Special Needs Resource Guide

Autism: From Prenatal Beginnings to Early Treatment

BY ERIC COURCHESNE, PH.D.
PROFESSOR OF NEUROSCIENCE, UC SAN DIEGO
CO DIRECTOR, UC SAN DIEGO AUTISM CENTER OF EXCELLENCE

Autism is a prenatal disorder. This conclusion comes from an abundance of evidence from cellular, molecular, genetic, animal model and postmortem studies. Its biological onset may be as early as the end of the first trimester and during the second trimester.

Early defects involve abnormal production, organization and growth of brain cells and abnormal production, development, and function of synapses. These defects lead to abnormalities in brain connections and activity. At these prenatal beginning stages heterogeneity is already present with variation in underlying genetics, excess brain cells, and which brain cell-types and brain layers are most affected. These, in turn, lead to variation in brain size and growth, axon development and connectivity in multiple regions including the cerebral cortex, amygdala, cerebellum, and striatum. Thus, variation in underlying brain structure and function exist before, and underlie and explain, the variation in the first clinically detectable behavioral symptoms. For example, brain imaging shows that at ages 1 to 2 years, toddlers with autism who have little brain response to speech later have very poor language skills, while those with a very strong brain response to speech later have very good or optimal language outcome. These different types of brain organization to language call for different approaches to language and social intervention at extremely early ages. Developing novel biological markers to define best treatment at extremely young ages is an essential next step in the field.

There is clear evidence of genetic influences in the origin of autism in an important percentage of children. Hundreds of genes have been implicated. Genetic screening, however, remains a challenge due to the extreme heterogeneity of the hundreds of identified but very rare gene mutations, and the fact that a substantial percentage of genetic risk may be due to common genetic variation and not to mutations. For the vast majority of ASD toddlers, therefore, DNA explanations for different developmental trajectories, neural functional characteristics, subtypes, and behavioral variation remain largely unknown.

Non-genetic factors may account for a substantial percentage of risk, perhaps as much as 30% to 41%, and such factors may act either independently or in combination with genetic factors. One of the most important non-genetic causes under intense investigation is abnormal activation of the mother's immune responses during the first or second trimesters, commonly referred to as Maternal Immune Activation or MIA. MIA animal models of autism, where the prenatal trigger mimics viral or bacterial infection, show many brain and behavior abnormalities commonly present in ASD.

Since autism is prenatal, when it is not detected in infants and toddlers, it is not because it wasn't present, it is because it was missed. Therefore, there is a vital need for early screening, detection, and treatment. In the past decade major progress has been made in early clinical screening and detection of infants and toddlers in the general pediatric population. Studies demonstrate that risk for ASD can be detected as young as 12 to 24 months using parent report screening tools such as the CSBS at well baby check-ups with follow-up confirmation at autism specialty clinics. This screening procedure is fast, easy, inexpensive and effective, and can be done in any pediatric office or clinic. Studies show that when pediatricians and autism specialty clinics work together, risk detection and diagnostic evaluation can occur as early as 12 to 20 months, and interventions can then begin in less than 2 months. In the future, novel biological and behavioral tools will be utilized in combination to enhance early identification and develop biological subtype-specific interventions.

Early interventions and services may improve the child's developmental outcome and help parents at a crucial time in human brain development. It has been scientifically established that during the first postnatal years, the human brain undergoes a profound period of establishing and refining neural connections. This important developmental step of the construction of functional and adaptive neural circuits is thought to be strongly dependent on input from the environment. If an infant or toddler with autism is identified and behavioral treatment begins before or while early brain connections are being established, it is likely that brain function for that toddler stands the best chance of being optimized. This is superior to treatment that begins after abnormal mature circuitry is already established. It is for this very reason that the early identification and treatment of autism is essential and ethically demanded.

ERIC COURCHESNE, PH.D.

Eric Courchesne does research on the early brain development and clinical progression of autism, including molecular, cellular, genomic and neural defects that lead to early language and social symptoms in autism. His work is internationally recognized. His studies integrate behavioral, developmental, genomic, and brain imaging findings to provide a comprehensive understanding of the early neurobiology of autism and identify optimal treatments specific to biological subtypes. His has published over 200 articles in major journals such as JAMA, Science, Neuron and the New England Journal of Medicine.