



SCIENCE POLICY

Poverty Can Harm Early Brain Development, Researchers Say

A host of recent studies show that growing up in poverty can shape the wiring and even the physical dimensions of a young child's brain, with negative effects on language, learning, and attention. Those findings raise important policy questions in areas ranging from education and health to juvenile justice and social welfare, researchers said at a Capitol Hill briefing organized by AAAS.

Scientists have long known that brain development can be harmed by factors such

children may be more likely to raise their own children in poverty, "and there you have a vicious cycle.

"The promise of neuroscience," Farah added, "is to understand how this works so that you can intervene" to disrupt that cycle.

Recent technological advances, such as functional magnetic resonance imaging, are giving neuroscientists a window into some of the brain's deepest structures and innermost workings. But in a culture that

tends to venerate free will and view poverty as evidence of weak character and moral breakdown, the emerging insights face an uncertain road to acceptance.

The briefing, held 26 June, drew an audience of over 100 people, including congressional staff, federal scientists, and journalists. It was held with the support of U.S. Representatives Chaka Fattah (D-Pennsylvania) and Brian Bilbray (R-California), and was the first in a series of three Capitol Hill briefings on neuroscience organized by the AAAS Office of Government Relations with support from The Dana Foundation.

In the opening presentation, James Griffin, director of the Early Learning and School Readiness Program at the National Institutes of Health, described the early growth of the brain. By the time a child is 3, the brain is 80% the size of an adult's, with 1000 trillion neuron connections that will be critical to continuing development. Areas such as the prefrontal cortex that govern more complex functions—language, problem-solving, self-regulation, and social bonding—develop most rapidly from ages 1½ to 4.

"This really is a crucial period in brain development," Griffin explained. "We know we need to...take full advantage of what we can do for children (at that age) so they reach their full potential."

That's the importance of cognitive nurturing, the researchers said. When parents or caregivers spend time reading with a child, the intellectual activity helps build neural connections. Without that engagement, important connections will not be activated—and those not activated often are pruned away as the brain develops.

Stressful lives can cause parents to engage less with children, and stress also acts directly on young brains, leaving a physical signature. Farah said her lab and others are finding that higher income levels are associated with greater volume in the prefrontal cortex and in the hippocampus, a center for memory and learning.

Related studies suggest disparities in brain function between low-income and higher-income children. Farah cited "highly robust, sizeable differences" in the functions of these areas, affecting language, self-regulation, and working memory.

Both Griffin and Farah emphasized that the brain can recover from effects of childhood poverty. But, they said, preventing harm is more efficient than repairing it.

Developing strategies to address these issues would require broad shifts in public policy. Even without that, the researchers said that parents and caregivers can have a constructive impact just by talking and reading to their children and doing what they can to build a sense of security.

For children, the future "depends on us understanding really, fully, what is the science... and how do we put it into practice," said Annapurni Jayam-Trouth, chair of the Department of Neurology at Howard University. "The science must be transmitted via many channels of education to the general public, especially to low-income communities, so intervention can begin early at home."



Deep insight. Functional magnetic resonance imaging allows neuroscientists to assess the structure and function of children's brains.

as poor nutrition and exposure to lead. But researchers at the briefing cited studies that are probing how a lack of "cognitive nurturing"—talking and reading to a child, for example—and sustained exposure to "toxic stress" set off a cascade of hormonal and neural responses far different than those in a child who is raised in a more secure, stimulating environment.

"Where a child grows up in impoverished conditions...with limited cognitive stimulation, high levels of stress, and so forth, that person is more likely to grow up with compromised physical and mental health and lowered academic achievement," said Martha Farah, director of the Center for Neuroscience and Society at the University of Pennsylvania. Once grown up, those



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AAAS Delegation Makes “Positive” Visit to Iran

A small delegation led by Nobel laureate and former AAAS President Peter Agre delivered a series of lectures and met with Iranian science leaders, researchers, and students during a week-long science diplomacy visit to Tehran.

Although the visit came at a time of tension centered on Iran’s disputed nuclear research and tightening Western economic sanctions, the presentations and meetings focused on shared interests in research and building a dialogue based on science. And, Agre said, the Americans were warmly received.

“Overall, it was a very positive visit,” said Agre, the 2009 AAAS president. “Our meetings with faculty and students were always positive—it seems to me that we all have a lot to share.... From a scientific viewpoint, the doors are certainly open.”

The AAAS visit was “a milestone,” said Abolhassan Vafai, a professor at Sharif University of Technology. “[The meetings] created a very conducive and fruitful atmosphere for establishing scientific dialogue between the two nations.”

The delegation was invited and hosted by Nasrin Soltankhah, Iran’s vice president for science and technology. The visit was initiated earlier this year when AAAS representatives met in New York with Iranian Foreign Minister Ali Akbar Salehi, who 35 years ago earned a Ph.D. at MIT.

Traveling with Agre were his wife, Mary, a preschool teacher, and Norman P. Neureiter, senior adviser to the AAAS Center for Science Diplomacy and chair of the

senior advisory board at *Science & Diplomacy*, AAAS’s new online quarterly. While in Iran from 6 to 13 June, they spoke at elite universities and civic organizations and met with top government and science policy officials, scholars, and students.

The delegation also was invited to a brief visit with Iranian President Mahmoud Ahmadinejad in his private reception area. Speaking in Farsi, the president offered cordial remarks that emphasized the universal values of science and the belief that knowledge produced by research should benefit all of humanity.

While in Iran, Agre was named an honorary member of the Sharif University faculty and given an office there; he agreed to return every year for 10 days of lectures and other scholarly activity.

Support for science diplomacy by AAAS and others worldwide is based, at least in part, on a basic principle: Common scientific interests and joint research can create engagement and build trust between nations even when governmental relations are strained or broken.

Scientific research has provided a continuing basis for Iran-U.S. engagement. Iran has an accomplished science sector, with focus areas including medical and stem cell research, petroleum engineering, space exploration, and nanotechnology. Many of Iran’s science policy leaders and university faculty members were educated in the United States or Europe, and 5600 young Iranian scientists last year had student visas to live in the United States while studying



Landmark of learning. The Avicenna Building at Sharif University of Technology is named for the influential Persian polymath who lived a thousand years ago.

in nonsensitive fields. The U.S. National Academy of Sciences since 2000 has had an agreement to foster cooperation with the Iranian Academy, and some 20 seminars and workshops have been held in Iran, the United States, and occasionally other countries.

After the AAAS delegation returned, Neureiter discussed the Iran trip during an hour-long look at science diplomacy on The Kojo Nnamdi Show, on WAMU-FM in Washington, D.C. [Listen to the archived show at www.aaas.org/go/kojo/].

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AAAS

New Dues Rates Approved for 2013

The AAAS Board of Directors has approved a dues increase for 2013. The Board authorizes increases to cover two kinds of expenses: unavoidable costs associated with running AAAS and publishing *Science*, and new expenses that add value to membership. Postage and paper increases and improving online resources are examples of the kinds of expenses the Board anticipated in setting the 2013 rates.

The new rates are effective for membership terms beginning after 31 December 2012. As listed at right, they do not include

postage or taxes for international members, which are additional.

For further information, including subscription rates for *Science Online*, librarians should contact AAAS or their subscription agents, or go to the *Science Online* Web site.

All members will be advised of the new dues rates on their renewal notices for 2013. Member dues and voluntary contributions form the critical financial base for a wide range of AAAS activities. For more information, contact the AAAS Membership Office at 202-326-6417 or www.aaas.org/membership.

Regular professional members	\$151
Postdocs and K-12 teachers	\$99
Emeritus members who receive print <i>Science</i>	\$115
Students	\$75
Patrons	\$310
Institutional rate for print for high schools and public libraries	\$360
All other institutions receiving print	\$1176

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