Experiences with a science hotline

LAURA J. EVANS AND DONALD T. FRAZIER
Department of Physiology and Biophysics, College of Medicine,
University of Kentucky, Lexington, Kentucky 40536-0084

Evans, Laura J., and Donald T. Frazier. Experiences with a science hotline. Am. J. Physiol. 264 (Adv. Physiol. Educ. 9): S1-S7, 1993.—Scientific literacy of the population may be enhanced by outreach programs conducted by universities. One such program, the University of Kentucky Science Hotline, has been successful in attracting and answering many inquiries from students, teachers, and others. The authors describe the organization and management of this hotline. The operation is inexpensive and efficient, with 35 faculty and staff members in 21 departments responding to 515 calls during the first year of operation. Fifty-four outreach visits were arranged through the hotline. Other benefits have included a more positive public image of scientists and the creation of links between academic scientists and precollege teachers.

EDUCATION has been one of the hottest topics of debate in the late 1980s and shows signs of continuing unabated throughout the 1990s. There is a growing national awareness that our educational system is failing to empower our children to be competitive in the world marketplace. The catch phrase “functionally illiterate” is applied to an alarming number of people who do not read well enough to fill out a job application or who cannot read a road sign. Perhaps even more disturbing is the revelation concerning scientific illiteracy. National surveys indicate that only 5–7% of our population qualifies as scientifically literate (1). Whereas our society may have a general appreciation for science, there is little understanding of the process. Unfortunately, this lack of understanding has led to many attacks on the scientific community by animal rights activists and antiscience organizations.

There is a growing movement among precollege and college educators to improve the science education in the United States. Why do we need to make science a basic rather than optional part of the curriculum for grades K–12? First, at a time when technology is developing at an ever increasing rate, the number of applicants to many college science programs is remaining steady or even dropping. By increasing the scientific interest of primary and secondary students, we hope to increase the number of students choosing science as a career. This is essential to universities and industries, which will need increased numbers of chemists, biologists, engineers, and physicists in the coming years. Second, we need to increase the scientific literacy of the general population. In the next few decades the American public will make political decisions about such issues as gene therapy, alternative energy sources, environmental protection, and a multitude of medical advances. There is an entire industry based on selling fad diets, megavitamins, and questionable cures for cancer and acquired immune deficiency syndrome (AIDS). The target is people who do not have a basic grasp of health science. We cannot expect people to make scientifically based conclusions if we do not give them a solid educational base in science.

The obvious questions are, therefore, “What can we do to increase science literacy?” and “Who is going to do this?” It would be easy in this decade of widespread budget crises to acknowledge the problem and then defer it to better financial times. The seriousness of the situation makes this position unwise. A very low-budget and high-impact program for improving science literacy would be to engage the relatively untapped resource of this country’s college and university faculty in outreach efforts. These faculty are in the unique position of being involved in the latest scientific research, as well as being the educators of precollege teachers. The involvement of an army of individual science and biology college faculty members with teachers, students, and parents on the local community level could greatly enhance the appreciation of science. The time commitment for each faculty member would be small, but the overall impact can be great. Typical programs that are being developed both in our department and nationally include teacher workshops to improve science teaching techniques, visits by school groups to university labs, summer research opportunities for high school teachers and students, and college faculty involvement in classroom activities.

The cornerstone of our Science Outreach Program is the statewide toll-free University of Kentucky Science Hotline (800 number), set up to receive calls from students, teachers, parents, and other citizens with a scientific inquiry. The notion for a hotline stemmed from the need to establish a better communication link between the University of Kentucky Department of Physiology and Biophysics and high school teachers who were taking part in our annual high school teachers’ workshops. We felt that providing easy access would cement the relationships developed between our staff and the participants. As anticipated, there has been a dramatic increase in the number of requests for tours of the Department of Physiology, speakers for science clubs, and information for students interested in college science programs. The scope of the hotline continues to increase as a direct result of the media publicity it has received. The only real costs are for the operation of the phone line itself, and yet it has the potential to impact on every student and teacher in the state.

The first step in establishing a science hotline is to secure permission and support from the appropriate institutional authorities. The source of funding will determine whether it is a physiology department, college of medicine, medical center, or university service. It is important to encompass the entire institution, if possible. The University of Kentucky Science Hotline is staffed by university operators 24 h/day, 7 days/wk. Operators answer calls and record the caller’s name, phone number, age, and question. This information is forwarded to the coordinator (DTF), who either answers the call himself or forwards it to an appropriate faculty member or

S4 1043-4046/93 $2.00 Copyright © 1993 the American Physiological Society
other resource. Any student, teacher, or parent with a substantive question or a need for resource material related to science activities may take advantage of this hotline. It was important to state up front that the hotline was not established to do students' homework or to provide medical advice on the phone. A hotline is relatively inexpensive; in our case the cost of the toll-free 800 line and the operators to answer it is \( \sim \$1,500 \) yr. It is important that an operator handle the calls rather than use an answering machine. Most children do not have experience leaving complete messages on answering machines. The presence of a live operator adds human warmth and ensures that we will have adequate information with which to answer the call. The operator can prompt the caller for information about the question, allowing us to route the question to the appropriate consultant.

Answering all these questions is a significant undertaking. In the fall semesters, August through December, we get an average of 4 calls/wk. In the spring semesters, January through May, the number jumps to 10-16 calls/wk because most science fairs are held in February and March. All data about each caller, including age, hometown, type of question, and who answered it, are entered into a database manager program that allows us to generate summary reports. Periodic analysis of these reports helps us to evaluate our progress in each geographic region in the state.

It is very important to develop a consultant list for ready reference. The directors of the various graduate and professional programs are ideal as initial contacts. On most campuses, names of program directors can be obtained from the graduate school Dean's office. We have experienced a tremendous enthusiasm from faculty, and it has been easy to recruit contacts to return students' calls. We have over 35 faculty and staff in 21 different departments who have served as resources for answering questions. These consultants come from the Colleges of Medicine, Agriculture, and Arts and Sciences, as well as the Center for Biomedical Engineering, Center for Robotics and Manufacturing Technology, and Computing Center. Many of the faculty call students back themselves, offering themselves as permanent resources for individual students. We also are able to refer students through the hotline to such resources as the Kentucky Arthritis Foundation, the Cancer Network, and the Kentucky Assistive Technology Service Network.

Although the majority of the calls could be answered by the hotline coordinator, it is wiser to utilize as many expert contacts as possible. For example, the coordinator could provide a high school student with a list of symptoms of Fetal Alcohol Syndrome, while a neonatologist might also discuss with the student the socioeconomic effects of the disease or the emotional impact on the parents. This one-to-one interaction is far better than one coordinator responding to hundreds of calls. One major reason for establishing a hotline is to make this wellspring of resources available to precollege students. It is, therefore, important that the coordinator refer calls to the experts and resist the temptation to become the science guru. This should not diminish, however, the importance of a dedicated hotline coordinator. It is essential to have one person who oversees the calls, making sure each is answered in a timely manner and identifying the appropriate resources.

After the Science Hotline was established, the next priority was to advertise this service throughout the state. Notices were placed in the statewide publications of the Kentucky Science Teachers Association and the Kentucky Educational Association. In addition, the hotline was featured in radio, television, and newspaper releases, with much of the impetus emanating from the media itself. On the first day of operation the hotline received 14 calls, from teachers, parents, and students in five counties. Calls included a teacher asking for environmental science project ideas for fourth graders, a 13-yr-old asking for advice on a microbiology science project, an 8-yr-old with a question on the effects of exercise on weight gain in mice, a community college student wanting information on a University of Kentucky graduate program, a high school science teacher who wanted to bring her class on a field trip, a parent needing help with her son's science project, and a high school teacher asking for information on the University of Kentucky's Minority Teacher's Program. It was immediately clear that a need existed, and the university faculty were positioned to play a very important role in helping to revitalize the science curriculum.

The first year of operation, January 1991 through March 1992, resulted in a total of 515 calls from 63 Kentucky counties. The calls were from 422 students (82%) from grade 1 through college, 63 teachers (12%) of grades 2-12, 18 parents (4%) of children aged 6-11, and 12 interested Kentuckians (2%), including one 70-yr-old nursing home resident (see Fig. 1).

Figure 2 shows the number of calls from students in each grade level. We receive the greatest number of calls from students in grades 5-9. Over one-third of the calls requested help for science fair projects. It was immediately clear that in our state a large number of science and biology teachers appreciate the need for hands-on science but feel inadequately trained. Follow-up calls to teachers revealed a great deal of relief and appreciation for this extramural resource. Throughout most of Kentucky, science fairs are held for grades K-8 but not for high school students. This could account for the drop off

![Fig. 1. Origin of calls to University of Kentucky Science Hotline between January 1991 and March 1992.](http://advan.physiology.org/)
in number of calls from the higher grades and could speak directly to why the precollege science curriculum is not thriving in Kentucky, or nationally.

Calls from students covered science topics from one end of the spectrum to the other. They included astronomy, engineering, physics, ecology, zoology, botany, medicine, general biology, math, career planning, earth sciences, physiology, microbiology, anatomy, and biochemistry. For record keeping, calls were divided into general question categories (Fig. 3). The majority of calls fell in the life sciences (36%) and physical sciences (32%) categories. The rest of the calls were divided between medicine (14%), chemistry (13%), career planning (4%), and math (1%). We were somewhat surprised by the paucity of calls concerning math. It reinforced our belief that the majority of students consider math and biology to be completely unrelated.

The range of calls is revealed by the following examples. A 7-yr-old asked about the surface of the moon. A 9-yr-old wanted to know how to type blood. A 14-yr-old was designing a project to test how the color of a room affected the mood of a person. A 17-yr-old wanted to know how to use electromyograms to trigger a robotic arm he had built. Another student asked how radio waves can travel through a wall without making holes. One student had mononucleosis and wanted to know more about it. Why is blood red? Can human embryos breathe amniotic fluid? How can you reproduce acid rain? Who was the French scientist who discovered digestive enzymes? How do video display terminals affect the behavior of fruit flies? A college student wanted help designing a computer keyboard for a quadriplegic.

Teachers comprised ~12% of the callers. As shown in Fig. 4, over one-half of their calls were to seek advice or solutions to science-related questions. Calls from elementary school teachers consisted mainly of specific questions they needed more information about for their students, such as whether a squid can regenerate a severed tentacle. High school teachers more often requested information on college programs for their students. Many callers asked for help on laboratories they were designing, such as building a heart model or testing the effectiveness of sun blocks. Twenty-seven percent wanted to arrange visits to the university, and 18% requested a speaker to come to their school.

Most parents who learned about the service called to solicit help with their children’s science projects. They frequently felt frustrated and inadequate and welcomed any help that could be provided. There were several calls about pets and about animals found in the yard and one call from a woman with a violent iguana. The positive public image created by this small service was outstanding.

We were somewhat surprised to receive calls from citizens not directly involved with students or schools. A fireman involved in a program to educate children about fire safety was looking for a source for lycopodium powder, which he used in his demonstrations. An elderly man in a nursing home had read about the problem of tiger mollusks in the Great Lakes and wanted to discuss with a university student a theory he had about controlling their adverse behavior. A local physician wanted to know whether a certain chemical was carcinogenic, and a radio disc jockey wanted to know the purpose of a turkey’s wattle. One caller best exemplified the public relations value of the service with the comment that, for the first time, the public had access to the resources of its university.

Demographics indicate calls from 63 of Kentucky’s 120 counties (Fig. 5). Although the majority of callers are in the central and eastern parts of the state, we are seeing a slow but steady increase in calls from the westernmost counties. The University of Kentucky is located in Fayette County and has traditionally served central and eastern Kentucky.

One measurement of the success of this service has been the large number of on- and off-site outreach visits
arranged through the Science Hotline. The Science Outreach Program now averages visits from 18 high school groups per year to the university, with an average of 30 students/group. During these visits individual departments can arrange lab tours, scientific demonstrations, and career counseling for high school students. Off-campus visits by outreach personnel now number 36 per year (4/mo, 9 mo/yr). These visits include judging science fairs at middle and elementary schools, career talks to science clubs, speakers at Science Olympiads, and demonstrations on science and scientific procedure in individual classrooms.

In conclusion, the Science Hotline is a useful and a highly successful venture. The number of calls received since initiation of the hotline verifies that this service fills a very real need in the education of the students and teachers in Kentucky. Many of the calls we receive ask for information that simply is not found in a typical school library. It is important to encourage students to ask questions and seek solutions beyond those that they can find in their textbooks. The availability of university faculty helps to ensure that this inquiry will not end in frustration and burnout. The communication link provides a conduit through which academic scientists can improve recruiting by encouraging students to visit the university and consider science for their careers. The type of calls we receive can also be useful in determining the type of outreach programs that are needed for teachers and students. For example, the huge number of calls from students and their parents about science projects has encouraged us to develop a program for elementary and middle school teachers on preparing students for science fairs. The significant change in public attitude toward our institution, as a by-product of this service, cannot be minimized. The image of our faculty and campus as being involved rather than isolated has tremendous political ramifications. It solidifies the concept that the University of Kentucky, as a land grant institution, is a resource for all Kentuckians. Equally relevant is the opportunity to show our constituency that scientists are people, too! Nationally there is a generally poor public portrayal of scientists. This very simple service has done a great deal to create a positive image of our university’s scientists as approachable, interested, caring people. Allowing impressionable, developing students to experience the enthusiasm we feel for science serves an additional purpose of demystifying the scientific profile. We can show teachers and students that science is a journey of curiosity and imagination and not just a collection of facts to be memorized. Most importantly, the Science Hotline creates a link between college faculty and precollege teachers that is essential to improving the science education our students receive.

Address for reprint requests: D. T. Frazier, Dept. of Physiology and Biophysics, College of Medicine, Univ. of Kentucky, MS507 Medical Center, Lexington, KY 40536-0084.

Received 18 December 1992; accepted in final form 6 April 1993.

REFERENCES