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EDITORIAL

Citizen Scientists Generate Benefits for Researchers, Educators, Society, and Themselves

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WHAT, EXACTLY, IS A "CITIZEN SCIENTIST"? "The term 'citizen scientists' refers to volunteers who participate as field assistants in scientific studies. Citizen scientists … are not paid for their assistance, nor are they necessarily even scientists."[1] Two hundred years ago, everyone was a citizen scientist and made their living in another profession. Ben Franklin, who invented the lightning rod and bifocals, made his living as a printer, diplomat, and politician. Contrast that with today's call from the National Oceanic and Atmospheric Administration National Weather Service to "Be a Citizen Scientist" (www.weather.gov/om/brochures/Citizen_Scientist.pdf) and join its network of 230,000 trained severe-weather spotters.

In September 2011, you may have heard that an amazing event occurred: citizen scientists formulated a structure for a key enzyme related to the development of the AIDS virus by using FoldIt,[2] an online game in which volunteers can shake, wiggle, or pull apart different pieces of a protein molecule (http://fold.it/portal/). It took these gamers a mere 2 years to crack a code that had eluded scientists. What you may not know is that this breakthrough was just the latest contribution by citizen scientists, who are increasingly moving into the life sciences, and that FoldIt was created because of a project called Rosetta@home.[3]

Rosetta@home, like the more famous SETI@home that sorts through radio signals in the Search for Extraterrestrial Intelligence (SETI), harnessed volunteers' unused computer power to research complex issues through so-called grid computing. When the volunteers noted to the researchers that they could do a better job of manipulating the molecule than the computer, the researchers developed the FoldIt program, and the rest, as they say, is history.

It is interesting to note that most of the gamers didn't have sophisticated knowledge of biology, but instead had good spatial reasoning skills—something that is difficult to emulate in a computer program. We don't know yet whether these successful gamers have increased their knowledge of and improved their attitude toward science, but an earlier study may provide some clues.

Environmental science was one of the first fields to solicit volunteers in projects such as the National Audubon Society's Christmas Bird Count, which began in 1900. The Birdhouse Network (TBN) is a more complex citizen scientist project involving the creation of nesting boxes and reporting on the behaviors of cavity-nesting birds such as swallows; interaction with TBN staff is encouraged. In a standardized evaluation of this project, the researchers determined that participants' knowledge of bird biology increased, but they were unable to detect a significant increase in attitude toward science or the environment, or increased knowledge of the scientific process. As a result, the authors suggested, "Citizen-science projects that hope to increase understanding of the scientific process should be framed in a way that makes participants particularly aware of the scientific process in which they are becoming involved."[4]

How can we encourage more individuals to become citizen scientists? As we wrote in our last editorial about engaging the public in scientific discourse, how we frame the issue is key. Also important are the software and other tools that make participation easy. Most citizen scientists, such as those now becoming involved in genomic research, derive satisfaction from knowing that researchers will use the data they contribute. Science grant recipients will increasingly find public outreach requirements as a condition of funding, and should welcome the opportunity to engage citizens in a way that encourages participation.

As National Academies of Science researchers put it, "Citizen science has a number of benefits for four separate communities. For scientific researchers, it allows projects that were previously impossible to be done quickly and easily. For volunteers, it can provide fun, a sense of community, and the ability to contribute to science. For STEM (science, technology, engineering, and mathematics) educators, it can offer the opportunity for increased learning, a window into the process of science, and a chance to promote the idea that 'I can do science.' For society at large, it can build a closer connection between scientists and the public, and can result in a public with increased knowledge about science and scientific habits of mind."[5]

Given that anyone with Internet access has the potential to serve as a citizen scientist, we think that cybertherapy projects and citizen scientists are a good fit. We hope that you, our CYBER reader, will consider the benefits of engaging citizen scientists to the fullest extent possible in your work as you test and validate new virtual environments and related technologies.

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