Date: Wed, 3 Nov 1999 09:40:38 -0800 (PST)
From: Burton Guttman <guttmanb@elwha.evergreen.edu>
To: "Lyttle, Lee" <LyttleL@evergreen.edu>
Subject: Re: Generally Educating the Scientist

Thanks for asking, Lee. I'm sorry it's taken me so long to reply, but you know how busy we get around here. I assume this is just a first go-around, because these are critical issues, and there's lots to say.

> A. Breadth of Knowledge
> 1. What understandings about languages and other cultures would your dream science graduating senior have?

Knows at least one foreign language (ideally something like German, French, Spanish, Russian) very well, at least well enough to read, and has some conversational facility. Has at least read about several other cultures, especially non-European, and has some conception of other cultures' worldviews. But not to ignore the European tradition: Should have a broad acquaintance with European-American tradition in music, art, literature, theatre, ideally with deeper knowledge of at least one area.

> 2. What history would s/he know? Would s/he have some exposure to the 'study of history' itself?

Understands the grand sweep of human history in the manner of Wells's _The Outline of History._ Has a firm grasp of the timescale, so is in no danger of thinking that the Civil War happened around 1930 or that Socrates was a contemporary of Henry V. Knows American history well. Has a good grasp of European history at least since the Renaissance, and has some understanding of how the development of modern science fits into that history.

> 3. Is there a psychological aspect to your field that s/he would understand? If so, can you describe just a bit of it?

Not sure I understand this question, but I'll take a stab at it. Science is a human endeavor and is done to satisfy human needs. Among those needs are aesthetic, intellectual, and security. Science has a strong aesthetic aspect that must be understood; that means appreciating the beauty and order of the universe, as well as the aesthetic dimensions of scientific theory. It isn't often appreciated that scientists seek theories that have a certain beauty and elegance, in addition to just being correct descriptions of how the universe operates. The intellectual dimension of science is largely what Richard Feynmann called "the joy of finding things out." There is deep intellectual satisfaction in finding new things, making new discoveries, and also in simply grasping as fully as possible the whole understanding of how the world operates, as revealed by modern science. Finally, science is done in part for reasons of security. We are all born strangers and afraid into a world we never made, and to exist comfortably in this world, we must understand it, know its dangers and its opportunities, know (particularly these days) how fragile it can be, how easily it can be ruined by human activity, and know what we must do to conserve and protect the world.

> 4. Is there a philosophical aspect to your field that s/he would understand? If so, can you describe just a bit of it?

Science is the principal way of knowing about the world, so it immediately raises all the classical epistemological problems. A good scientist ought to have an understanding of much of philosophy, especially epistemology, and ought to be acquainted with major issues in the philosophy of science and ought to be interested in pursuing some of those philosophical questions.

> 5. What artistic understandings, information or sensibilities related to the sciences would s/he have? Is there anything important about how art is done or how artists think that your dream senior would know?

This is a big question that I could probably answer best over a cup of coffee or a glass of beer. Science and art have some interesting and intimate connections, I think, though I don't pretend to understand this well. I think the processes of creativity in art and science are very similar. I also think science and art are at one level complementary ways of viewing the world and at another level are identical; I have in mind the excellent representations of organisms done by people with a fine ability to draw, pictures that once filled biology books and now are too often just ancient artifacts.

> 6. Are there any applicable or related environmental issues that s/he would be capable of discussing intelligently?

EVERY environmental issue. Ought to be deeply concerned about major environmental issues, should have a strong background of knowledge, should be able to bring scientific knowledge and analytical ability to bear on these issues, and should be personally involved in working on at least one issue.

> 7. Are there issues imbedded in social theory, social change, or public policy (economics, anthropology, law, political science, etc.) that your dream science senior would understand?

I have little faith in anything called social theory, but every scientist ought to have a clear understanding of the many ways science impacts social and political issues. This is another huge subject, so I'll just allude to it. Public policy is too often made solely on the basis of economic and political power with little attention to, or knowledge of, the serious technical and scientific issues. I have in mind particularly environmental issues, where policy-makers seem to know nothing about the scientific basis of the issue nor to give much of a damn about it. Scientists need to understand these complex connections and need to be involved in trying to educate the public and our legislators about the scientific realities.

> 8. What other areas of knowledge, besides the scientific one, not mentioned above would your dream science senior have a general or detailed understanding of?

My dream senior would be a broadly educated person with a least a little knowledge of many subjects, even recognizing that that could be a dangerous thing.

> B. General Skills

> 1. Are there particular critical thinking skills that are important for your dream senior to possess?

This sounds like asking, "In what manner should a scientist be able to reason?" The ability to think logically and analyze issues critically is (to me) all one complex ability, and I don't think it can be dissected into parts that one should or should not know.

> 2. What types of writing are most important for him or her to have had (expository, narrative, research, expressive, grant, others)?

Sure, all those things, but primarily just the ability to write well, an ability that I'm afraid we may not be developing very well at Evergreen.

> 3. Which artistic skills or capabilities would your dream science senior have?

A basic ability to draw. I wish mine were better developed. Of course, I'm also assuming a lot of general knowledge of art, as I've mentioned elsewhere.

> 4. What type of research skills would s/he have that would be most useful?

Whaddya mean? Every scientist has particular abilities characteristic of the particular science. You mean ability to search for information using library tools? In that case, the answer clearly is a good working knowledge of all modern library methods.

> 5. Does your dream senior excel in a particular type of oral communication (public presentation, small group discussion, debate/rhetoric, other) that will serve him or her particularly well as a scientist or science enthusiast?

He/she is well-spoken and is able to stand up in a large group and articulate ideas and arguments clearly and persuasively.

> 6. What other skills not mentioned would your dream graduating science senior have?

Let's see--walks on water, leaps tall buildings in . . . Well, you get the idea.

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