regardless of previous immunization status,[7-10] eliminating all but importations and secondary cases. Brief 1997 resurgences of measles in Brazil and Canada raised questions about strategies for eradication[5,11] but should not have been a surprise given the potential for importation of the highly contagious virus that finds even small susceptible groups.

WHO has already made the case for worldwide eradication of measles,[8] concluding that: using current vaccines, worldwide eradication is feasible sometime between 2005-2010; single-dose strategies are not adequate to achieve eradication; surveillance must be based on clinical findings suggestive of measles; laboratory diagnosis is an important means of tracking measles transmission; outbreaks provide opportunities to elicit political support for eradication; obstacles to eradication are perceptual, political, and financial; international cooperation is needed between countries, donors, and specialized agencies; linkage with polio eradication efforts is advisable.[7]

Success in developed and some developing countries has demonstrated the potential of aggressive measles control policies. Yet the impact of uncontrolled measles is still felt in the developing countries, where adoption of a two-dose and school-age catch-up policy is urgently needed. With a new Director General of WHO, the time may be ripe for the United States to urge the world to create an effective measles elimination effort.

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References

1. World Health Organization. World health report 1998. Geneva: WHO; 1998.
2. Jamison DT, Jardel J-P. Forward. In: Murray CJL, Lopez AD, editors. Global comparative assessments in the health sector: disease burden, expenditures and intervention packages. Geneva: WHO; 1994. p. v-vii.
3. Murray CJL, Lopez AD, Jamison DT. The global burden of disease in 1990: summary results, sensitivity analysis and future directions. In: Murray CJL, Lopez AD, editors. Global comparative assessments in the health sector: disease burden, expenditures and intervention packages. Geneva: WHO; 1994. p. 97-138.
4. World Health Organization. Health for all in the 21st century. Draft EB101/8. Geneva: WHO; 1998.
5. Progress toward elimination of measles from the Americas. MMWR Morb Mortal Wkly Rep 1998;47:189-93.
6. Tulchinsky TH, Ginsberg GM, Abed Y, Angeles MT, Akukwe C, Bonn J. Measles control in developing and developed countries: the case for a two-dose policy. Bull World Health Organ 1993;71:93-103.
7. De Quadros CA, Oliver JM, Hersh BS, Strassburg MA, Henderson DA, Brandling-Bennett D, Alleyne GAO. Measles elimination in the Americas: evolving strategies. JAMA 1996:275:224-9.
8. World Heath Organization, Expanded Programme on Immunization. Meeting on advances in measles elimination: conclusions and recommendations. Wkly Epidemiol Rep 1996;71:305-9.
9. Measles eradication: recommendations from a meeting cosponsored by the World Health Organization, the Pan American Health Organization, and CDC. MMWR Morb Mortal Wkly Rep 1997;46(RR-11):1-21.
10. Progress toward measles control and elimination, 1990-1996. MMWR Morb Mortal Wkly Rep 1997;46:893-7.
11. Cutts FT, Steinglass R. Should measles be eradicated? BMJ 1998:316:765-7. ■

Neuroscience and Public Policy

I am writing to comment on the article "The Brain and Child Development: Time for Some Critical Thinking" (PHR 1998;113:388-97).

This is indeed the time for some critical thinking regarding the influence of scientific knowledge of brain development on public policies on behalf of young children. Two fundamental questions must be answered. First, should current knowledge of brain development influence public policy? Second, does such knowledge suggest that funds spent for children ages 0–3 years (and beyond) be increased? The answer to both of these questions is unequivocally "yes."

Dr. Bruer has criticized the "brain science/policy link" by suggesting that the neuroscience presented by early child advocates is selective, oversimplified, interpreted incorrectly, does not have the support of mainstream neuroscientists, and is just not new.

The oversimplification, misinterpretation, and exaggeration of scientific data are inevitable since the press wants good stories and politicians are trying to sell their programs. For this reason, scientific training in the past included the lesson that it was somehow "unethical" to speak with the press. "Good scientists" just didn't engage in dialogue in the public arena, assuming that their statements would be twisted and misconstrued by the uninformed lay public. This *elitist attitude*, to the good of the public that pays for the research, has come to an end.

Neuroscientists as a group are beginning to accept their responsibility for conveying their new data to the public. The Society for Neuroscience, which represents the most prominent neuroscientists in the world, has sponsored "Brain Awareness Week" each spring, during which the society encourages scientists to share information about the brain with the public. Neuroscience leaders, including the present and past presidents of the Society, were prominent among the participants at the White House Conference titled "Early Child Development: What New Research on the Brain Tells Us about Our Youngest Children." After all, the public has paid for this research precisely so that it could be used to improve health and well-being. Indeed, mainstream neuroscientists have now taken the challenge to "simplify" their findings so that those who are experts in other fields—such as education, public health, and politics—can implement policies for children that make sense

biologically. Dr. Bruer does not speak on behalf of neuroscientists when he claims that the enthusiasm for a link between science and policy is stemming only from lay groups.

Dr. Bruer states that there are few "new" data to support policy change. Neuroscience supporting the notion of critical periods is a culmination of research that began over 30 years ago and has been replicated, refined, and expanded in the intervening years. Recent publications have typically led to refinements of previous concepts and views; this is the scientific method. For example, Elbert and coworkers (Science 1995; 270:305-7), using new technology, found that string instrument players show greater cortical representation for the left than the right digits, but only if they began playing the instrument prior to adolescence. Although music teachers might have known (and scientific data generally do support) that musical instruments are more efficiently learned in childhood than in adulthood, we can now take this understanding a step farther, at least for string instruments. It would be scientifically sound to deduce that the greater cortical representation of the left digits is associated with some synaptic alterations in the motor cortex and that early "enrichment" makes a difference. Of course it has been exciting to recognize that the adult brain is capable of considerable plasticity, but this is not an argument against the presence of the very different phenomenon of *developmental* plasticity, which has been studied and validated for so many years. There is even a whole body of literature demonstrating that the brain areas mediating adult plasticity differ from those that mediate developmental plasticity. Does Dr. Bruer challenge this notion?

I agree with Dr. Bruer that the first three years of life cannot be considered "the" critical period. But the view that exuberant synaptic growth is primarily under genetic, not environmental control, is too simple. Indeed, it is now widely believed by most neuroscientists (including the experts cited by Dr. Bruer) that there is a continuous and complex interplay between genes and environment.

Now that a "brain science/child policy link" has been established, it is incumbent upon both neuroscientists and policy makers to use that link to implement effective interventions. While there is still much to be learned regarding the effectiveness of "enriched" environments, it is clear that the "complex" environments present in Roxbury and East Palo Alto are less than optimal for success in today's society. Ongoing discussions and critical evaluation of the science and the policies derived from it will act to dispel misinterpretations and oversimplifications and lead to sound biologically based policies that will benefit our children.

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Dr. Bruer replies:

The Elbert et al. article (Science 1995;270:305-7) that Dr. Chugani cites as an example of "new" research on critical periods is not about critical periods for string players and is not indexed as such in the literature. Elbert et al. reported that cortical reorganization in the representation of the fingering digits among string players was correlated with the age at which the person started to play, but the study did not control for how long subjects had been playing. Generally, people who start practicing a motor skill at a younger age will have practiced it longer when tested as adults. Because of this confound between age of start and duration of practice, the article says nothing about critical periods. According to one of the study's authors (Personal communication, Edward Taub, 1998), most policy discussions miss the point of the article entirely. The significant, new finding is that neuronal plasticity persists in the mature nervous system, not that there are critical periods early in development.

Advocates of the brain science/child policy link tend to interpret all data and studies they cite from the perspective of critical periods and the importance of early experience and tend to ignore a substantial corpus of neuroscientific and behavioral research that suggests otherwise.

It should also be noted that research on rodents raised in isolated versus complex environments, if it speaks to the human case at all, suggests at most that Harvard Square and nearby Roxbury are equally complex biological environments. But they are very different socioeconomic environments. From the perspective of mainstream America, Harvard Square is the culturally preferred environment, the one we would most likely label "enriched" when thinking of success in late 20th century America. However, we must remind ourselves that "complex" is a descriptive term, whereas "enriched" is a normative one. And when we label an environment "enriched," we are generally speaking from a middle-class, mainstream perspective. Those who advocate for the specific science/policy link that I criticize tend to argue for polices and practices from an overwhelmingly white, middle-class, Eurocentric vantage point. Brain science cannot tell us that our culturally preferred ways are biologically optimal, no matter how much we would like to believe that it does.

Some critical thinking is indeed in order on these issues.

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