

## ASPERGER SYNDROME: A PRIMER FOR OPTOMETRISTS

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**F**or the past 20 years I have been fascinated by vision and its relationship to learning and behavior in individuals with special needs, especially autism. Early in my training as a mental health professional, I administered tests such as the Rorschach inkblots and was distressed by the psychological interpretations of clients' responses. Didn't the brain's processing of vision influence an individual's description? Why were subjects considered "crazy" if they saw objects instead of people? My coursework in psychology, mathematics and counseling did not satisfy my thirst for information about vision, so I turned to other disciplines for solutions.

In the 1980's I was fortunate to discover answers to my endless questions about the role of vision in development, learning and special needs from pioneers in optometry. Drs. Amiel Francke and Bob Kraskin opened doors that allowed me to share what I had learned with colleagues in other fields. Dr. Irwin Suchoff mentored me and encouraged me to put my thoughts down on paper. I detailed my trans-disciplinary approach to special needs in lectures, articles in this *Journal*, in Regional Clinical Seminars and eventually in the book, *ENVISIONING a Bright Future: Interventions that Work for Children and Adults with Autism Spectrum Disorders*,<sup>1</sup> published in 2008 by the Optometric Extension Program Foundation (OEP).

In my odyssey, one population fascinated me: those with Asperger syndrome (AS), or "Aspies." Often I have heard bright friends comment, "I think I have a little bit of Aspergers" and at times, I have believed that I did too. What other explana-

tion is there for a 13-year-old girl to beg for a subscription to *Recreational Mathematics Magazine* instead of *Seventeen*? Today, AS is extremely visible (pardon the pun!) in contemporary culture. The wildly popular sitcom "Parenthood" on NBC includes an endearing eight-year-old Max with Aspergers, who insisted upon having a bug expert as entertainment for his birthday party. The 2009 movie "Adam" starring Hugh Dancy was a hit. And the breakthrough came when Claire Danes won an Emmy last year for her superb portrayal of Temple Grandin, arguably the world's most famous and accomplished individual with Asperger's, in an HBO movie.

Grandin was introduced to the literary intelligencia in *The New Yorker* by psychiatrist/neurologist Oliver Sacks in 1993 as "An Anthropologist on Mars."<sup>2</sup> She and her friend Donna Williams, have written serious autobiographies<sup>3,4</sup> where they relate painful, graphic details about growing up with Aspergers. Other authors, including John Elder Robison,<sup>5</sup> and Daniel Tammet<sup>6</sup> use humor and pathos to describe their lives. Two best-selling novels, *The Curious Incident of the Dog in the Night-time*<sup>7</sup> and *House Rules*,<sup>8</sup> both written by neurotypical authors, have protagonists with AS diagnoses, whose astute attention to detail make them expert at solving mysteries.

My valued personal copies of these pieces, read over the past 15 years, have in the margins wildly colored notes ascribing many behaviors of these tortured individuals' attempts at dealing with faulty visual processing. As I look back on my scribbles, I am surprised at the consistency and strength of my reactions. Was I the only one to interpret their behaviors this way? Why didn't anyone refer these indi-

viduals to behavioral optometrists? What would have happened had any of them undergone vision therapy for probable visual or ocular abnormalities?

In this article I will present some of the fascinating information I have gathered about AS. As a member of the Peer Review Board of this *Journal* almost since its inception, I have read and edited many articles. Editing the paper on "Ocular Findings in Rett Syndrome"<sup>9</sup> (another diagnosis included in the autism spectrum) was the catalyst for writing this "Viewpoint" article.

### What is Asperger Syndrome?

**Asperger Syndrome** is named for a Viennese physician, Hans Asperger. In 1944 Asperger published a paper describing a pattern of behaviors in several young boys who had normal intelligence and language development. However, they also exhibited autistic-like behaviors with marked deficiencies in social and communication skills.<sup>10</sup> Only in the past few years has AS been recognized by professionals and parents as a subset of autism. Some dispute whether AS is truly a type of "high-functioning" autism,<sup>11</sup> a non-verbal learning disability or something else entirely.

### How is Asperger's Diagnosed?

Since 1994, AS has been classified as one of the pervasive developmental disorders (PDD) in the *Diagnostic and Statistical Manual of Mental Disorders (DSM)*.<sup>12</sup> If you are unfamiliar with this tome, trot over to the reference section of your public library and take a look. I think you will be astounded! Along with the myriad of questionable diagnoses of childhood disorders, you will find menopause and alcoholism. The main purpose of this reference book is for insurance coverage (or

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rather denial in most cases.) This “bible” of the American Psychiatric Association is published about every 10 years; the present edition is the fourth, and the fifth is to be published in 2012.

Individuals with AS can exhibit a variety of characteristics, and the disorder can range from mild to severe. AS individuals show marked deficiencies in social skills, have difficulties with transitions or changes and prefer sameness. They often also have obsessive routines and may become preoccupied with a particular subject of interest. In other words, those with AS have a normal IQ and many individuals (although not all) exhibit exceptional skill in a specific area. These talents include, but are not limited to, perfect pitch, photographic memories, amazing drawing skills, the ability to perform complex arithmetic calculations without pencil and paper, and the “party skill” of telling the day of the week for any given day of any year. Recently, some highly accomplished individuals, viewed as “odd” by others, including Thomas Jefferson and Albert Einstein have been “diagnosed” with AS.<sup>13</sup>

While language development in AS is by definition not delayed, individuals with the syndrome often have deficits in pragmatics and prosody. Vocabularies may be extraordinarily rich and some children sound like “little professors.” However, persons with AS can be extremely literal and have difficulty using language in a social context. One boy I know pictured a brown four-legged antlered animal in a parfait glass when asked if he wanted chocolate mousse.

AS individuals are often highly sensitive to sounds, tastes, smells, and sights that no one else seems to hear, experience or see. In the words of one very articulate 18-year-old, who is now lecturing about growing up with high-functioning autism, “The pain of lights, sounds and the bees and motorcycles in my head were really bad...The hardest thing to process was snow. Having it land on you was absolutely overwhelming. Processing it changing from cold snow to liquid on my skin drove me out of my mind. I could not tell how deep it was...I felt like I was going to keep falling and the crunching sound made it feel like I would disappear under it.”<sup>14</sup>

Many prefer specific types of clothing (soft sweat pants, long sleeves, or socks without seams) and eat only certain foods (primarily the white ones that require little chewing). Parents, teachers and others often perceive their heightened responses to

sensory experiences as rudeness or inappropriate behavior, and try to extinguish them as being socially unacceptable.

Those diagnosed with AS after age 10 often manage to develop age-appropriate self-help skills, adaptive behaviors (other than social interaction), and curiosity about the environment. As they get older, it becomes apparent that they often have a great deal of difficulty reading nonverbal cues (body language) and determining proper body space.

A person with AS perceives the world very differently. Many behaviors that seem odd or unusual are, in fact, due to a unique combination of a high degree of functionality and social naiveté. Others may thus view an Aspie as eccentric and can easily tease and bully him.

### **Females with Aspergers**

Think AS, think male. Aspie boys outnumber Aspie girls at least 4:1 and maybe as much as 10:1.<sup>15</sup> Why? Theories abound. Perhaps because diagnostic criteria for AS are based on behavior, and behaviorally “different” boys are often more disruptive than behaviorally “different” girls. The more verbally adept girls may be able to talk their way out of trouble, and just seem immature or odd rather than disabled. Blabbing endlessly about Scooby Doo or My Little Pony is more socially acceptable than conversing about dinosaur classification. Girls spending time in an imaginary world of creative play beats boys’ “in-your-face” questioning.

Aspergian single-mindedness is also associated with more “male” professions such as engineering and science, which, not surprisingly are becoming more popular with females. Temple Grandin has written about appropriate careers for those with AS,<sup>16</sup> which include auto mechanics (the chosen profession of John Elder Robison mentioned above), engineering, web design and other computer-related specialties.

One interesting theory revolves around genetic differences. British researchers believe that the X chromosome holds the secret of the gene(s) for autism. Girls inherit X chromosomes from both parents, but boys only inherit one, from their mothers. Their hypothesis is that the X chromosome, which girls inherit from their fathers, contains an imprinted gene, which protects the carrier from autism, thus making girls less likely to develop the condition than boys.<sup>17</sup>

### **The Person is not the Diagnosis**

Diagnosing AS is not analogous to diagnosing diabetes, Tay-Sachs or leukemia: no genetic, blood, urine, stool or hair analysis defines the diagnosis. Rather, diagnosis is made by experts who recognize a specific cluster of symptoms. From the time I got down on the floor as a neophyte psychologist in the late sixties to participate in play therapy with my young clients, I wanted to know the CAUSE of their symptoms. Why do a majority of folks with AS:

- Process language in such a peculiar fashion?
- Not give sustained eye contact?
- Experience serious sensory overload as described above?
- Enjoy computers and video games?
- Have a niche area of concentrated knowledge or talent?

I think visual dysfunctions might well have something to do with it, don’t you?

### **Inflexible Vision Causes Inflexible Behavior**

How many ways can vision be slowed down? You are able to answer that better than I. Behavioral optometrists know only too well that impaired binocular or perceptual functioning, or visual information processing are frequently misinterpreted. In the past, and in some quarters today, we mistakenly assumed that individuals with these deficits were slow cognitively, or retarded, a word rarely used any more, or even learning disabled. In essence, vision was, and still is, not always given the consideration it deserves.

My extensive clinical experience indicates that many individuals with AS typically are slow processors of visual information. Aberrant behaviors such as poor eye contact, eye rolling and closing, blinking, hand waving, side glancing and squinting are frequently interpreted as “visual stims.” To me these behaviors are intelligent ways to try to jump-start their vision. I believe that poor internal visual processing is one of the reasons many Aspies are so attracted to external concrete visual helpers, such as computers and video games. Some cognitive psychologists, and even Temple Grandin herself,<sup>18</sup> think that people who use visual materials to their advantage are visual learners. I disagree. I believe that computers, pictures, video games and movies replace visual images that are usually gained from personal sensory experiences. This allows them to compensate for their poor internal

visual processing. For that reason, vision therapy can have great potential for many individuals with AS.

## History Taking

While people with the same diagnosis display some of the same symptoms, they do not necessarily require the same treatments. Determining the appropriate treatment for a unique individual requires knowing the cause of an individual's symptoms. In my book, I give a "tongue-in-cheek" example. Diagnosis: headache. Possible causes: too much stress, MSG poisoning, a brain tumor or a nagging mother-in-law! Obviously, whether you reach for the aspirin, Alka Seltzer Gold or make an appointment with a neurologist or lawyer depends upon what you think is the cause of your headache.<sup>1</sup>

Determining cause requires taking a complete history. Complete is the important word here. A *complete* history takes time and effort. It must include pre-natal, natal, environmental, developmental and medical information. When autism occurs in clusters, such as in Brick, NJ,<sup>19</sup> epidemiologists are all over the possible culprits. These include chemical plants and playgrounds built with arsenic-soaked telephone poles. When single events, such as a case of AS occur in a family, we need to investigate them with the same fervor.

But, I'm an *eye* doctor, you say. Why do I need to know about arsenic poisoning and mothers' thyroid status? Those factors affect the whole person **including** their visual functioning, in a similar way to alcohol and medications. Biologically, the visual system is one of the most demanding systems in the body. The components of the visual system and their ability to function at an acceptable level are going to suffer if the mother was exposed to toxins during her pregnancy. Likewise, the baby is at risk if the home that the baby came into on the first day of life was moldy. These are not abstract examples. I personally know cases of AS where this occurred from exposure to toxins.

## Commonalities in the Histories of Individuals with AS

**Toxicity from lead, mercury, arsenic, antimony and other heavy metals is common.** Researchers have correlated the severity of autism with the level of the toxic body's burden.<sup>20</sup> Those with high-functioning autism thus have a smaller burden than those with full-blown autism. However, this body burden is still significant because with AS the body must still deal

with its albeit lesser toxic load. The havoc AS wreaks on neurological, endocrine, gastrointestinal and other functions, including vision is large.

Lead has been recognized as a neurotoxin for many years. Pediatricians now routinely check children's lead levels. Parents and professionals in a number of scientific fields recognized the symptoms their autistic children and patients demonstrated was similar to those of mercury poisoning.<sup>21</sup> They listed these symptoms side by side, system by system, and recognized that autism may in fact be a unique form of mercury poisoning. The next time you see dilated pupils, think mercury, as well as brain tumor.

Lead<sup>22</sup> and mercury are just two of the many toxic metals implicated in autism. Many toxins can affect the thyroid, sometimes triggering hypothyroidism.

## Individuals are frequently male children of mothers with hypothyroidism.

According to the American Thyroid Association, about 2-3% of Americans have pronounced hypothyroidism, and as many as 10-15% have subclinical, or mild hypothyroidism.<sup>22</sup> More than half the people who have hypothyroidism do not know it. Could the autism and thyroid disease epidemics be related? Raphael Kellman, M.D. believes so. He has researched this subject extensively.<sup>23</sup>

The thyroid is a tiny gland located in the throat area. It secretes hormones, essential for energy production in every cell of the body, and for normal brain development during critical periods beginning in utero. Thyroid hormones T3 and T4 regulate neuronal proliferation, migration, and differentiation in discrete regions of the brain during definitive time periods. Deficiencies in any of these thyroid hormones during critical times, especially the first two years of life, can have significant deleterious behavioral and cognitive effects. It can cause nervous system damage such that autistic symptoms are likely to ensue.<sup>24</sup> Translation: thyroid dysfunction may masquerade as autism.

A parent who learned about thyroid first hand is Audrey McMahon, a founder of the Learning Disabilities Association (LDA). She knew something was wrong with her son, born in 1951, long before we knew much about diagnosing and treating developmental problems. Audrey had been taking thyroid medication since the age of 13. After researching her family's history, she deduced that her brother's delays were related to their mother's hypo-

thyroidism, and that her great uncle was also probably affected. Her son is thus the third generation from a family of women with underactive thyroids. McMahon's indefatigable search for answers finally led to the diagnosis of her son's AS in the early 1980s.<sup>25</sup>

## "Picky eating" is one hallmark of AS.

The eating habits of Aspies are as varied as the individuals themselves. Quirky sensory systems, particularly in olfaction and taste make Aspergians balk at certain textures, smells, colors, appearance and combinations of foods. Some dislike foods that are too thick (soups), grainy (peaches) or lumpy (spaghetti sauce). Many cannot tolerate foods that touch each other on the plate.

In *House Rules*,<sup>8 (p 334)</sup> Jacob's mother survives by designating each day by color. "Fridays are blue. Once you get past blueberries and yoghurt and blue jello, what's left? Blue corn chips, blue potatoes, blue popsicles and bluefish (which Jacob points out is not technically "blue")." At least this method provides a somewhat varied and questionably more nutritious diet that attempts to bypass meltdowns.

Often, pizza, macaroni and cheese, cereal and milk, cookies, crackers, bagels and cream cheese, and an infinite number of wheat and dairy combinations are the mainstay of an AS, with ice cream, chicken nuggets and French fries thrown in. As if that's not being particular enough, most kids are brand specific, too. Don't even think of substituting a generic for Kraft, Chef Boyardee or McDonalds.

Desperate parents try cooking at home, grinding up spinach in brownies and protein powders in shakes, but often to little avail. Sorry, "I don't like it," "Yuk!" a heave across the room or a two-hour meltdown are common refrains and reactions. So what's a mother to do? Most win the battles by caving in; unfortunately, they are losing the war on health and nutrition. Eventually, depending on the strength of a family's genetic constitution, constipation, diarrhea, asthma or other health problems creep up. Then off to the doctor who prescribes something to make them "go" or something to make them "stop going" and the cycle of drug side effects is added to the picture.

An alternative is for parents to take control, the earlier the better, and not allow AS children to tyrannize the family table. Those who do, institute special diets for special kids.

The Autism Research Institute (ARI) collected anecdotal evidence from parents on which interventions helped their AS children most; of those who tried a gluten-free casein-free diet, 70% reported that their children showed improvement. Other special diets with high marks are Specific Carbohydrate Diet with 64% and a rotation diet with 60% improvement.<sup>26</sup> So, just removing certain foods and adding others decrease inappropriate symptoms, and increase appropriate outcomes such as better sociability, focus and mood. Is it going to be easy? No! Is that worth a try? You bet!

Remember how nutrition affects visual function.<sup>27</sup> Pizza, macaroni and cheese and French fries simply do not give the visual system what it needs to function well. Even though some of the same doctors who prescribe the medications assure parents that kids get what they need over time, I don't believe it, do you? Where are vitamins A, B, C and D?

#### **Vitamin and mineral deficiencies are common in AS.**

The late psychologist Bernard Rimland, PhD, father of a son born in 1956, never believed the prevailing theory that autism was a result of poor parenting or "refrigerator mothers." He looked elsewhere for clues to his son's behaviors. His journey resulted in the founding of the ARI in 1967. From the start his research focused on the biology of autism, eventually leading to the movement, Defeat Autism Now! It has documented cases of reversing autism.<sup>28</sup>

Rimland emphasized the role of vitamin B6 and magnesium deficiencies in autism. Numerous studies support vitamin and mineral supplementation.<sup>29</sup> Later, he expanded his repertoire to include many other essential vitamins and minerals.

ARI publishes an annual paper relating anecdotal evidence from parents of children with all types of autism who have tried a variety of treatments, including vitamin and mineral supplementation. In 2008, ARI published a separate version of this paper reporting on data collected from 1,297 parents of family members with AS. The following were the most efficacious:

- Minerals: Calcium, magnesium and zinc;
- Vitamins: A, B3, B6, B12, C and D
- Other supplements: Cod liver oil and digestive enzymes

Readers wishing to view the whole chart can find it online.<sup>26</sup>

Of particular interest to optometrists is the work of developmental pediatrician, Mary Megson, M.D., who views the visual issues in autism as a biological problem that improves with Vitamin A supplementation in the form of Cod liver oil. One of the first effects she sees is the disappearance of the "sideways glance." She believes this is a biological adaptation to a blocked visual pathway.<sup>30</sup>

I have observed that an increasing number of optometrists are adding nutritional supplementation to their tool chest. Not all vitamins and supplements are created equal, so choose only pharmaceutical grades with care. Cheap vitamins with fillers will not do the job. In addition, I believe that one reason some studies show no or little improvement with supplementation is that the dosages were not at therapeutic levels. For individuals with deficits so huge that autistic-like features exist, sometimes mega-doses of vitamins or minerals are needed, at least for a while. Think of supplementation as filling an empty bathtub, and then keeping it full when the drain has a slow leak.

#### **Individuals with AS tend to be clumsy and perform poorly in activities requiring good eye hand coordination, balance and depth perception.**

Another hallmark of AS is motor clumsiness. One of the first indications that individuals with AS have motor issues is delayed walking.<sup>31</sup> Later they report being the last chosen on teams, even in elementary school. They avoid all games with balls because they know they perform poorly. Dr. Tony Attwood, a well-known clinical psychologist writing for The Online Asperger Syndrome Information and Support (OASIS) center, questions if this characteristic should be one of the official DSM diagnostic criteria.<sup>32</sup> Possibly it will show up in 2012.

One belief that has permeated Asperger mythology is that motor problems are due to faulty proprioception, the sense responsible for the muscles and joints sending information to the brain about the position of one's limbs in space. In my opinion, this explanation may be a piece of the puzzle, but certainly not the solution. Researchers found that their subjects could balance on one leg while their eyes were open, but could not when asked to close their eyes.<sup>33</sup> Perhaps they needed visual reinforcement to overcome another inadequate sensory system indicating the right test but the wrong conclusion.

I sometimes can diagnose an AS by his stiff or halting gait. When my home office had open stairs, I found watching my client ascend the stairs more diagnostic than the standardized tests waiting at the top. Some of my Asperger clients simply freaked out, refusing to climb them. Repeatedly, in my practice I hear stories of bullying because of trouble that those with Aspergers have just finding their way around the halls of schools and the neighborhood. Poor balance, illegible handwriting even in middle and high school, and trouble interpreting others' postures, gestures or movements are common.

Common panaceas are adaptive physical education (in severe cases), friendship circles providing a buddy to protect the potential victims, social skills training classes, and anti-bullying workshops. In the best case scenario individuals with gross and fine motor issues find their way to classes in martial arts or to occupational therapists (OT).

Of all the entry points to reaching AS patients the visual-motor problem is the easiest. OTs should be your best friends and referral sources. (In more and more cases I have found that they are also your spouses!) A good OT with knowledge of sensory integration and understanding of developmental vision is worth this professional's weight in gold. Find one, especially in the school system, who can refer her cases to you once she has worked her magic.

After an evaluation of a patient presenting with eye-hand coordination problems, vision therapy makes sense to parents. Progress is often swift and visible (pardon the pun, again.) All the above interventions serve to help an Aspie compensate, but none can perform the magic of a developmental optometrist who trains the motor and visual systems to work together as a team.

#### **High testosterone levels are common in Aspergers, especially in females.**

In 2009, British researchers at Cambridge University, headed by Autism Research Center Director Simon Baron-Cohen, reported on a longitudinal study. They found that levels of testosterone in amniotic fluid were linked to children's autistic traits up to ten years later.<sup>34</sup> The traits cited include less eye contact, developing fewer interests, and having poorer quality relationships.

Why is high testosterone of interest? The higher the testosterone, the more "male" characteristics an individual expresses.

In males, more “maleness” may not be a problem until it becomes extreme, resulting in aggression and rage. I have read about at least one case recently where out-of-control males with AS attacked family members and in a few cases killed them.<sup>35</sup> In females, the same type of aggressiveness may be present and is less acceptable socially. At lower levels with girls it can have the same negative results.

As early as 1964, Dr. Bernard Rimland stated in his now classic book<sup>36</sup> that males are more vulnerable to organic damage than girls, whether through hereditary disease, acquired infection or other conditions. This conjecture is supported by the work of geneticist Mark Geier, MD, PhD and his son, David.<sup>37</sup> Understanding the synergistic relationship between mercury and testosterone has become the passion of the Geiers. They found that:

- Mercury toxicity significantly elevates testosterone, but not estrogen. Estrogen is protective. Girls on the autism spectrum have even higher testosterone levels than the affected boys. This led the Geiers to conclude that heightened testosterone overcomes the naturally protective effects of estrogen. Testosterone binds with mercury, thus rendering it invulnerable to biomedical chelators often prescribed to lower metal toxicity. The chelators can only pick up the free-floating heavy metals.
- The severity of autism correlates with levels of testosterone in prenatal amniotic fluid, the higher the testosterone, the more severe the autism.
- Seemingly unrelated biomedical treatments that benefit autistic children have one commonality; they lower testosterone levels.<sup>38</sup>
- Testosterone production could be temporarily halted with the drug Lupron,<sup>39</sup> a synthetic protein that acts like a natural hormone in the body. It decreases testosterone in men and decreases estrogen in women. This medicine has been used for many years to treat advanced prostate cancer, precocious puberty and boys with undescended testicles. In women, some forms of this medicine may be used to treat endometriosis, uterine fibroids, or other female hormone-related problems.<sup>40</sup>

Strong adulation comes from parents whose children have benefitted greatly from Lupron. I know several for whom using Lupron kept their kids out of institu-

tions. Read the above cited literature, talk to parents and form your own opinions.

The results of a study on the role of sex hormones in autism just became available.<sup>41</sup> The exciting findings were published on PLoS ONE. This is an interactive open-access online journal for the communication of all peer-reviewed scientific and medical research. The study was funded by Autism Speaks, a non-profit organization that seems to be focused on the genetics of autism. Dr. Valerie Hu and her team at George Washington University found that “male and female sex hormones regulate the expression of an important gene in neuronal cell culture through a mechanism that could explain not only higher levels of testosterone observed in some individuals with autism, but also why males have a higher incidence of autism than females.”<sup>42</sup>

One of the most exciting findings of this study is that the gene, named RORA, encodes a protein that works as a “master switch” for gene expression. It is critical in the development of the cerebellum, as well as in many other processes that are impaired in autism. RORA has been found to be diminished in the brain of autistics.<sup>42</sup> This gives a possible connection between testosterone levels and motor problems, as the cerebellum plays a vital role in motor control.

### Vision Therapy and AS

So far as I know, the only book describing vision therapy for AS is Dr. Melvin Kaplan’s *Seeing Through New Eyes*<sup>43</sup> and it is over five years old. Formal research on patients with AS of all ages is necessary to corroborate anecdotal reports on the pervasive incidence of vision dysfunction in AS. I conducted literature searches on Google, PubMed and the web-site of this *Journal* (www.oepf.org) and got no hits for “Vision AND Asperger Syndrome.” Why is there such a dearth of research on this population that can benefit so profoundly from the work of developmental optometry? Virtually every intervention for AS cited in this paper is supported by research.

Institutional or coordinated and well-planned private practice setting retrospective or prospective studies could fill the gap. A starting point would be to determine the types of ocular and visual conditions that are present in AS. These findings could either then be compared to a matched control group or to an unbiased population. The next phase would be to investigate the efficacies of appropriate

optometric interventions on these conditions. Some possible research questions appear below:

- Is there a relationship between strabismus and AS?
- What is the incidence of AS in those who have had strabismus surgery?
- Can lenses and/or prisms lessen undesirable behaviors in patients with AS?
- What other types of vision therapy are most beneficial for patients with AS?
- What motor/movement therapies are complementary to vision therapy in AS?
- Do patients following special diets and biomedical treatments fair better with the addition of vision therapy?

I believe that families of individuals with Aspergers deserve answers to these questions.

### Conclusions

Asperger Syndrome, like more severe diagnoses on the autism spectrum, is a complicated disorder with significant visual components. Developmental optometrists must be primary members of the evaluation and treatment team. Furthermore, they must become knowledgeable about and conversant with professionals in other disciplines who are working with these individuals.

Only through the use of a trans-disciplinary approach that includes experts in genetics, diet, nutrition, sensory, motor, language, social-emotional and vocational areas can the needs of this population be appropriately met. A major optometric contribution would be research to determine the occurrence of ocular and visual dysfunctions in the AS population, and then ascertain the efficacy of the appropriate interventions.

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For the past 20 years I have been fascinated by vision and its relationship to learning and behavior in individuals with special needs, especially autism. Asperger's Syndrome was first described in 1944, by Hans Asperger. Just a year later Leo Kanner described autism symptoms. It is incorporated for the first time in the Diagnostic and Statistical Manual of Mental Disorders, in its fourth edition (DSM-IV), within the developmental disorders. Within this group, in addition to the Asperger's Syndrome, were also Autism disorder, Rett's Disorder, Childhood Disintegrative Disorder and Non-specified Generalized Developmental Disorder. Adults with Asperger's syndrome acquire adequate formal language, but many have problems using it effectively to communicate. This happens because, neurocognitively, they don't have the capacity to understand other people's mental states or empathize.