SCIENCE AND SOCIETY

A role for neuroscientists in engaging young minds

William Cameron and Eric Chudler

Neuroscience receives little attention in elementary school education, although students at this age are active explorers of their environment and can relate easily to exercises that involve the science of their senses. The neuroscientist has an important role in supporting elementary educators who might be uncomfortable with teaching science. To encourage such scientist–teacher interactions, changes must be made in the culture of the scientific community to promote these partnerships, with the ultimate goal of improving neuroscience literacy.

Elementary school teachers, who teach students from 5–12 years old, are different from their secondary school counterparts. Most secondary (middle and high school) science teachers have had some formal training in the sciences and teach within their discipline. By contrast, the elementary school 'teachers of science' are delivering science content as one of many diverse topics in their classroom, and frequently lack formal science training[1,2]. Consequently, many elementary school teachers might be reluctant messengers of science. This presents a broad cultural gap between the scientist and the 'teacher of science', and necessitates that both engage in some form of professional development so that they might have a meaningful dialogue about how scientists can contribute in a classroom environment. For this partnership to succeed, the scientist must have the motivation to participate, and must receive the support of their institutions, professional societies and funding agencies.

There are many ways in which scientists can lend their expertise to the educational process, through various interactions with teachers and students. This article will discuss why it is important for children to learn about neuroscience and neuroscience-related issues, and will consider the challenges of teaching neuroscience to children and how these challenges might be addressed. We will define the nature of the problem as we see it, then we will propose some solutions that might apply on a more global basis.

Children and neuroscience

The importance of the nervous system becomes apparent early in a child's life. From the time that we are born, sensory receptors that respond to stimuli such as light, pressure, sound and chemicals provide the brain with information about our environment. Children are inquisitive by nature, and they soon learn to gather information from the outside world by tasting, touching, seeing, hearing and smelling. The more children know about their senses, the better they are able to interpret their environment and make decisions on the basis of this information.

The cultivation of the inquisitive nature of the younger student is evident in the design of hands-on exhibits and activities in science museums. For the last four years, the Oregon Health & Science University (OHSU) has held a Brain Fair at the Oregon Museum of Science and Industry to initiate Brain Awareness Week. In hands-on exhibits developed by OHSU neuroscientists, there are few topics that fail to fascinate the young mind, from demonstrating the action of the baroreceptor reflex by tipping the child upside-down, to falsely perceiving the location of their arm in space when the tendon of elbow flexors is vibrated (FIG. 1).

It is likely that most people — even early school-age children in some cases — will be affected directly or indirectly by a neurological disorder. For example, a young person might have a grandparent with Alzheimer's or Parkinson's disease. Even more relevant to elementary school classrooms is the presence of students with learning disabilities, such as dyslexia or attention-deficit/hyperactivity disorder (ADHD). A basic understanding of the delicate balance of brain chemistry and how it can be manipulated with drugs such as Ritalin might make it easier for an affected student to understand why they need to take their medication, and might lessen the stigma attached to their illness by their peers. A good working knowledge of the structure and function of the nervous system should help individuals to better understand and manage these diseases.

Neuroscience is also relevant to a healthy lifestyle. A survey of 43,700 US secondary students in 2002 revealed that over half of these students had tried an illicit drug by the time that they finished high school[3], and such choices are often made at an early age. Although the use of some drugs has decreased or remained steady, young students are still at risk from addiction and other drug-related health problems. There is evidence that the use of alcohol, tobacco and marijuana in elementary school greatly increases the likelihood of use in secondary school[4], indicating that drug prevention programs should start early in a student's education. Many school health education programmes have been developed to combat student drug use, with varying levels of success. Some of the most popular drug abuse awareness programmes, such as Drug Abuse Resistance Education or DARE, teach children strategies to recognize and avoid the pressure to use drugs, but have little content regarding their neurological effects.

Figure 1 | **Exhibits at the Oregon Health & Science University Brain Fair. a** | M. Doyle and S. Morrison demonstrate the baroreceptor reflex. The electrocardiogram is visualized using handgrip electrodes and audibilized using a Doppler probe over the median artery at the wrist. The young student can see and hear their heart rate while in the vertical (head up) position, horizontal and almost vertical (head down) positions. For most children, their heart rate underwent a 50% reduction. **b** | P. Cordon demonstrating the misperception of muscle and joint position with vibration of the tendon. The student is asked to position both of their arms in a similar space with one arm receiving the vibration and the other not. The arm with the muscle receiving the vibration is sensed to be longer than it really is and as a result the subject positions the non-vibrated arm at a larger joint angle.

It is conceivable that increasing students' knowledge about the deleterious neurological effects of drugs could reduce their subsequent drug use, although more research is needed to determine whether the inclusion of neuroscience concepts will have the desired impact.

Although healthy lifestyles are clearly important for society as a whole, health-related issues are not among the neuroscience topics that the general public and younger students find most interesting. In a survey of Brazilian adults, it was revealed that memory, consciousness, learning, emotion and development were among the most popular topics, whereas drugs, disease and movement were among the least popular[5]. Another study[6] reported a substantial discrepancy between children's and neuroscience professionals' perceptions in terms of the children's understanding and motivation to learn neuroscience. This study showed that the children were more interested in the functioning of the healthy brain than the dysfunctional brain, and it concluded that the neuroscience literacy of children must be increased before they are receptive to more complex discussions about drug abuse and disease. A larger survey of neuroscience interests in both children and adults might help to direct the efforts of the neuroscience community in increasing literacy.

The often complex and conflicting information about neuroscience that is provided by the media necessitates that students have the skills to evaluate this information critically. On ten occasions in 2002, the cover story of *TIME* magazine was related to neuroscience (for example, pain, autism, anxiety, drug abuse). Other popular magazines, such as *Newsweek* and *Scientific American* in the United States and *New Scientist* in the United Kingdom, also frequently feature articles about the brain, and newspapers publish many articles about new discoveries in brain research or new methods to treat neurological disorders. Students make extensive use of the Internet to research neuroscience-related issues for personal reasons and school projects. V. Rideout[7] reports that 90% of 15 to 24 year olds have used the Internet, and of these individuals, about 25% have gone online to research depression, mental illness or problems with drugs. Increasing neuroscience literacy should help students to analyse this information in a more critical manner.

The teaching of neuroscience also has important implications for career choices. The higher incidence of diagnosed neurological disorders has created new job opportunities, presenting the neuroscience community with an opportunity to cultivate the interests of young students and encourage them to consider careers in the neurosciences early in their education. In addition to research and teaching positions, jobs abound in industry (drug development and equipment manufacture), medical care (neurology, neurosurgery, psychiatry and nursing) and the media (health and science reporting) to name but a few. To recruit the best and brightest young students, scientists need to impact classroom teaching and share their excitement for their work to promote neuroscience as a valued, viable career pathway to students young and old.

Challenges of teaching neuroscience

There are some important hurdles to overcome in bringing an effective neuroscience curriculum to the elementary classroom. Important reforms are currently taking place in science education in the United States, and there are two main components to these reforms that have implications for how neuroscientists might contribute to the educational experience. One is the movement away from didactic lecturing and towards hands-on inquiry, and the other is the adoption of a set of national science standards for various ages or grades that are being used to measure the performance of schools nationwide.

In the last decade, science education pedagogy has stressed the importance of hands-on, inquiry-based learning[8]. Hands-on inquiry stimulates engagement in reasoning and teaches children to solve problems by limiting the number of variables. Moreover, inquiry-based learning prepares children for the uncertain nature of scientific investigation and strengthens their powers of observation. Neuroscience provides an excellent opportunity to generate inquiry-based exercises for elementary school, and neuroscientists could provide welcome support to teachers who are facing this transition. A simple experiment demonstrating the variation in two-point discrimination can be easily accomplished with only a paper clip and a classmate (FIG. 2) — from this exercise, the children can hypothesize why the perception of touch is different between their lips and the skin on their upper arm. For many teachers, however, inquiry-based learning is a new concept, and they do not share the same comfort level as a scientist in working through an open-ended exercise, especially when it involves a classroom of 30 or more students.

More difficult for the neuroscientist is the issue of generating effective curricula or hands-on exercises that are age-appropriate and, in the United States, based on the standards established by the American Association for the Advancement of Science (AAAS). For a curriculum to be used by pre-college educators, it must meet national benchmarks for scientific literacy[9,10]. The paucity of age-appropriate, inquiry-based neuroscience materials is one serious obstacle that is faced by teachers. Elementary and secondary school science textbooks devote little space to the nervous system. However, the lack of attention that neuroscience receives in textbooks is being addressed at a local level by several organizations that have developed stand-alone or supplemental material for the classroom. At the elementary school level, for

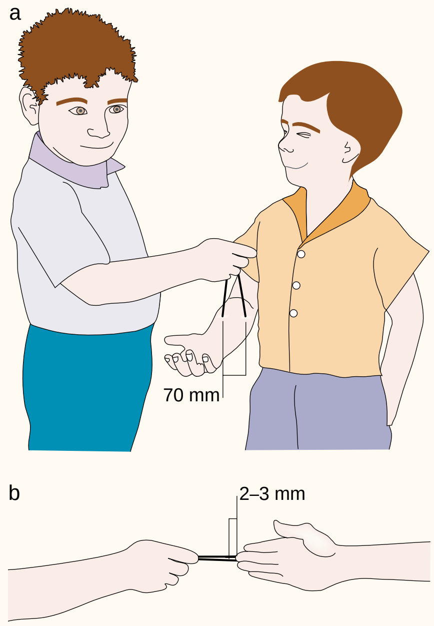

Figure 2 | **The two-point discrimination experiment.** A paper clip is totally unfolded so that the distance between the two ends can be varied from a few millimetres to 1–2 centimetres (a more precise instrument would be a compass). The subject is asked to close their eyes and the experimenter places one or two points of the paperclip gently on the skin and asks if they sense two points or one point. In the upper forearm, the tips of the paperclip can be spread apart by up to 70 mm and the contact of two points will be perceived as only one. When repeated at the finger tip, tips of the paperclip separated by 2–3 mm can still be sensed as two points.

example, Baylor College of Medicine has developed and evaluated 'BrainLink', a set of workbooks covering topics such as comparative neuroanatomy, sensory pathways and motor pathways[11]. At the national level, the National Institute on Drug Abuse has created the 'Brain Power' curricula for second and third grade students (ages 7–8 years) to learn about the effects of drugs on the brain. This programme is working towards broad dissemination and is available on the National Institute on Drug Abuse web site (BOX 1). For secondary students (12–15 years), the Lawrence Hall of Science/Full Option Science System[11] has created a rich, inquiry-based curriculum titled 'Human Brain and the Senses'. The Internet is also a valuable resource for the distribution of neuroscience-related material for younger secondary school students[13,14] (BOX 1). For high-school students (13–18 years), the Society for Neuroscience and the National Association for Biology Teachers have developed Neuroscience Laboratory and Classroom Activities[15] to supplement neuroscience material. Although each of these curricula has its merits, they have not been widely adopted, either because of lack of exposure, or because they failed to integrate into the national standards for inquiry-based activities.

There is always a danger that basic neuroscientific findings that are translated for elementary or secondary teachers and students might be misrepresented or misinterpreted[16]. A lack of expert knowledge can make it difficult for the educator to judge what is good science, and can lead to the perpetuation of popular myths, such as the so-called 'Mozart Effect'. This theory holds that music can improve memory, awareness and the integration of learning styles. The original study[17] found a short-lived enhancement of spatiotemporal reasoning for several college students after listening to a Mozart piano sonata. No other laboratory has replicated the findings of this study, yet untested and unsupported corollaries about the benefits of music in learning and memory persist. Other examples of public misconceptions about the brain include: "We only use 10% of our brain", "A wrinkle in the brain is added each time we learn something new" and "The brain is inactive while we sleep". As evidenced by a Brazilian survey[18], the incidence of incorrect assumptions about the brain is inversely related to the amount of schooling in the subject. There is an important role for neuroscientists in helping teachers to recognize good science.

Few neuroscientists take the time to translate their science into a form that can be used by teachers and educators, and for those who do invest time and effort in this endeavour, there are few rewards in terms of career development. These efforts do not usually carry the recognition or value of the published papers, research grants and university teaching responsibilities that are necessary for promotion in academic institutions. Although several agencies in the United States and the United Kingdom (National Institutes of Health (NIH), Howard Hughes Medical Institute and The Wellcome Trust) provide funding options for the development of science education material, there is a need for additional avenues of funding. It has been left to just a few programmes, like the NIH Science Education Partnership Award (SEPA) programme, to fund this work.

Successful integration of neuroscience into elementary classrooms is also hampered by a communication and culture gap between scientists and educators[19]. For example, scientists have been taught to have a critical nature, whereas teachers tend to have a more nurturing temperament. Furthermore, scientists and educators commonly have a language barrier, each using jargon that is unfamiliar to the other profession. For example, postdoctoral fellows are commonly described as being 'trained' in a research laboratory, whereas most teachers would prefer to use the phrase 'professional development' to describe continuing educational opportunities and growth[19].

In summary, there are few incentives to bring the neuroscientist to the classroom and to form any relationship with elementary classroom teachers. Their language and culture are opposed in many ways, so bringing them together will require some professional development on both sides.

Meeting the challenges

There are two issues that are central to the success of a neuroscience educational programme. First, the scientist must be encouraged to develop a relationship with the teachers. This partnership is essential to the successful translation of their research and the generation of standards-based curricular materials, and it could take many different forms. Second, the scientists who undertake these efforts must receive support from the academic/research institutes or industrial businesses that employ them, the professional societies to which they belong and the agencies that fund their work. All of these institutions are stakeholders and can potentially benefit from improved science literacy among the general public.

Overcoming the communication gap. To overcome the communication gap between neuroscientists and educators, both parties would benefit from additional professional development. Some organizations have taken steps to provide this kind of training and to facilitate the formation of partnerships between teaching institutions and research facilities to improve the dialogue between the two groups. It is not essential for the scientists to be established investigators, and in fact, students in training are proving to be a valuable resource for these partnerships. Undergraduate science students, graduate students and postdoctoral fellows often find it easier than their more senior colleagues to relate to elementary teachers. One model of the effective use of younger scientists is the Elementary Science Education Partners' *Every Child a Scientist*[20], which teams undergraduate science majors from Emory University and affiliated colleges with elementary teachers in the Atlanta Public School to facilitate inquiry-based exercises. The undergraduate students receive

Box 1 | Getting started: neuroscience resources to use with children

The following web sites provide information for neuroscientists and resources for teachers and students who are interested in learning more about the brain.

- Brain & Mind Magazine: http://www.epub.org.br/cm/
- BrainConnection: The Brain and Learning: http://www.brainconnection.com
- Brain Science on the Move: http://www2.neuroscience.umn.edu/brainscience/cool_stuff.htm
- Comparative Mammalian Brain Collection: http://www.brainmuseum.org/
- DANA Alliance: http://www.dana.org
- Digital Anatomist: http://www9.biostr.washington.edu/da.html
- ePsych: http://epsych.msstate.edu/
- The Human Brain — The Franklin Institute Online: http://www.fi.edu/brain/index.html
- National Institute on Drug Abuse: http://www.nida.nih.gov
- Neuroscience for Kids: http://faculty.washington.edu/chudler/neurok.html
- A Science Odyssey: You Try It: Probe the Brain: http://www.pbs.org/wgbh/aso/tryit/brain/
- Seeing, Hearing and Smelling the World: http://www.hhmi.org/senses/
- Society for Neuroscience: http://www.sfn.org
- The Reconstructors: http://reconstructors.rice.edu
- The Washington University Medical School Neuroscience Tutorial: http://thalamus.wustl.edu/course/

college credits for their rewarding work with the schools, and the elementary school teachers get a person with science background to help them with the transition to hands-on inquiry using modular science kits.

Teachers and scientists have different strengths and weaknesses that they bring to the partnership. Many elementary school teachers might not be comfortable with science if they did not specialize in this area during their teacher education, and they might need additional instruction to become familiar with neuroscience topics. In turn, most neuroscientists have little or no preparation for the elementary or secondary school classroom, and they might have unrealistic expectations of what can or cannot be accomplished with students in a particular grade. Although these problems exist, it is clear that scientist–teacher collaborations can work and are desired by pre-college teachers. According to a Bayer and National Science Teacher Association survey[21], 80% of science teachers believed that it was either very important or essential for students to be exposed to scientists and/or engineers. Moreover, 95% of the teachers thought that contact with scientists and/or engineers was an effective way for students to appreciate careers in science and engineering. The formation of teacher–scientist networks and peer-to-peer mentoring should provide an effective and practical means to form collaborations between scientists and teachers, and these partnerships will require continuing support for teachers and scientists throughout the academic year.

Recognition of science communicators. The pressure to spend more time in the laboratory has limited the opportunities for scientists to establish a connection with the public that funds them. In 2000, the Wellcome Trust carried out a survey on public attitudes towards science in the United Kingdom[22], and two-thirds of those surveyed agreed that scientists want to make life better for the average person. Interestingly, a similar proportion thought that "scientists should listen more to what ordinary people think". To remedy this situation, systematic cultural change must occur at all levels of the research enterprise. From the top, professional societies and funding agencies need to recognize those members and investigators that have effectively communicated their research to the public. Professional societies can draw attention to these contributions by presenting awards to such individuals at national and international meetings. A select group of individuals with exceptional accomplishments in both research and translation should be sent on the lecture circuit and presented to the next generation of scientists (graduate students and postdoctoral fellows) as role models.

Within the last year, the Society for Neuroscience has adopted a Strategic Plan[23] that underscores the importance of the educational mission as part of the larger effort to improve neuroscience literacy in the United States. To recognize members who have made important contributions to the promotion of science literacy, the Society has announced the Science Educator Award. This represents an important first step in supporting scientists who communicate effectively with the public.

Funding agencies are also uniquely positioned to initiate this culture change. When applying for a grant, an investigator could present a plan for how they will disseminate the information that is generated from the research to the public, and this could become an important factor in the peer review process of their grant. The National Science Foundation has started to address this need by requiring grant recipients to discuss how their research will have a broad impact. One way that grant recipients can fulfil this requirement is by developing educational materials for pre-college students and participating in the professional development of school teachers. In addition, agencies could offer supplements to ongoing grants to develop inquiry-based exercises that would capture the essence of work in the laboratory, or even support a pre-college teacher in the laboratory to learn first-hand about how inquiry-based investigation is conducted.

Neuroscience: the next generation

It is always difficult to institute cultural change within a generation. Therefore, the promise for greater involvement in public education resides with the next generation of investigators. There are two ways that funding agencies could encourage the scientist in training to become an effective public communicator. First, funding agencies that award training grants could incorporate a requirement for the professional development of communication skills and effective translation of the trainee's science. Trainees could opt to partner with a local teacher, support an inquiry-based exercise in their classroom or take a public advocacy role in a governmental review process.

Second, some trainees in neuroscience would welcome the opportunity to cross-train in science education, but there are few funding opportunities for developing this career alternative. There should be grant programmes that provide individual training opportunities for predoctoral and postdoctoral trainees in science education. In the United States, the National Science Foundation offers a programme to train graduate students in science education[24], but has not offered the equivalent for postdoctoral fellows in recent years. In the United Kingdom, the Wellcome Trust supports the placement of Ph.D. researchers in secondary schools through the Researchers in Residence programme. Scientists with this educational training will be ideally suited to bridge the gap

Figure 3 | **Exhibits to teach children about the brain. a** | Brain swim cap. An image of the brain silk-screened onto a swimming cap enables young students to colour various lobes or in this case to attach a Velcro body part to the area of the brain that is responsible for processing sensation. This interactive exhibit was on display at the Oregon Brain Fair during Brain Awareness Week celebration in 2002. **b** | LumiGlass™ exhibit. The random pattern of electrostatic discharge across the LumiGlass™ is altered by grounding at different places using the fingers. By careful placement of their fingers, the student can simulate the dendritic morphology of a bipolar or pyramidal neuron. This photograph also comes from the Oregon Brain Fair, 2002. **c** | Gelatin brain. A simple mould of the brain can stimulate discussions about the sulci and gyri or the consistency of the brain. In many instances, the children will ask if it is real. This exhibit has been used every year at the Brain Fair at the same station where the public can view fixed human brains. **d** | The real thing. Student holding a human brain at the University of Washington Brain Awareness Week Open House. The student is fully gloved and carefully monitored by a scientist.

between teachers and scientists, and facilitate interactions between their colleagues.

Professional societies and funding agencies could call on the expertise of their rank and file to join teachers and science educators in special workshops or symposia to draft age-appropriate curricula. Ideally, these curricula would reflect the interests of teachers and students, fulfil the goals of the national science standards and convey the excitement of the latest discoveries. Different teams of scientists and educators would be assembled to develop age-appropriate curricula and exercises targeted for elementary or secondary students. Modern neuroscience research has a wealth of images and graphics that depict complex spatial relationships and interactions. One such resource, from J. W. Sundsten at the University of Washington, is the three-dimensional animations of the brain at the Digital Anatomist project (BOX 1). A web-based repository could be developed to link to or hold these kinds of resources. This would give access to both the scientific and educational community with one goal — to spark the imagination of young students.

Given the consolidated resources of the professional societies and funding agencies, a large-scale educational project could be undertaken. In the 1950s, Bell Laboratories produced an award-winning series of films about science, including *Our Mr. Sun*, which impacted a whole generation of baby boomers. With the incredible power of computer-assisted graphics, it is a good time to direct these tools at the production of films to inspire the next generation — an 'Our Mr. Brain' for the twenty-first century. By targeting early education, these materials will also serve an important function by improving the general literacy of the public.

Many excellent educational materials have already been developed by individuals, institutions and organizations all over the world (BOX 1) but these are not generally well recognized by the world community. Once again, international professional societies have an important role in helping their membership to compile and post these resources for use by others. At national and international meetings, there should be a forum to present educational materials for the benefit of fellow neuroscientists, and a web site could be developed to consolidate materials such as curricula, science fair exhibits, teaching demonstrations and images/animations of eye-catching research projects. One event that has served as an important catalyst for neuroscience education efforts worldwide is Brain Awareness Week, co-sponsored by the Dana Alliance and the Society for Neuroscience (BOX 1). This event has successfully brought public attention to the brain and neuroscience research each year since its inception in 1996, and has opened doors to the classrooms of elementary and secondary schools for neuroscientists.

In the classroom, a simple idea, such as the image of a brain printed on a swimming cap, can be a powerful tool for promoting understanding of how the areas that process different types of sensory information are distributed across the cortex (FIG. 3a). A simple electronic device can be used to demonstrate how the branching pattern of neuronal dendrites is shaped by the synaptic inputs (FIG. 3b). Using the fingers as synaptic inputs, contacts with the surface of the LumiGlass™ draw the electrical discharge towards the contact points. Bipolar, multi-polar and pyramidal morphology can be demonstrated by selective placement of the fingers. A gelatin mould of the brain can be made to the consistency of a fresh brain that will flatten or compresses itself from its own weight (FIG. 3c). A standard for all audiences is a real human brain (FIG. 3d)

These examples mostly demonstrate anatomical features of the nervous system, but it is also important to include hands-on activities relating to the brain as an electrical and chemical organ. The Iowa KidsJudge programme has found an effective means to demonstrate the nature of electrical communication with muscles. Using a mild transcutaneous stimulator, a physical therapy student activates the median nerve and generates involuntary contraction of the muscles of the hand. In another exercise, children can demonstrate the contribution of smell to sense of taste. Different flavoured jellybeans are chewed with the nose patent or pinched closed. Because the consistency of the jellybeans is similar, they are recognizable only by adding the sense of smell.

At its annual meeting, the Society for Neuroscience holds symposia, poster exhibitions and hands-on activities for its members, teachers and students. The European Dana Alliance sponsored a special event at the 2003 British Neuroscience Association Meeting on the Teaching of Neuroscience and the Public Awareness of Science. There are several events that offer exchange of ideas and open discussion, but they need to engage a larger fraction of the worldwide neuroscience community.

Future prospects

The reality of today's academic environment is that many policy decisions are driven by finance. The drive to secure more grant funding is fuelled by the funds that are brought to the hosting institution. This factor has contributed substantially to the focus on research productivity at the expense of communicating the findings of the research. Funding agencies could help to change this culture at the level of the institution by rewarding those institutions that have developed an infrastructure to support its investigators' contributions to science literacy. In this way, the agencies would be nurturing the public advocates, media attention and data that are crucial for defending their budgets to the government or governing board, while helping to inspire their investigators to make a connection with the new generation of scientists.

Each research institution has a crucial role in this cultural change. With or without the leadership of the professional societies or the incentive of the funding agencies, the institution can provide recognition for the importance of communicating research findings effectively, and this should be an important consideration at the time of promotion and tenure. Workshop, video conferencing or web-based instruction should be provided to facilitate the interactions of scientists with teachers, students and the public in various venues. This type of training will be valuable for preparing scientists to enter elementary classrooms or to speak with members of their local legislature. Graduate training programmes could incorporate a requirement for release time to participate in public education.

The mainstream neuroscience journals could provide a forum for the further discussion of these issues. *The Neuroscientist* is one of the few neuroscience journals that routinely carries such articles, in its Neuroscience and Society section. There are other examples of educational supplements published in other fields, such as the American Physiological Society's Advances in Physiological Education and the American Society for Cell Biology's education site. These are great resources but are rarely visited by the rank and file of the professionals. There is need for more avenues for discussion in scientific publications with the goal of educating our public both young and old.

In summary, there is a pressing need for the neuroscientist in the elementary classroom. The funding dilemma in the schools and low teacher morale[25,26] make intervention by scientists even more valuable. Some might feel that the onus should reside with the teacher to get more training without the help of the neuroscientist, yet teachers are the first to admit that contact with a scientist early in the education of a student enhances their interest in science. There is more than one way to contribute to neuroscience literacy in schools — some scientists will find that they enjoy participating in a classroom setting, whereas others will prefer to help to conceptualize the scientific fundamentals of their field in an inquiry-based exercise. Still others will provide effective testimony before government committees to defend funding for science and education. A successful effort of this kind requires mutual support from peers, institutions, professional societies and funding agencies. For this investment, there will be extraordinary returns.

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Online links

FURTHER INFORMATION
Advances in Physiology Education: http://advan.physiology.org/
Brain Awareness Week: http://apu.sfn.org/baw/index.cfm
Cell Biology Education: http://www.cellbioed.org/
Elementary Science Education Partners: http://www.emory.edu/COLLEGE/ESEP/
European Dana Alliance: http://www.edab.net/
Howard Hughes Medical Institute: http://www.hhmi.org/
National Institutes of Health: http://www.nih.gov/
The Wellcome Trust: http://www.wellcome.ac.uk/
Access to this interactive links box is free online.