REFLECTIONS ON AUTISM

Clarence E. Schutt, Ph.D.

Autism was once a private matter. It was rare to encounter a person with autism. If one did, it was usually a family member or neighbor. Treatments were non-existent or based on treating parents to improve their parenting skills. In some regrettable instances, questionable and invasive medical treatments were undertaken in response to the nearly unbearable sense of desperation felt by families. As studies began to include ever larger numbers of recognized cases, autism came to be described in terms of a core set of behaviors, principally arising from a dysfunctional social engagement system. These behaviors serve as the basis for diagnosis and for therapies that use reward circuits in the nervous system to reinforce positive social behaviors (directed eye gaze, joint attention, purposeful speech) and diminish unwanted ones (self-injury, biting, hair-pulling, scratching, obsessive activity).

However, central to any discussion of autism is the near universality of communication impairments, including in some cases complete lack of speech, echolalia, or poor responsiveness to social context. Frustration of this basic human drive can itself explain many of the socially maladaptive behaviors associated with autism. It is becoming increasingly clear that communication technologies, in many cases developed to help victims of stroke, Parkinson's disease, cerebral palsy, and Amyotrophic Lateral Sclerosis (ALS, or Lou Gehrig's Disease), may enable autistic individuals to express their natural intelligence, often underestimated because of difficulties in writing and speaking.

Persons with autism may also face serious problems with processing the reports of their senses, such as overloads, ineffective parsing into 'chunks' of information, even cross-modal interference. The latest neuroimaging tools, working at the millisecond time resolution required to observe these subtle events, are beginning to reveal where and when a sensory signal can become distorted or out-of-synch with converging information from other channels. In learning to speak, a young person's brain must subtly intermix and modulate external sounds with self-generated utterances transmitted through the bones of the skull. Any slight delay or distortion can interfere with learning to speak, even though the person may perfectly well understand language, syntax and grammar. This signaling perspective can equally provide insights into some of the movement, coordination, and body awareness problems faced by persons with autism. The proprioceptive and endocrine systems are largely outside of our conscious control and, unless new tools are developed to track communications along the mind-body axis, these processing problems are only describable as externally-observed behaviors. However, once autism is seen in a multi-system context, it is conceivable that some widely used interventions might be tailored better to meeting specific challenges faced by individuals with autism.

The field of autism research was once isolated and outside the purview of the medical community, except for a few pioneers whose vision and compassion set the stage for the advances being made across a broad front today. The prospects for a deeper biomedical understanding of autism were heralded by the publication of the seminal book by Dr. Bernard Rimland and the discovery of cerebellar Purkinje cell abnormalities in post-mortem specimens by Drs. Margaret Bauman and Tom Kemper. Dr. Mary Coleman made a strong case for metabolic disturbances, not just in the brain, as a common feature of autism. Dr. Donald Cohen believed that autism arose from a derailment, somewhere along the line, of the normal process of child development.

Considering the tremendous advances in developmental biology then being made, it was possible to dream of an ultimate understanding of what causes autism. It was the Decade of the Brain and the Human Genome Project was just getting underway when the National Institute of Child Health and Human Development (NICHD) hosted a workshop on the future of autism research. Included were some of the most influential and successful scientists of the time, few of whom were working in the field of autism. The hope was to take a fresh look at the baffling and seemingly intractable problem of autism with eyes opened by rapid advances in the understanding of Parkinson's disease, cystic fibrosis, and cancer. At about the same time, through the efforts of family advocates and champions within the government, funding for autism research began to accelerate, as evidenced most recently when President Obama declared autism to be a high priority for the National Institutes of Health.

Any comprehensive hypothesis must begin with four basic facts about autism, each of which provides important clues for researchers: 1. identical twins with autism have a high concordance rate for the behavioral symptoms of autism (70-90%) compared with fraternal twins, indicating a genetic origin; 2. the prevalence rate for males is at least four times higher than for females, suggesting linkage to the sex chromosomes or an endocrine protective factor in females; 3. autism is highly heterogeneous in its presentation, with large differences in speaking ability, motor disturbances, aggression, eating disorders, numerical ability, and artistic talent; 4. autism appears to be on the increase, either because of as yet unidentified features of modern life (environmental factors, pathogen-human interactions) or possibly because more broadly-defined diagnostic categories have expanded the autism spectrum, resulting in only an apparent increase.

But what is autism? How does it arise? Why doesn't it always 'run in families' if it is genetic, but appears instead in just one or two generations (except for 'syndromic' forms of autism, such as Fragile X or Rett Syndromes)? Why aren't identical twins 100% concordant for the outward signs of autism? These questions force us to look beyond purely psychosocial or behavioral descriptions of autism and focus on the search for explanations in terms of the brain circuits involved in speech and behavior. Answers might be found in exploring how genetic networks controlling the development of these systems are influenced by the full panoply of molecules processed every day by our bodies in increasingly manufactured surroundings. It is possible that only a few neuronal subtypes are affected, say a certain class of inhibitory cells, greatly increasing the prospects for targeting these specific cells for repair or pharmacological intervention. What must be remembered is that autism is not a degenerative disease, but rather a condition, perhaps of metabolic origin, that could be shifted to another state by a wide variety of interventions, not just pharmaceuticals or behavioral protocols.

While autism certainly appears to be of neurodevelopmental origin, appearing early in life, it is often a lifelong condition. Persons with autism need physicians and other medical support staff that understand how difficult it is to convey where pain might be or to provide answers to the usual questions in a medical examination. Furthermore, the physiological or metabolic causes of the outward behavioral indications of autism might have heretofore undisclosed effects on other bodily systems such as the gastrointestinal or autonomic nervous systems.

Expectations for a deeper understanding of autism are considerably better now that new investigators, well-trained in molecular, cellular, and neurobiology, have been drawn into the field by the opportunity to address the profound and disturbing mystery of autism. It is not just basic science that is providing new insights but also medical doctors, trained in neurology and physiology, who are now seeing greater and greater numbers of persons with autism.

The human brain and its astonishing cerebral cortex, using all of the conscious and unconscious signals reaching it from the senses and internal circuits, creates patterns of association, memory and action that

express the unique personalities of all human beings. Autistic individuals are creating their lives as are the rest of us. A few have broken through to express themselves and have revealed that despite appearances their dreams and hopes are those we all share.

References

Bauman, M., Kemper, T.L. (1985). Histoanatomic observations of the brain in early infantile autism. *Neurology,* 35, 866-74.

Bristol, M.M., Cohen, D.J., Costello, E.J., Denckla, M., Eckberg, T.J., Kallen, R., Kraemer, H.C., Lord, C., Maurer, R., McIlvane, W.J., Minshew, N., Sigman, M., Spence, M.A. (1996). State of the Science on Autism: Report to the National Institutes of Health. *Journal of Autism and Developmental Disorders*, 26(2), 121-154.

Cohen, D.J., Volkmar, F.R. (Eds.) (1997). *Handbook of Autism and Pervasive Developmental Disorders, Second Edition*. New York: John Wiley & Sons, Inc.

Flagg E.J., Cardy J.E., Roberts W., Roberts T.P. (2005). Language lateralization development in children with autism: insights from the late field magnetoencephalogram. *Neuroscience Letters,* 386(2), 82-7.

Folstein, S. & Rutter, M. (1977). Infantile autism: a genetic study of 21 twin pairs. *Journal of Child Psychology and Psychiatry*, 18, 297-331.

Gillberg, C., Coleman, M. (2000). *Clinics in Developmental Medicine: The Biology of the Autistic Syndromes*. London, UK: MacKeith Press.

Luria, A.R. (1973e). *The working brain: An introduction to neuropsychology*. New York: Basic Books.

Office of Management and Budget. (2009). *Fiscal Year 2010 President's Budget*. Retrieved August 20, 2009, from The White House Website: http://www.whitehouse.gov/omb/budget/Overview

Rimland, B. (1964). *Infantile Autism: The Syndrome and Its Implications for a Neural Theory of Behavior*. New York: Appleton-Century-Crofts.

Williams, D. (1996). *Autism-An Inside-Out Approach: An Innovative Look at the Mechanics of 'Autism' and Its Developmental 'Cousins*'. London: Jessica Kingsley Publishers.