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Giant Screen Films and Lifelong Learning

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Bridging Gaps between Science and Society

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Those who have access to the expressive tools of giant screen films must harness the power this medium can wield to accurately depict the multiple faces that science and scientists present to society, a challenge that has not yet lived up to its potential.

Science has been depicted in contrasting modes in our society: as the answer to environmental woes; as an arcane field to which only the anointed have access; and as a hopelessly emotionless way of understanding our world. Scientists in our society have been similarly viewed in contradictory ways: as clear-thinking savors of the modern world; as thick-lensed nerds in lab coats; and as inarticulate hermits sequestered in remote field stations.

What is science and how should it be communicated to the general public? Who are scientists and how should they be portrayed to society? Those who have access to the expressive tools of giant screen films must harness the power this medium can wield to accurately depict the multiple faces that science and scientists present to society, a challenge that has not yet lived up to its potential.

Science comes from the Latin word *scio, sciere*, to know. Ultimately, science is about how humans come to understand the world around us. A set of approaches have come into being - the scientific methods of generating and testing hypotheses, use of deduction and induction, maintaining an objective outlook, using statistics to determine whether there are significant differences between experimental treatments, and the use of manipulations to focus in on what parameters shape particular interactions.

My own scientific interests concern the organisms and interactions that occur in the canopy of temperate and tropical rainforests. With a cadre of other scientists who have explored this "last biotic frontier" of our biosphere, I have spent the last two decades climbing trees with modified mountain-climbing techniques to perch in old-growth trees in order to measure and understand the ecological importance of canopy-dwelling plants and animals to ecosystem-level processes such as nutrient and carbon cycling of forests. In 1988, some of this work was captured in a giant screen film *Tropical Rainforest*, filmed in a tropical cloud forest in Monteverde, Costa Rica, where I have studied the ecosystem processes since 1987.

The process of making that film allowed me to create a powerful story about tropical rainforests that was shown to tens of thousands of people who watched the film in giant screen theaters all over the world. My colleagues, students and I watched with a combination of amusement, awe, and disbelief to see the giant trucks disgorging climbers, soundmen, ladder-holders, rope-slingers, huge cameras and film canisters that produced the film. I watched Ben Shedd compose the film sequence from sketches derived from his notebooks, creating images of what he projected to be the work of science. We went over and over the same sequence of actions; I rappelled with ropes from 100 feet above the forest floor to the ground below, waiting for the light, waiting for the sound, waiting for the right film moment, finally hearing the words "it's a wrap".

with other scientists, writing of a 30-page document, gathering and presenting preliminary data that will convince the reviewers that the project is doable and my colleagues and I are the ones to do the work. It must contain the backgrounds of all the scientists involved, written out in the form of *curriculum vitae*, along very carefully stylized formats. The proposals are circulated to scientists in one's field who write reviews and rate the proposal. These reviews are then themselves reviewed by a panel of scientists chosen by the program director of the NSF program to which it most closely relates. If, after all of this scrutiny, the proposal falls within the top 10%, then the scientist receives some or all of the funding necessary to answer the question.

Then the real work begins - the hiring of research personnel, the travel to the study site, the collection of samples. Very often, pilot studies are first carried out to help design the actual sequence of data collection. Preliminary studies are evaluated, modifications of the original design are made, and data begins to be tapped into the computer. When patterns begin to emerge, the scientist discusses preliminary results with peers, writes up progress reports, again evaluates and modifies design.

After data have been collected and analyzed, then comes the process of peer review of a report. Typically, scientists first report their findings orally, at a conference such as the Ecological Society of America annual meeting. This gives scientists the opportunity to informally review each other's work. Then the scientist writes a paper, which he or she submits to a peer-reviewed journal. The editor sends out the manuscript to anonymous reviewers who scrutinize the article for errors or "leaps of faith". When the reviews come back, the editor makes a decision about whether to accept the paper or reject it. Often, even if the paper is accepted, the author must respond to the comments of the reviewers and make extensive revisions. Only after those revisions will the paper be published.

Often, even if a paper is published in a good-quality scientific journal, the journey of that piece of information can be buried in the arcane language and low circulation of the scientific record. It is extremely rare for the popular press to pick up on a scientific article and bring it to the attention of the public eye.

Thus, this last piece of the process - the conveying of the message to the public - is often overlooked by the scientists. As obviously important as this step in the process is, most scientists receive little training for this piece.

That connection - between scientist and public - is crucial. The access that your films have to the general public compared to the output of a single scientific paper is in the realm of orders of magnitude. I can look up the number of times my scientific papers are cited in an Index called the SCI - Scientific Citation Index. Even my most important publication, which was featured in 1981 on the cover of *Science*, one of the two most prestigious scientific journals in the world, has been read by at most 2000 people; other papers in more obscure journals may enjoy a readership of far less than that. Sometimes all of the reprints ordered remain in their little box, requested by not a single other scientist.

In contrast, when I have appeared in films - the giant screen film, *Tropical Rainforest*; a National Geographic film called *Heroes of the High Frontier*, an educational film for children called *Voyage of the Mimi* and being a "way cool" scientist on *Bill Nye the Science Guy*, I know that my work is seen by thousands, even millions of other humans. Not only are the numbers fantastic, but the "societal credibility" boggles the mind of humble scientists who are used to talking to groups of students or fellow scientists at annual conferences. Many times I have been in airports or taxis, when the person I

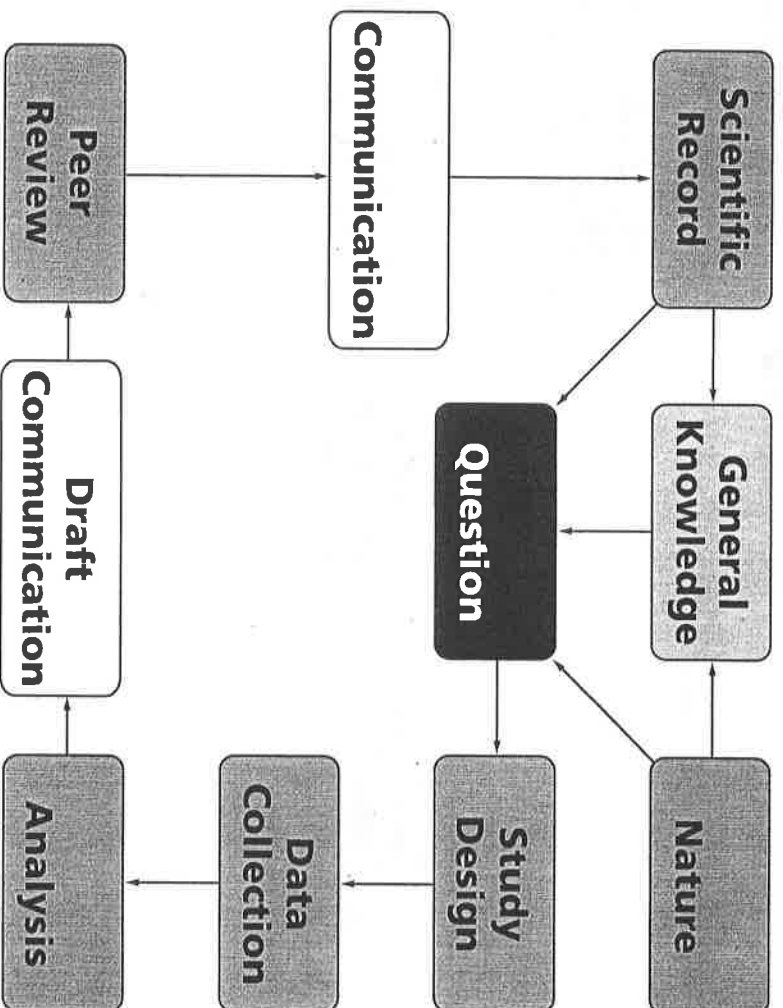


Figure 1

Supplementary Remarks

In extending her written remarks, Nadkarni stated that many scientists think that journalists and the media strive to capture the sensational in soundbites. Scientists are often portrayed as nerds working with machines: their human side may not be portrayed. Fortunately, there are more and more ways for scientists to communicate with non-scientists concerning their work. Giant screen films are one very effective way. The process of science shares many similarities with artistic creation:

- Both scientists and artists look to nature for inspiration.
- Scientists and artists often have to work alone, the scientist in the lab or in the field and the artist in a studio.
- Artists and scientists also often have to work collaboratively with others.
- Art and science involve a considerable amount of tedium and drudgery (e.g. cleaning brushes, analyzing data).
- Artists and scientists both have to communicate. Artists do so by showing their work. Scientists communicate with other scientists by publishing their analysis and results in research journals and with the public through media, including giant screen films.
- The impetus for artistic creation and scientific research comes from the wellspring of curiosity and the desire to make an impact.

The rainforest canopy presents a rich environment for researching and understanding biodiversity, with research findings of great relevance. The research goes far beyond stereotypes of primates swinging between trees. Many plants are useful for medicinal purposes. They also have economic value for their aesthetic features. Rainforest research now focuses on interactions of rainforest life. The rainforest canopy is a good setting for researching broad-scale issues such as global climate change and for looking at the social implications of related changes. For example, researchers are transplanting rainforest plants to different settings to see how they survive and how climate change and other factors interact to affect the plants. One general conclusion is that it takes a long time for plants to regenerate from the impacts of major changes in the environment. One interesting line of further research is showing how the survival or demise of some plants and animals can be used as broader indicators of change and how the changes might affect humans (cf. canaries used in coal mines to determine if the air is healthy to breathe).

As the result of rainforest research in recent years, public interest in the rainforest is heightened. To support continued research, public education and support, rainforest canopy researchers have formed the International Canopy Network (ICAN). The group is developing a Web page, has a 700-member listserve, writes articles for magazines reaching adults and children, and consults with the media on covering issues related to rainforest research. The group may serve as a model of how scientists can effectively communicate the processes, results and implications of their work to the public.

Nadkarni closed her remarks by presenting several recommendations on how giant screen film makers can present science more effectively. She suggested that film makers should:

- Educate themselves on the scientific process and the scientific content of films under development.
- Educate scientists on the communication potentials and limitations of giant screen films.
- Establish close working relationships with scientists, read scientific research journals, and seek out scientists who have a commitment and ability to communicate their scientific work to the public.