

## The Challenge



- Understanding the increased prevalence of neurodevelopmental disorders
- Establishing firm linkages between exposures and neurodevelopmental disorders
- Translating environmental health research findings for use by pediatric health care providers, parents, families, and others

## Environment and the Developing Brain

Neurodevelopment refers to how the brain and nervous system develops. Scientists have made tremendous progress in understanding how the brain works, and are gaining new insight into the role that early environmental exposures may play in the development of a broad spectrum of childhood and adult disorders, including autism, attention deficit disorder, and learning and movement disorders. Research supported by the National Institute of Environmental Health Sciences (NIEHS) has clearly shown that it is not just genetics that impacts the risk of neurodevelopmental disorders, but the interplay of genes and the environment. Researchers are also making progress in tackling hard questions about the vulnerability of the developing brain as they look at timing and level of exposures, including low-dose exposures *in utero* and during childhood, to unravel some of the mysteries of impaired neurodevelopment.



### Autism

Autism spectrum disorders (ASD) are complex neurodevelopmental disorders with early childhood onset. The incidence of ASD is increasing. According to the U.S. Centers for Disease Control and Prevention (CDC), about 1 in every 110 American children have some form of autism. These disorders, for which there is presently no cure and only limited treatments, generally have lifelong effects.

### Attention Deficit Hyperactivity Disorder

Attention Deficit Hyperactivity Disorder (ADHD) is a condition of the brain that makes it difficult for children to control their behavior or pay attention. About 4.5 million children 3-17 years of age (7 percent) have ADHD, according to the (CDC). The exact cause of ADHD has not been determined; however, the condition is thought to have both a genetic and environmental component.

### Lead: Many Successes, More Work to Be Done

One of our country's greatest success stories in environmental health is related to lead. Our role in supporting research on the effects of lead has helped to mobilize parents, environmental advocates, environmental health researchers, the U.S. Environmental Protection Agency (EPA), and Congress to remove lead from gasoline, paints, and other products. The result has been a sharp reduction in blood lead levels throughout the country. But there is more work to be done, since new research supported by NIEHS and other NIH institutes show that even low levels of lead have impacts on children's intelligence and behavior. NIEHS will continue to support efforts to evaluate the causes and health effects of low levels of lead, and to develop and evaluate strategies to mitigate childhood exposures, recognizing that prevention is key to a successful end to this problem.



## NIEHS Focus

NIEHS is one of the federal government's leading supporters of biomedical research on understanding how the environment influences the development and progression of human disease. NIEHS awards grants to support research at universities across the country and also conducts research in its own laboratories in Research Triangle Park, N.C. NIEHS has a long tradition of supporting research in the area of neurodevelopment.

Some examples of ongoing research:

- With support from NIEHS, the Children's Center at the University of California, Davis is conducting the first large-scale human population case-control study of children with autism. In the [Childhood Autism Risks from Genetics and the Environment \(CHARGE\)](#) study, researchers are looking at a wide range of environmental exposures and their effects on early development in more than 1,600 California children.
- In the [Early Autism Risk Longitudinal Investigation \(EARLI\)](#) study, researchers are enrolling mothers who have a child with autism and who are pregnant again. This study will follow mothers during their pregnancy and their new babies through age three, to identify prenatal, neonatal, and early postnatal exposures that may influence risk of the child developing autism.
- Researchers are evaluating pesticide exposure as a potential risk factor for ADHD.
- Researchers at Columbia University are finding that a mother's exposure to urban air pollutants, known as polycyclic aromatic hydrocarbons (PAHs), can adversely affect a child's IQ.
- The National Toxicology Program and in-house researchers are developing and refining comprehensive test methods to assess both the short- and long-term effects of early exposure to environmental chemicals, and the impact these chemicals may be having on adolescent behavior and adult disease.
- Researchers are trying to determine how diet and nutrition can mitigate neurotoxic developmental effects.
- Researchers are studying the neurotoxic properties of metals, such as lead, arsenic, tin, mercury, and manganese, pesticides, tobacco smoke, polychlorinated biphenyls (PCBs), and polybrominated diphenyl ethers (PBDEs) used to make insulation fire retardant.



## Our Collaborators

- NIEHS continues to consult regularly with the scientific community and advocacy groups, to help establish its research agenda.
- Several of the [NIEHS-EPA Children's Centers](#) focus on research in neurodevelopment.
- NIEHS serves on the U.S. Department of Health and Human Services (HHS) [Interagency Autism Coordinating Committee](#), which coordinates all ASD efforts within the HHS.
- NIEHS is a major partner in the [National Children's Study](#), the largest study to be conducted on the effects of environmental influences on health and development of children from birth to 21. The study seeks to prevent and treat some of the nation's most pressing health problems, including autism, asthma, diabetes, heart disease, and obesity.
- Researchers are using the latest brain imaging techniques in adults and children, to determine the impact of early life exposure on the structure and function of the brain.
- NIEHS-supported findings are suggesting that the immune systems of both the child and mother play a role in early brain development, and problems in immune function can contribute to neurodevelopmental difficulties.
- NIEHS supports basic research to determine the mechanisms and pathways by which toxicants may bring about damage to the developing brain.
- Through the [American Recovery and Reinvestment Act](#), NIEHS and other institutes were able to increase National Institutes of Health (NIH) support for autism research.