is due.

### Inform yourself about what constitutes a high-quality EPO project.

### Prepare a brief lay-language synopsis of the proposed research that describes the broader scientific context of your particular research.

A few sentences may be sufficient. This passage will facilitate your dialog with potential EPO collaborators. You may wish to draw on text from your proposal summary, particularly if your proposal is a resubmission.

### Plan to include in the proposal budget funds to support the EPO project, in addition to funds to support the research.

Some principal investigators scale their EPO projects so that the EPO costs to the grant will be roughly 5–10% of the research budget.

### Determine if you want or need to enlist the support of an EPO collaborator.

If you lack sufficient experience, skills, time, or contacts to accomplish the EPO you aspire to do, partnering with an EPO professional is highly recommended. Identify and contact potential EPO collaborators to discuss your EPO ideas and/or solicit theirs. It's highly advisable to ask how your research may relate to and support existing or planned EPO efforts by their organization. Remember that EPO professionals can often help identify opportunities for supplemental funds and cost-sharing.

### Determine your EPO goals and then the appropriate audience(s)*.

Describe activities and objectives that reflect the needs of your specific audience(s).

### Determine what expertise and resources will be needed to accomplish your goals*.

For example, you might need help with writing, web-page design, event organization, curriculum development, marketing, and evaluation. Budget accordingly (e.g., salary support, facilities, supplies, travel funds), just as you would for the research-related elements of your project.

### Make plans to measure and document the success of your EPO efforts*.

If resources allow, the EPO team may also engage an independent professional evaluator to help design the EPO project, get feedback from the audience while the project is underway, and assess the impact of the project.

### Write a clear, detailed description of the EPO project for inclusion in the proposal*.

Specify goals and objectives, and state with whom you will work. Describe what you, personally, will contribute to the project. Explain who will benefit, how, and over what time period. Say why your project is likely to succeed (e.g., you've engaged the appropriate collaborators, are leveraging resources, creating something of lasting value) and how you will measure progress/success.

### Obtain, cite, and append to the proposal support letters from your EPO collaborators.

Support letters may contain details about the EPO effort that cannot fit into page-limited body of the proposal. Remember that you may also use the budget justification and the section of the proposal where you are asked to describe institutional resources and facilities.

** These steps can be greatly facilitated by consulting with an experienced EPO professional.*

## EPO Project Ideas

### Discrete Opportunities

These EPO efforts can be stand-alone activities or support larger, existing efforts.

- Interact with teachers at a professional development workshop.
- Consult with informal science center staff on the development of exhibits or public programs.
- Make a public presentation at your own or a nearby facility.
- Be interviewed by a journalist about your work.

### Sustained Opportunities

Sustained EPO efforts may allow you to develop more substantial relationships with the education community.

- Mentor a student for a science fair project.
- Host an educator or student in your lab, on a cruise, or in the field.
- Serve on an EPO-oriented advisory or review panel.
- Be a scientist-in-residence at a school, science center, museum, or aquarium.

### Product Development

You may contribute to the development of a tangible EPO product.

- Be a content expert on a curriculum-development team.
- Write a general-audience article about your work.
- Work with web designers and educators to produce online resources for non-scientists.
- Create visualizations tailored for classroom or educational program use.



## A Few More Helpful Tips

### During proposal preparation and after submission, keep your EPO collaborators apprised of major developments regarding the proposal.

Updates are especially important if your budget requires changes. Provide your EPO collaborators with copies of any proposal reviews, which can provide important feedback, regardless of whether or not the proposal is funded.

### Determine if what you're considering has already been done, in part or in whole, by others.

This may require some effort—an endeavor similar to a literature search one would conduct before embarking on a particular line of scientific work. If appropriate, cite others' work in your proposal. Describe how your proposed project will augment existing EPO programs or resources.

### Conduct an informal needs assessment to help you determine if the proposed program, product, or service will be considered worthwhile.

Consider asking representative members of the audience you intend to address how valuable what you propose would be to them.

### Notify the appropriate staff in your institution's business office early in the proposal-development process if you plan to include funds for EPO in your budget.

Depending on how business is done where you work, this notification may ensure that funds designated for EPO will be readily transferable to your EPO collaborators once the proposal is funded.

# Looking for EPO Partners

### A concern commonly expressed by scientists is: My science is extremely complex. How can I hope to base an EPO project on my work when it is difficult for some of my colleagues to understand?

Partnerships with science educators can be the key to addressing this understandable concern. Rather than teaching the details of your work, the goal of most EPO projects is to convey fundamental concepts that underpin your research, your excitement about your investigations, and the broader relevance of your discoveries. Professional science educators are adept at translating complex scientific concepts into materials appropriate for a variety of audiences. They are able to readily extract the most exciting and relevant aspects of your research for inclusion in quality EPO. Together, scientists and educators can ensure that the messages conveyed are both scientifically accurate and understandable.

Where can you find an EPO partner? Good places to look include nearby science centers aquariums, museums, and organizations that offer teacher training or professional development programs. The latter may include traditional or online university and/or community college education and extension departments. It is also worth exploring connections through national and regional educators' professional societies and federal and state agencies. Other programs and consortia as well as scientific professional societies are also excellent places to find connections to knowledgeable educators.

How might you approach an organization or individual to explore potential collaboration? We strongly urge you to seek out the individual(s) responsible for the EPO activities of the organization. Explain your interests and timeline; ask how your research may relate to and support existing or planned EPO efforts by their organization.



## Starting Points for Finding EPO Partners

- American Geophysical Union
- American Meteorological Society
- American Society of Limnology and Oceanography
- American Zoo and Aquarium Association
- Association of Science-Technology Centers
- Centers for Ocean Sciences Education Excellence
- Consortium for Oceanographic Research and Education
- EarthScope
- Geological Society of America
- Joint Oceanographic Institutions
- National Marine Educators Association
- National Oceanic and Atmospheric Administration
- National Science Teachers Association
- Ridge 2000
- Sea Grant
- Space Science Institute's Education and Public Outreach Partnership Directory
- The Oceanography Society
- U.S. Geological Survey

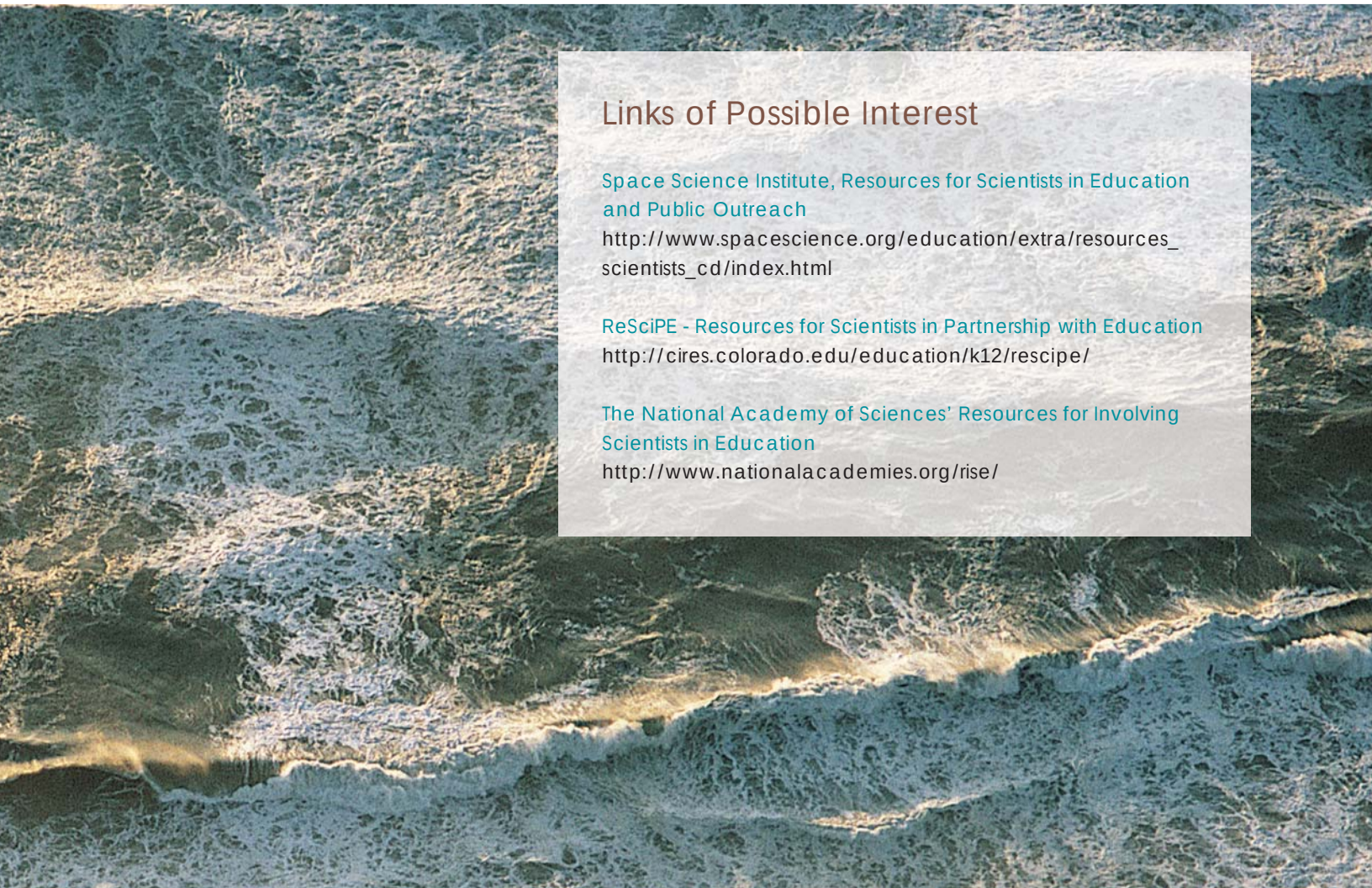
# Communicating Effectively

Whether you will be preparing a presentation for non-scientists, developing a web site*, or participating in a teacher professional development program, think carefully about how you'll get your points across. Consider the following:

- Strive for clarity and appeal to intrinsic human interests.
- Minimize jargon, or if you use a technical term, define it clearly.
- Use analogies and metaphors to explain physical or biological phenomena in terms of the familiar: bathtubs, swimming pools, cooking/eating, traffic, etc.
- Show photographs of people doing fieldwork, instruments, and the animals, plants, rocks, or waves you study. Be sure to explain carefully what is in the photo.
- Use plots, diagrams, and complex animations sparingly, or save them for your scientific publications where they will be most appreciated.
- Humor can be helpful. People may remember what you say or write better if you make them laugh.
- Explain not just what you do, but why you do it. What questions are driving you? What is the larger context for your work? Why do you find it exciting?
- Tell a story—all the better if it has some colorful characters or unresolved mystery.



**Before you add to the millions of documents available on the web, consider that many "general-purpose" web sites are of limited value to those their creators hope to reach. If you decide to go this route, pay special attention to conveying credibility and navigational ease. For more tips on web-site development, go to: http://www.tos.org/epo_guide/communicating.html.*



## Links of Possible Interest

Space Science Institute, Resources for Scientists in Education and Public Outreach
http://www.spacescience.org/education/extra/resources_scientists_cd/index.html

ReSciPE - Resources for Scientists in Partnership with Education
http://cires.colorado.edu/education/k12/rescipe/

The National Academy of Sciences' Resources for Involving Scientists in Education
http://www.nationalacademies.org/rise/

# Getting Feedback

Evaluation, however simple or sophisticated, involves the collection of information that allows one to assess the value or usefulness of a product, service, or experience. Think of it as a way to get feedback before, during, and after you conduct your EPO. You may be quite familiar with evaluation through your experiences giving and taking exams, with course evaluation forms completed by university students, and with the peer-review process by which colleagues weigh in about the merits of proposed research and the quality of manuscripts submitted for publication.

With a level of care comparable to that taken in designing a research program, a plan should be developed for getting from "where you are" to "where you want to be" in your EPO project. A good evaluation plan provides a structure for clearly understanding the need for your contribution to EPO, the desired outcomes of your project, and how the resources invested will address particular needs of the audience.

Soliciting feedback or collecting data from your intended audience at various stages in the implementation of a project is an essential component of project evaluation. Evaluation can help address questions such as:

- How likely is it that this EPO plan will succeed?
- What are the strengths and weaknesses of the EPO approach and execution?
- To what extent have the stated goals and objectives been met?

Asking such questions and devising a plan to answer them are hallmarks of high-quality EPO. The answers may prompt mid-course corrections, influence the design of future projects, and help justify the expenditure of resources to funders, colleagues, and the participating institutions.

We suggest you consult an expert, unbiased evaluator to guide you through this important process. Whether you partner with a professional or conduct your own assessment, we recommend the following three-step approach for EPO product or program development.



## Useful Links when Considering Professional Evaluation

- Information about NSF's Approach to Evaluation
  http://www.nsf.gov/ehr/rec/infoeval.jsp
- The 2002 User-Friendly Handbook for Project Evaluation
  http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf02057
- Information for Evaluation of Projects Funded by the Directorate for Education and Human Resources (EHR)
  http://www.nsf.gov/ehr/rec/eval_of_projects.jsp
- Finding an evaluator (NSF Education and Human Resources [EHR])
  http://www.nsf.gov/ehr/rec/findevaluator.jsp
- Harvard Family Research Project's evaluation periodical, The Evaluation Exchange, addresses current issues facing program evaluators of all levels, with articles written by the most prominent evaluators in the field.
  http://www.gse.harvard.edu/hfrp/eval.html

## Evaluate Before, During, and After

### Step 1: Analyze Audience

Begin with an analysis of the audience so that the project can be tailored to best suit users' needs. The objective is to understand users' interest in, familiarity with, and preconceptions about a subject area and product(s) to be developed. Reading the appropriate educational literature, or conducting surveys or focus groups, are some of the ways to solicit feedback and ground-truth an EPO project idea.

Typical questions asked during this phase, (called front-end evaluation) are:

- What is the intended audience's current state of awareness, knowledge, or skill?
- What product/program are they already using? Do they need a new, different product/program? Do they have the capabilities/skills to use the proposed product/program?
- What are their preferences for such products/programs?
- What would enable them to use and what would prevent them from using the proposed product/program?



### Step 2: Design, Develop, and Launch

During these phases, formative assessment is used to ascertain the strengths and weaknesses of what is being designed/developed/launched to ensure it works for the users. Users are often presented with design criteria, storyboards, and/or prototypes for review and asked to provide feedback on the usability of product(s). This phase may be iterative until you get the desired feedback from your user group.

### Step 3: Final (Summative) Evaluation

This phase involves reflecting on and accounting for the resources that went into a project, the activities undertaken, and the changes or benefits that have resulted.

Typical questions include:

- Whom (number of people and their demographics) has this project reached or benefited?
- How profound, deep, lasting were these benefits?
- What were the most valuable/successful elements of the project?
- What elements of the project were less successful/valuable?
- What, if any, understanding or action did the project inspire?
- How does this project/product/service compare with others like it in terms of effectiveness, reach, cost:benefit ratio?
- To what extent were the stated goals and objectives met?

# Frequently Asked Questions

### Do funding agencies support inclusion of $$$ for EPO in research proposals?

Although policies on this vary among agencies and even among divisions and programs within a single agency, the short answer is, "Yes." It is widely acknowledged that conducting research requires money for such things as salaries, equipment, and travel. Reviewers, panelists, and program officers are increasingly recognizing that designing, executing, evaluating, and disseminating quality EPO programs also require funding. Scientists and their education-focused partners should allocate sufficient funds to carry out their EPO plans.

### Will including EPO will give me any advantage in the review process?

There are many variables in the proposal review process. For large, multi-million dollar awards, a strong EPO section will enhance your chances of getting funded. Although the merits of the proposed research are paramount, NSF and other funding agencies are starting to place more emphasis on the broader impact of your proposed research. The level of attention paid to EPO is still very much in the hands of the reviewers, panels, and program managers.

### What is NSF's policy regarding Broader Impact?

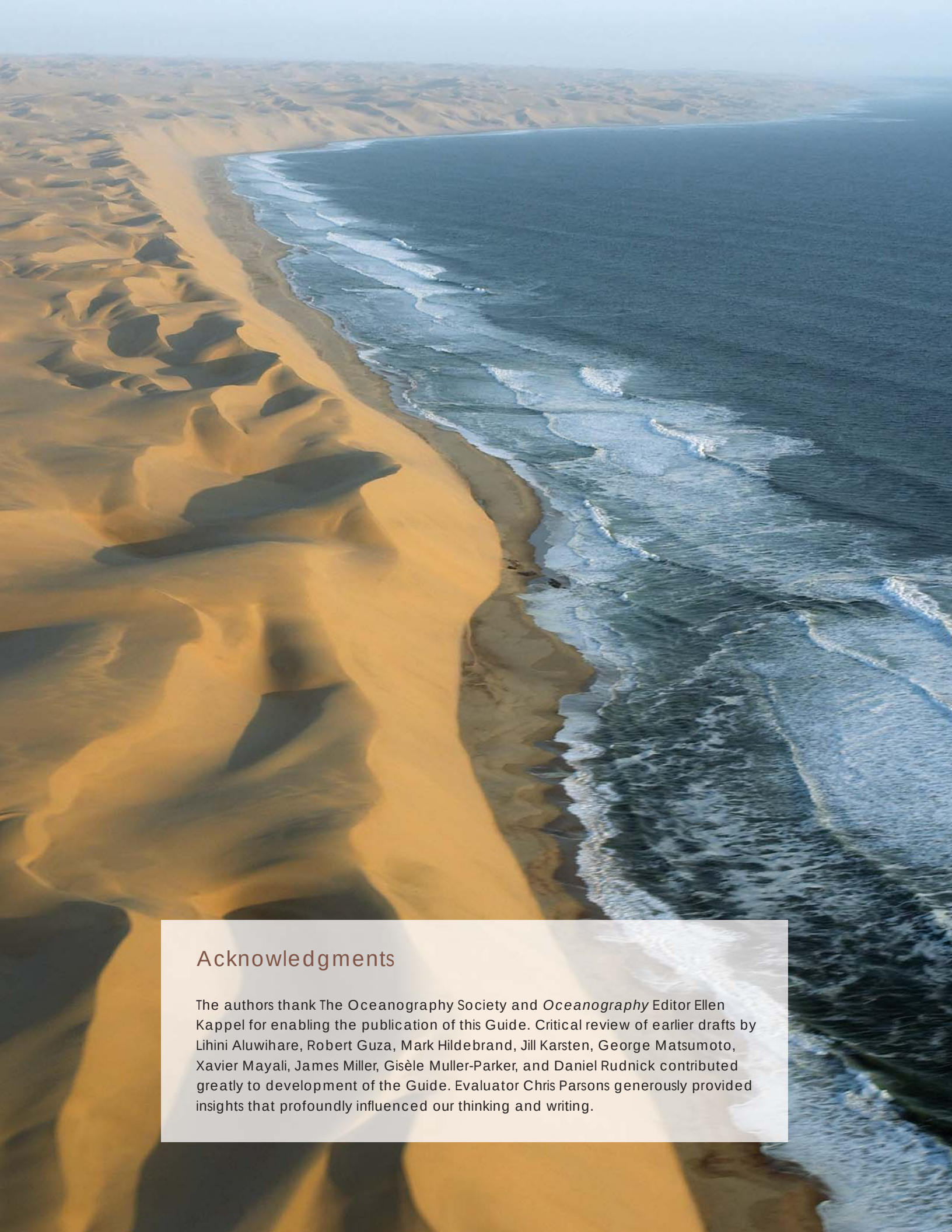
In 1997, NSF's National Science Board approved the use of two merit review criteria for NSF proposals: (1) the intellectual merit of the proposed activity and (2) the broader impacts resulting from the proposed activity. In October 2002, the NSF began returning proposals that did not include the required Broader Impact Statements. This shift in policy encourages scientists to participate in a variety of EPO projects as a way to satisfy Criterion 2. Other federal funding agencies have adopted similar policies.

### I am submitting my proposal to the Division/ Directorate X/Y at NSF. What are their particular requirements with respect to Broader Impact?

All NSF proposals are required to address merit review Criterion 2—Broader Impact. The extent to which Criterion 2 is scrutinized in the review process varies from program to program, in part reflecting the community of scientists within that discipline and/or the goals of the program. Speaking with a Program Manager is advisable if you need information on how Criterion 2 is treated for an individual program. Criterion 2 is very broad in scope and can be satisfied in many ways, one of which is EPO. For a list of NSF-recommended activities for satisfying Criterion 2, go to http://www.nsf.gov/pubs/gpg/broaderimpacts.pdf.

### How can I showcase my EPO activities in my promotion and tenure file?

Ask your EPO partner or the sponsor of the project to which you have contributed to write a letter of thanks outlining your contributions and the impact of your participation. Include this letter in the materials you submit to your department. EPO activities are increasingly considered in promotion and tenure deliberations.

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For more information on EPO visit the
EPO Guide web site at www.tos.org/epo_guide.

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