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Researchers Gain Understanding of How Poverty Alters the Brain

[By Richard Monastersky](#)

Brain studies of poor children reveal that their neural systems develop differently from those of other children, a finding that potentially points the way toward creating methods for ameliorating the effects of poverty on academic achievement.

"Growing up poor is bad for your brain—we've known that for a long time," said Martha J. Farah, director of the center for cognitive neuroscience at the University of Pennsylvania. "What's new is that neuroscientists have begun to try to understand this problem," she said last week at the annual meeting here of the American Association for the Advancement of Science, which ends today.

For generations, psychologists have noted that children raised in poverty perform poorer on cognitive tests, on average, than do students from wealthier families. Some researchers have taken those results to argue that intelligence is determined for the most part by genetics and that certain races are inherently smarter than others. In 1994, Richard J. Herrnstein and Charles Murray presented that case in their book, *The Bell Curve: Intelligence and Class Structure in American Life*.

But the new results from neuroscience indicate that experience, especially being raised in poverty, has a strong effect on the way the brain works. "It's not a case of bad genes," said Ms. Farah.

She and her colleagues have investigated the issue by trying to tease out which aspects of poverty alter specific cognitive skills, such as memory, language, and the ability to delay gratification. The researchers studied a group of African-American children of low socioeconomic status, who had been tracked from birth through high-school graduation by Hallam Hurt, a pediatrician at Penn.

Over the years, Dr. Hurt's team had assessed the home environments of the children, monitoring how nurturing parents were, and how intellectually stimulating the homes were—for example, whether the children had access to books and visited museums.

When Ms. Farah's team tested 110 of those children, they found that particular cognitive skills were linked with certain aspects of the environment. Children with better language abilities were more likely to come from intellectually stimulating homes, no matter how nurturing their parents were. Memory skills, however, matched the nurturing levels in the home, reported Ms. Farah, who will publish her results in an upcoming issue of *Developmental Science*.

Effect of Nurturing on the Brain

To test why, the researchers did MRI scans of the children. They found that students raised in nurturing homes generally had bigger hippocampi, the portion of the brain associated with

forming and retrieving memories. The discovery dovetails with previous research in rodents, which showed that rats raised in a stressful environment develop smaller hippocampi.

The results of the new work suggest that "it's worth making intervention and prevention programs because clearly a lot of the action here is experiential," said Ms. Farah. "This points out the fact that these phenomena are the result of adverse environments."

At the science association's meeting, Courtney Stevens, a postdoctoral research associate at the University of Oregon's brain-development laboratory, described other experiments on the cognitive effects of poverty. In one study, researchers put a net of electrodes on the heads of children and measured their brain waves. The children were seated between two speakers playing different stories and they were asked to pay attention to only one of the stories.

While the stories were being read, the children heard identical bursts of distracting noise coming from either of the speakers. The brains of the children responded differently to those same noises, depending on whether it came from the side they were listening to or ignoring. It's almost as if the brain has a volume control, turning up the sound on the side it is attending to, said Ms. Stevens.

The study revealed that students from lower-income families were less able to screen out the noises embedded in the stories they were supposed to ignore.

The students in the higher-income group, however, "had more gain on their volume control," she said. "Their brains were able to make a larger distinction between what they were trying to hear versus ignore."

With those results and others suggesting that cognitive skills are strongly influenced by environment, the Oregon team is developing intervention programs to try to counteract the effects of poverty. At the meeting, Ms. Courtney described one experimental program that has shown initial success.

Parental-Intervention Program

The program, developed by Jessica Fanning, a doctoral student at Oregon, trains parents to improve their communication skills and provides them with tools to improve their children's behavior, with the aim of reducing stress in the home. To test her program, Ms. Fanning recruited families from a Head Start program.

She found that after eight weekly sessions with parents, they reported less stress in the home, and their children performed significantly better on tests of language skills, nonverbal intelligence, memory, and attention.

The researchers have thus far tested only 14 low-income children and 14 controls. And they are tracking the children to see whether the effects persist. "At the end of the day, what we don't care about is a 5-point difference in I.Q.," said Ms. Stevens. "We care about this measure if it's going to translate into something persistent and useful."

While many of the researchers at the session supported the hypothesis that socioeconomic status plays a strong role in affecting brain development in children, Mabel L. Rice, director of the doctoral program in child language at the University of Kansas, described a new study that goes against the hypothesis, at least in the case of early verbal abilities. In tests of 1,766 children in Australia, Ms. Rice and her colleagues found no correlation between a child's verbal abilities at 24 months old and the parents' socioeconomic status or their education levels.

"The conclusion is that we don't want to assume too strongly that children of poverty are unable to acquire early vocabulary," she told *The Chronicle*.

Ms. Rice and three other researchers reported their results in December in the *Journal of Speech, Language, and Hearing Research*.