

Alternative and Innovative Therapies for Development Disorders, Like Autism

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Autism was first described in 1943. The 11 children presented what are now known as autism's characteristic features -- inability to develop relationships with people, extreme aloofness, delay in speech development, non-communicative use of speech, repeated simple patterns of play activities, and islets of unusual ability. The two most prominent features were recognized as aloneness and an obsessive insistence on sameness. Today's definition of autism includes the above along with restricted, repetitive, and stereotypical patterns of behavior, interests, and activities; a recognition that non-verbal communication may be as impaired as verbal communication; and an awareness that some children suffer from involuntary, violent outbursts. Abnormal movements, problems with coordination and fine motor movements and sensory impairments are also understood to be part of the disorder.

Research in the past five decades has changed this original concept of a single disorder (called infantile autism in 1943) to the current concept of a spectrum of disorders with multiple subtypes. Though this spectrum contains a variety of named conditions, all are descriptive, with none representing an actual biochemical or metabolic understanding. These names are readily recognizable by parents and include autism itself, Rett's disorder, childhood disintegrative disorder, Asperger's syndrome, pervasive developmental disorder, and atypical autism. What many parents do not understand is that these names represent different, apparent clustering of symptoms, and not a true understanding of the causes of these conditions. Since what can be said about autism is relevant to all of the other named disorders, I will use the term autism to refer to all related developmental disorders, only for the sake of brevity.

In addition to the core symptoms described above, symptoms potentially related to other conditions are frequently found among children with developmental disorders. For children with autism, about 60% have poor attention and concentration; 40% are hyperactive; 43% to 88% exhibit morbid or unusual preoccupations; 37% have obsessive phenomena; 16% to 86% show compulsions or rituals; 50% to 89% demonstrate stereotypical speech; 70% exhibit stereotypical behaviors; 17% to 74% have anxiety or fears; 9% to 44% show depressive mood, irritability, agitation, and inappropriate affect; 11% have sleep problems; 24% to 43% have a history of self-injury; and 8% have tics. The current trend has been to diagnose these behaviors and symptoms as other coexisting conditions (rather than attributing them to the developmental disorder itself). The resulting additional diagnoses include attention deficit hyperactivity disorder (ADHD), affective disorders (depression, bipolar disorder), anxiety disorder, obsessive-compulsive disorder, and Tourette's disorder (a disorder in which children have unusual tics and mannerisms and sometimes involuntary and repetitive cursing).

Genetic analysis has yielded a few potentially interesting genes that may contribute to autism, but no clear linkage has been established. For this reason, it has been suggested that the autism may involve multiple causes.

While autism was once thought to affect only 1 in 500 children, recent trends indicate that its incidence is increasing, and that it may affect as many as 1 in 150 U.S. children. Studies in both California and New Jersey have shown dramatic increases in the numbers of children diagnosed with developmental disorders in the past 10 years, an increase which has not been explained. Nevertheless, this dramatic increase has been used to argue against a genetic basis, but more in favor of environmental factors (increasing pollution, increasing vaccination, increasing toxic metal exposure during development) playing a role in the increase.

People with autism appear differently at various ages. Their symptoms and behaviors change with aging. In early childhood, hyperactivity, stereotypical behaviors, irritability, and temper

tantrums are be prominent. Tics, aggressiveness, and self-injurious behaviors appear in older children. In adolescence and adulthood, particularly in higher-functioning individuals, depression or obsessive-compulsive phenomena may develop and interfere with the person's ability to function and with his quality of life.

Modern medicine strives to understand the biochemical and metabolic basis for diseases. From this understanding, pharmacology aims to develop drugs that act at the level of the underlying impairments. The classic example comes from the discovery that insulin deficiency formed the basis of childhood diabetes and that insulin replacement was life-saving. Despite tremendous efforts, we are far from a biochemical or metabolic understanding of the causes of autism. No treatments have been developed that address the underlying problem causing autism, since it is not known and since autism may have many different causes, all culminating in the cluster of symptoms that present as developmental disorders. The treatments of conventional medicine for autism are as speculative and trial-and-error based as the alternative therapies. Conventional medicine approaches autism with a variety of treatments, including parental counseling, behavior modification, special education in a highly structured environment, sensory integration training, speech therapy, social skill training, and medication. The results of these comprehensive suites of therapies have not been sufficiently satisfying to prevent parents from seeking alternative therapies for the benefit of their children. If conventional medicine were completely successful in treatment autism, no need would exist for alternative or innovative therapies.

Exciting research efforts are underway to improve our basic understanding of autism. These efforts will help both conventional and alternative medicine practitioners. These researchers are developing ways to identify on biological grounds different subtypes of autism. Using electrophysiology (recordings of EEG, heart rate, blood pressure, breathing rates, and skin conductance) two subtypes were identified among 145 developmentally disordered children. These different profiles were thought to reflect different types of brain dysfunction. One type was associated with intellectual impairment and excess reactivity of the central, parietal part of the brain, while the other subtype linked typical autistic behavior with excess reactivity of the temporal part of the brain (the part of the brain that is also involved with language processing). In an earlier study of 222 children, these same researchers had identified four subtypes of developmentally disabled children based upon information from clinical assessments. They used the type of communication disorder, type of abnormal findings on the neurological examination, type of impairment of intelligence, and types of autistic behaviors to separate out four different groups of developmentally disabled children. These subtypes correlated with different findings on dopamine and homovanillic acid, brain neurotransmitter metabolites.

From a different direction, single-photon emission computed tomography (SPECT) of the brain was used to define functional abnormalities in two groups of childhood behavior disorders: (1) a "primary" category in which there is exclusive or predominant presentation with cognitive and/or behavioral dysfunction and (2) encephalopathies, often defined etiologically at the biochemical or molecular level, in which clinical expression includes, but is not confined to, neural dysfunction. Among other behavioral disorders, SPECT scan studies have suggested a pattern of hypoperfusion of two particular brain areas (the striatal and periventricular areas) along with excess blood flow to the part of the brain that handles sensation and movement (the sensorimotor cortex) in attention deficit hyperactivity disorder. Specific abnormalities have also been found in cerebral palsy and other brain conditions manifesting as problems with behavior (phenylketonuria, MELAS (mitochondrial encephalomyopathy with lactic acidosis and stroke-like episodes) syndrome, Wilson's disease, etc).

During my medical training, autism and its related disorders were considered essentially incurable. Little has changed in the intervening years. The autism clinic from my psychiatry residency was largely an exercise in diagnosis without treatment; what little we did for the children we saw was largely ineffective. While we had come a long way from Bettelheim's refrigerator mother theory of autism (in which a cold, unresponsive mother was the cause of the

condition), we were stuck in a genetic-biochemical hypothesis that allowed no possibility for cure or improvement. We were confident that the unknown genetic defect was buried deep in the biochemistry of the brain. We were excused from searching for treatments, thereby leaving this crucial journey to the parents.

The parents of autistic children convinced me that everything I had learned was wrong. Freed from the fetters of training and pessimistic professors, they taught me that children with developmental disorders are interesting, and have rich social and communicative lives, though different from their so-called normal counterparts. Attentive parents naturally learn the secret language of their autistic children without even realizing this amazing feat. Autistic children do communicate and do respond, but as if they live in a parallel universe, which can nevertheless be accessed by those who want to reach them. They respond to many treatments, including just receiving attention and being cared for. They respond to nutritional therapies, body therapies, reiki, and craniosacral therapy. They respond to acupuncture. They respond to biofeedback and to behavioral educational therapies. What don't they respond to?

Can autistic children become indistinguishable from so-called "normal" children? I have seen it happen sufficiently often to believe; though, in every case, the parents invested significant time and money to their child's treatment, far above what school systems and insurance carriers would have paid. To what can we attribute these successes, for no one treatment seems to out perform the others, and no clear signposts exist to tell parents what to do. Despite this, there are therapies with which I begin.

I have not seen any differences in the application of these alternative therapies to children that depending upon whether the child is diagnosed with autism, pervasive developmental disorder, Asperger's syndrome, or another related disorder. I am not sure that these distinctions are relevant. When we do eventually understand the neurobiology of developmental disorders, we may have very different classifications.

Science and Alternative Therapies for Developmental Disorders.

Little scientific research has been conducted on the many alternative therapies being discussed by parents. Science is expensive, and best funded by drug companies. Most of these therapies cannot be patented. They are not amenable to mass production, but require one-on-one human interaction, a mode of treatment which is definitely not profitable.

Beyond that, research on developmental disorders may require a different protocol than drug research. Typical drug research compares a treated group with a group treated with a placebo or to a standard of care drug considered the "gold standard" in the field. Longitudinal, observational research has fallen out of favor. This type of research is suited for the situations in which we are less than certain of what we are treating. Developmental disorders fall in this category. We cannot explain the various developmental disorders. We do not know how many different entities are contained within the one label of autism or pervasive developmental disorder. We do not know how many different pathways results in the collection of symptoms that get labeled as developmental disorders. How can we properly pick children to treat in randomized, controlled trials, if we don't even know what's wrong with them.

Parents need to remember that autism is not a diagnosis like diabetes. We know that type 1 diabetes results from a deficiency of insulin, probably from auto-immune causes, though there may be more than one pathway even there, to insulin deficiency. We know that type 2 diabetes results from insulin insensitivity - the receptors no longer respond to what insulin is circulating. With autism, we do not even come close to such a definitive explanation. We have many competing explanations, any or all of which may be correct.

Consider recent randomized, controlled trials of secretin (a peptide hormone secreted by both the brain and the pancreas that was initially reported as showing promising results for autistic children) that show no effect. Have these studies been properly conducted? Do we know which subtypes of autism to select for such a trial? Can we say that we understand autism sufficiently to select those children who would respond to secretin? I think not. What if only particular subtypes of autism respond to secretin. A trial that included multiple types of autism would not necessarily show positive results. A more appropriate study might be to observe children receiving secretin over time, comparing responders to non-responders. Then we might learn something about who responds. From this knowledge, we could select potential responders for a randomized, placebo-controlled trial that would be more successful.

So much of alternative therapies are based upon anecdotal reports, because the funds are lacking for rigorous studies. Yet, so much of clinical medicine is based upon anecdote and is not evidence-based either. Most of the drug therapies used for autism have not been subjected to rigorous clinical trials. They have not been shown to be better than placebo.

Pygmalion Effect. A major problem in autism treatment is separating what could be called the Pygmalion Effect from true biological efficacy. The problem is complicated by the possibility that true biological activity without an emotional and environmental context for a treatment doesn't really exist. The Pygmalion Effect is named after George Bernard Shaw's play in which a lower class, "uncultured" woman from the slums of London is trained to be a "lady," and becomes every bit as sophisticated as one born to this position. The effect has been demonstrated in elementary school classrooms. In the classic experiment, children's IQ's were measured and the children were ranked as higher or lower IQ. Teachers were told the opposite from what was found. High IQ children were presented to teachers as lower IQ. Low IQ children were presented to teachers as high IQ. One year later, the teachers' expectations were much more important in determining children's performance than their actual IQ. Knowing this, we could never ethically repeat this experiment, for we are so much more aware of how people's expectations for others, determines performance. A confounding problem in evaluating any therapy for autism, including vitamins, is this Pygmalion Effect. Because of this, many conventional physicians dismiss the potential value of alternative therapies in favor of pharmaceuticals. Drugs are always better studied than alternatives, because 1) they are easier to study, 2) more money exists to study drugs because of the potential profitability, and 3) it is more respectable as a researcher and a physician to study drugs.

Until sophisticated clinical trials are completed, any of the alternative therapies I will discuss could be explained partially or completely by the Pygmalion Effect. What is exciting about this is the realization that expectations can alter behavior. If parents expect strongly that their autistic child will improve, the child does. I am not afraid to try safe therapies that may only work because they activate this Pygmalion Effect. This type of healing is just as real as that produced by drugs, and probably much safer! While we struggle to find biologically active treatments for autism, we cannot err too greatly by supporting parents' enthusiasm for safe, new treatments. We know from research on the placebo effect that an enthusiastic doctor whose patients believe in him or her has a 70% success rate regardless of the effectiveness of the treatment. An unenthusiastic doctor has only a 30% success rate with an ineffective treatment. Therefore, we should never discount enthusiasm. I continue to believe that alternative therapies are an important part of treating autism, the above considerations aside.

Drug Therapy. Findings from preliminary studies of major neurotransmitters and other neurochemical agents strongly suggest that neurochemical factors play a major role in autism. The findings also provide the rationale for drug treatment in individuals with autism. Nevertheless, as scientific as drug treatments sound, and as helpful as these medications can be, they have not cured the problem of autism.

Nutritional Therapy. Nutritional therapies are the least expensive of all complementary and alternative therapies, therefore providing a logical place to begin. By far, the most common approach is to eliminate gluten, casein, and soy from the child's diet. This can be difficult since gluten can be found even the coatings of pills used for medicine. The simplest course is to eliminate all grains, soy, and dairy for one month, to determine if improvement occurs. Then various grains can be gradually re-introduced to determine if improvements are reduced.

The basis for the gluten/casein free diet is the opioid theory of autism. In the early 1980's similarities were noted between the behavioral effects of animals on opioids, such as morphine, and the symptoms of autism. People with autism were thought to have elevated opioids in their nervous system, the best known being beta-endorphin. The known effects of this compound were seen as similar to the symptoms of autism.

To support this hypothesis, elevated levels of "endorphin like substances" were found in the cerebrospinal fluid of some people with autism, especially among those children who appeared to feel less pain than the normal population, also exhibiting self-injurious behavior. At about the same time, abnormal peptides were found in the urine of people with autism. In the urine of about 50% of people with autism there appeared to be elevated levels of substances with properties similar to those expected from opioid peptides. Against the opioid hypothesis is the finding by Dr. Magda Campbell of the University of Pittsburgh School of Medicine that naltrexone, an opioid receptor blocker did not help autistic children (though some argue that her doses were too low).

The quantities of these opioid compounds in the urine were too large to come from the nervous system and could only have come from the incomplete breakdown of food. Normal proteins are digested by enzymes in the intestines and are broken down into these units. Incomplete digestion of proteins results in short chains of amino acids (known as peptides). Some of these peptides are biologically active, thought to potentially contribute to the symptoms of autism. While most are found in urine, a small proportion will cross the blood-brain barrier and interfere with nervous signal transmission in such a way that normal activity is altered or disrupted.

Defective intestinal enzymes (especially dipeptidyl-dipeptidase IV) allow incompletely digested gluten and casein (with opioid properties) to "leak" across the gut and into the blood stream. In larger doses, these molecules cause hallucinations. Those who cannot metabolize gluten, produce a-gliadin and gliadinomorphins, compounds which bind to the opioid receptors (C and D) that are associated with mood and behavior disturbances.

Glutens are proteins found in the Plant Kingdom Subclass of Monocotyledonae (monocots.) These plants are members of the grass family of wheat, oats, barley, rye and triticale, and their derivatives, including malt, grain starches, hydrolyzed vegetable/plant proteins, textured vegetable protein, grain vinegar, soy sauce, grain alcohol, flavorings and the binders and fillers found in vitamins and medications.

Casein is a milk protein, with a molecular structure similar to gluten's. Casein (from human or cow milk) breaks down in the stomach into a peptide known as casomorphine, which has opioid activities.

Gluten and casein could also be problematic for reasons unrelated to their effects upon opioid receptors. One potential effect is an allergic reaction (delayed hypersensitivity type) similar to what is found in celiac disease and its variants.

In fact, autism has some surprising similarities to celiac disease. Genes influencing both autism and celiac disease are close together. I have seen children improve on a gluten/casein free diet despite negative antibody testing for celiac disease. Perhaps these children will have celiac disease when they are adults. HLA testing for the celiac genes can better define this, but is not

usually covered by insurance. For more information on celiac disease, see <http://www.healing-arts.org/celiac>.

The opioid theory predicts more of a toxicological reaction than an allergic one. The results are more like poisoning than the kind of extreme sensitivity that occurs in celiac disease or sensitivity to certain food colorings.

A strict gluten and casein-free diet appears to reduce the level of opioid peptides and improve autism for some people. The younger the child is when the diet is implemented, the better are the results. The initial response to the diet may be negative, consisting of an upset stomach, anxiety, clinginess and slight ill-temper. Experience suggests that these are good signs and are signs that a positive response will follow. While the diet is difficult to follow, one month is usually sufficient to determine if following the diet will help. After one month, if any question exists, challenging the child with a grilled cheese sandwich on whole wheat bread helps to determine if symptoms will worsen after exposure to gluten or casein. Sensitive children become clearly worse after this meal. Outcome is best tracked by counting self-stimulation behaviors in the same 30 to 60 minute time slot every day, by counting gastrointestinal complaints made per day, by counting the number of times the child initiates eye contact in a half-hour time frame, to name a few. Objective scales like the Autism Child Behavior Checklist, the Achenbach Child Behavior Checklist are helpful, too.

At least half of my patients improve significantly after starting the gluten/casein free diet. Excellent cookbooks exist and are found on our web site (<http://www.healing-arts.org/children>). Second on my list of interventions, after "GF/CF diet" or variants of it, is vitamin supplementation.

Vitamin therapy.

The role of metabolic abnormalities in autism and other developmental disorders is relatively unknown, though many case reports and anecdotes have been written about autistic children recovering with nutritional therapies. Because of the several known metabolic (genetic) defects that are associated with autistic-like symptoms, it stands to reason that milder versions of these more severe disorders exist and that metabolic problems span a range from minimal to severe. The metabolic problems that are known to be associated with autism include those related to phenylalanine and histidine metabolism. Various enzyme deficiencies and abnormalities are linked to autistic symptoms. When the metabolic consequences of an enzyme defect are well defined, treatment with diet, drugs, or nutritional supplements may bring about a dramatic reduction in autistic symptoms.

A number of vitamins have research to support their use among children with developmental disorders. Others are used based upon theory or case reports of benefit.

Magnesium. Magnesium deficiency has long been speculated to be a central precipitating event and common pathway for a number of children's developmental disorders, as well as other conditions found among developmentally disabled children (Tourette's syndrome, allergy, asthma, attention deficit-hyperactivity disorder, obsessive compulsive disorder, coprolalia, copropraxia, anxiety, depression, restless leg syndrome, migraine, self-injurious behavior, autoimmunity, rage, bruxism, seizures, heart arrhythmia, heightened sensitivity to sensory stimuli, and an exaggerated startle response). A number of theorists link magnesium deficiency to biochemical effects on substance P, kynurenine, NMDA receptors, and vitamin B6, substances implicated in autism. A number of studies have reported improvement with magnesium supplementation, though usually in conjunction with vitamin B6. Magnesium is high on my list of supplements, though its usefulness may only come from its calming effects and its effects on relaxing smooth muscles.

Trace and Other Minerals. Hair analysis for mineral content has been used to determine differences in samples from control, autistic and autistic-like children. Significant differences were noted between children with autism and normal males and females for calcium, magnesium and mercury. The autistic population had significantly lower levels of calcium, magnesium, copper, manganese and chromium and higher levels of lithium and mercury as compared to sex- and age-matched controls. Children with autistic spectrum disorders (pervasive development disorder, for example) had lower levels of magnesium, cadmium, cobalt and manganese as compared to controls. Discriminant function analysis using the 14 trace elements correctly classified 90.5% of the normal and 100% of the autistic population. Using a stepwise procedure, the five elements with the greatest discriminatory power were calcium, copper, zinc, chromium and lithium. Analysis based on these five trace elements led to the correct classification of 85.7% of the normal and 91.7% of the autistic group. The concentrations of trace elements in hair from normal children differed from patterns observed in both autistic and autistic-like children. Affected children may need supplementation with calcium, magnesium, copper, manganese, zinc, and chromium, cobalt, and other trace minerals. They may need reductions in mercury and lithium levels (see the mercury section later in this paper). Mineral and trace mineral supplements are frequently prescribed to autistic children with anecdotal reports of good results. I also recommend these supplements.

Pyridoxine (Vitamin B6). Vitamin B6, or pyridoxine, has been thought to be a factor in autism, as well as Alzheimer's disease, hyperactivity, learning disability, anxiety disorder, and depression. It plays an intrinsic role in the synthesis of certain neurotransmitters. Autistic children have been reported to respond to high dose vitamin B6 and magnesium with decreased physical aggression and improved social responsiveness. Doses of pyridoxine used in reports with positive outcomes have ranged from 15 to 30 mg/kg per day or 700 to 1000 mg/d. Doses of magnesium have ranged from 10 to 15 mg/kg per day or 380 to 500 mg/d. The majority of studies do report a favorable response, though the studies have methodological shortcomings. A 10-week double-blind, placebo-controlled trial was conducted at Case Western Reserve University with 10 patients (mean age 6 years, 3 months) with an average dose of 638.9 mg of pyridoxine and 216.3 mg of magnesium oxide per day. However, the treatment periods were rather short (2 weeks to 30 days). Measures of change included the Children's Psychiatric Rating Scale (CPRS), the Clinical Global Impression Scale, and the NIMH Global Obsessive Compulsive Scale. No side effects were noted.

Vitamin B12 and Folic Acid. No significant change was found when folic acid and vitamin B12 was given to an unselected group of children with autism. On the other hand, behavioral improvement was noted among prepubertal boys with fragile X syndrome treated with folate 10 mg/d. Another study found no significant behavioral change among 4 autistic boys with fragile X syndrome who were given folic acid. This finding calls for a trial of folate in autistic children because about 8% of autistic people also have fragile X syndrome. Despite this limited data, a trial of folic acid for autistic children seems justified.

Zinc has some crucial functions in brain development and function. During development, zinc binds to p53, preventing it from binding to supercoiled DNA and ensuring that p53 cause the expression of several paramount genes, such as the one that encodes for the type I receptors to pituitary adenine cyclase-activator peptide (PACAP), which directs embryonic development of the brain cortex and adrenal glands. Zinc is required for the production of CuZnSOD and Zn-thionein, which are essential to prevent oxidative damage. Zinc is required for the function of essential enzymes for growth and homeostasis. For example, the synthesis of serotonin involves Zn enzymes and since serotonin is necessary for melatonin synthesis. A Zn deficiency may result in low levels of both hormones. Unfortunately, Zn levels tend to be low when there is excess Cu and Cd. High estrogen levels lead to increased absorption of Cu and Cd, as does smoking and eating food contaminated with Cd. Ethanol ingestion increases the elimination of Zn and Mg (which acts as a cofactor for CuZnSOD). Increased Cu levels may also be found in people with Wilson's disease, which is a rather rare disease. However, the heterozygote form (only one faulty copy of

the chromosome) is not so rare. Therefore, the developing fetus of a pregnant women who is low in Zn and high in Cu may experience major difficulties in the early development of the brain, which may later manifest themselves as autism. Similarly, a person who gradually accumulates Cu, will tend to experience a gradual depletion of Zn, with a corresponding increase in oxidative damage, worsening autistic symptoms.

A currently popular nutritional theory of autism links its symptoms to the separation of the G-alpha protein from retinoid receptors by the pertussis toxin found in the DPT vaccine among already genetically susceptible children. Children at highest risk have a family history of at least one parent with a pre-existing G-alpha protein defect, including night blindness, pseudohypoparathyroidism or adenoma of the thyroid or pituitary gland. Natural vitamin A may reconnect the retinoid receptors critical for vision, sensory perception, language processing and attention.

Melatonin. An abnormal circadian pattern of melatonin was found in a group of young adults with autism. Melatonin, at a dose ranging from 1 to 10 mg, has been effective in some autistic children with sleep problems. Serious side effects were not observed.

A group of Vancouver, British Columbia, health professionals studied the use of oral melatonin in the treatment of chronic sleep disorders in children with disabilities since the Fall of 1991. They reported their first 100 patients, half of whom were visually impaired or blind. Children with neurological, neuropsychiatric, and developmental disabilities are predisposed to chronic sleep-wake cycle disturbances. Disorders such as blindness, deaf-blindness, mental retardation, autism, and central nervous system diseases, among others, diminish the ability of these individuals to perceive and interpret the multitude of cues for synchronizing their sleep with the environment. Melatonin, which benefitted slightly over 80% of our patients, appeared to be a safe, inexpensive, and effective treatment of sleep-wake cycle disorders. The oral dose of fast release melatonin taken at bed-time ranged from 2.5 mg to 10 mg. Side effects or the development of tolerance was not observed.

Symptomatic vitamin A and D deficiencies in an eight-year-old with autism.

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An 8-year-old boy with autism developed a limp and periorbital swelling. He was found to have hypocalcemia and radiographic evidence of rickets. Ophthalmologic examination revealed xerophthalmia and corneal erosions. Serum vitamin A was undetectable and serum 25-hydroxyvitamin D was decreased. Dietary history revealed a markedly altered intake consisting of only french fried potatoes and water for several years. All biochemical and physical abnormalities reversed with appropriate supplementation. The nutritional content of french fries is reviewed. Feeding dysfunction is an integral part of autism and closer attention should be paid to potential nutritional deficiencies.

vitamin E,

peroxynitrate,

A case has been described of an autistic 15 year old boy with seizures, mental retardation, aerophagia, breath holding, and self-injury. Pyridoxine administration dramatically reduced seizure activity and improved other symptoms as well. An autosomal-recessive genetic disorder exists in which the binding of pyridoxine to the enzyme glutamic acid decarboxylase-1 is

impaired, leading to reduced synthesis of gamma-aminobutyric acid (GABA). The clinical result is seizures appearing even before birth. The gene affected is at 2q31. Knowing this, I have treated autistic children, especially those with seizures, with high dose pyridoxine, often with good results.

A number of disorders of neurodevelopment, including attention deficit hyperactivity disorder, dyspraxia, dyslexia, and autism, have been reported to be associated with fatty acid abnormalities ranging from genetic abnormalities in the enzymes involved in phospholipid metabolism to symptoms reportedly improved following dietary supplementation with long chain fatty acids. Dr. Patricia Kane has promoted awareness of fatty acid metabolism among autistic spectrum children. Through BodyBio, she offers analysis of fatty acids on the red blood cell membrane to determine their relative levels. Fatty acid metabolism can be directed toward a pro-inflammatory state or an anti-inflammatory state, the former being worse for autistic children. Supplementation with specific fatty acids (especially omega-3 and omega-6) can alter pro-inflammatory tendencies toward anti-inflammatory. While the details of fatty acid therapy can become quite intricate, three oils provide almost all of the compounds needed: evening primrose oil, borage seed oil, and marine lipids.

Inositol has not emerged as effective for autism in clinical trials, though it does help patients with depression, panic disorder and obsessive compulsive disorder (OCD). Inositol is a precursor of the second messenger for some serotonin receptors. A controlled double-blind crossover trial of inositol 200 mg/kg per day showed no benefit on 9 children with autism.

We can broadly speak of an inflammatory theory of autism, in which nerve cell membranes are irritated and nerve transmission is affected. The inflammation can come from a variety of sources, including viral infections, auto-immune phenomena (in which the body's immune system attacks its own nervous system), post-vaccine reactions, abnormal molecules in the nervous system (coming from the leaky gut and deficient enzyme activity in the gut), and abnormal fatty acid metabolism. The inflammatory theory can explain the role of some vitamins as anti-oxidants (preventing and reversing cellular damage from inflammation) and as direct anti-inflammatory agents (vitamin C, omega fatty acids).

Vitamin supplementation alters metabolism of the nervous system and provides an abundance of resources for healing within the brain. Getting children to take vitamins can be difficult, but can be overcome by blending vitamins into palatable drinks or by mixing the vitamins into foods that the children will eat. Stevia is a sweetening herb that makes these concoctions more palatable without causing the adverse side effects sometimes associated with simple sugars.

My basic supplement program includes vitamin C, trace minerals (vanadium, germanium, selenium, tungsten, tin, etc.), common minerals (zinc, manganese, magnesium, calcium), B vitamins (with extra thiamin, B6, and B12), vitamin A, evening primrose oil, marine lipids, OPC-3's, and vitamin E.

Recent enthusiasm has centered around vitamin A followed by doses of 5-10 mg per day of urecholine. I have seen some children appear to benefit from this approach, and others not benefit at all.

Environmental Toxins, Detoxification Approaches, and Chelation.

The literature that links autism to environmental toxins draws upon more extensive studies of the possible role of environmental toxins in the pathogenesis of Parkinson's disease, an adult neurodegenerative disorder. Considerable evidence supports the role of toxins, particularly pesticides and herbicides, in contributing to this disease in at least some affected individuals (presumably, the genetically most vulnerable). Proponents of the environmental toxin theory

argue that early exposure to synthetic chemicals is one suspect for the dramatic, recent increase in the incidence of autism. Impaired detoxification of environmental chemicals is thought to be common to both autism and neuro-degenerative diseases like Parkinson's disease.

A small pilot study of 20 children (15 males and 5 females) with a formal diagnosis of autism (mean age, 6.35 yrs, range = 3-12 years) investigated the possible role of toxins coupled with impaired liver detoxification. Measures included: (1) Glucaric Acid Analysis, (2) blood analyses for identification of specific environmental (or xenobiotic) agents, and (3) Comprehensive Liver Detoxification Evaluation. The distributions for the autistic children on these measures were significantly different from what would be expected in a normal population ($p < .01$; using Kolmogorov-Smirnov testing for a chi-square and Normal distribution of the Glucaric Acid). All the 20 children showed liver detoxification profiles outside the normal range. Blood analyses conducted for 18 of the children showed evidence of levels of toxic chemicals exceeding adult maximum tolerance for 16. In the two cases where toxic chemical levels were not found, there was abnormal d-glucaric acid findings suggesting excess xenobiotic influences on liver detoxification processes. The authors proposed that the interaction of xenobiotic toxins with immune system dysfunction and continuous and/or progressive endogenous toxicity leads to the development of behaviors found in the autistic spectrum.

Closely related to theories of excess xenobiotic exposure coupled with impaired liver detoxification is the impaired sulfate metabolism theory of autism. Sulfation is an important method of detoxification, especially for phenolic compounds, and its impairment has been found in a number of degenerative neurological and immunological conditions, including Alzheimer's disease, Parkinson's disease, motor neuron disease, rheumatoid arthritis, delayed food sensitivity, and drug intolerances. Preliminary data suggests that impaired sulfation may also be important in multiple chemical sensitivities and diet responsive autism. One of the important enzymes involved is S-carboxymethyl-L-cysteine (SCMC). Reduced activity of this enzyme has been found in the previously mentioned conditions. Impairment is demonstrated by measuring the speed with which the probe drug acetaminophen (Tylenol) is metabolized. Delayed processing is presumed to be due to starvation of the sulfotransferase enzymes (like SCMC) for sulfate substrate. We know that the general population's ability to metabolize acetaminophen is bimodal, meaning that the population separates itself into efficient and inefficient metabolizers. Another 2.5% of the population are thought to be non-metabolizers. Poor metabolizers will have difficulty with the sulfoxidation of amino acids like cysteine to sulfate (along with other sulfur containing compounds). Impaired sulfation may be relevant to intolerance of phenol, tyramine, and phenylic food constituents, and may be a factor in the success of the Feingold diet.

Another popular environmental theory of autism is that it is caused by environmentally acquired mercury, either through causal contact or through vaccination. Mercury is thought to exert its neurological effect on the brain. Exposure to mercury is known to cause immune, sensory, neurological, motor, and behavioral dysfunctions similar to the traits defining or associated with autism, and also similar to existing abnormal findings in neuroanatomy, neurotransmitters, and biochemistry of individuals with autism. Thimerosal, a preservative added to many vaccines, is argued to be a major source of mercury in children who, within their first two years, may have received a quantity of mercury that exceeds safety guidelines. Proponents of this theory suggest that: (i) many cases of idiopathic autism are induced by early mercury exposure from thimerosal; (ii) this type of autism represents an unrecognized mercurial syndrome; and (iii) genetic and non-genetic factors establish a predisposition whereby thimerosal's adverse effects occur only in some children.

Important to the environmental toxin theory is the reality that the developing nervous system is exquisitely sensitive to toxic insult during certain critical periods, precisely because they are dependent on the temporal and regional emergence of critical processes (i.e., proliferation, migration, differentiation, synaptogenesis, myelination, and apoptosis). Evidence from numerous sources demonstrates that neural development extends from the embryonic period through adolescence. In general, the sequence of events is comparable among species, although the time scales are considerably different. Developmental exposure of animals or humans to numerous agents (for example, X-ray irradiation, methylazoxymethanol, ethanol, lead, methyl mercury, or chlorpyrifos) demonstrates that interference with one or more of these developmental processes can lead to developmental neurotoxicity. Different behavioral domains (e.g., sensory,

motor, and various cognitive functions) are subserved by different brain areas. The toxic developmental neurobiological hypothesis of autism argues that various disorders including schizophrenia, dyslexia, epilepsy, and autism may be the result of interference with the normal ontogeny of developmental processes in the nervous system. Of particular concern is the possibility that developmental exposure to neurotoxins may accelerate age-related decline in function. This concern is compounded by amplification of subtle damaging effects as development proceeds, producing much larger effects later in life when the full impact of disrupted, earlier processes become apparent. The argument here is that amounts of mercury and other environmental toxins that would be inconsequential to the adult brain, may have profound impacts if encountered during critical phases of development.

Toxic chemicals in the environment--lead, polychlorinated biphenyls, mercury, and certain pesticides--are known to cause some fraction of neurodevelopmental disabilities, though how much is vigorously debated. Unfortunately, too few chemicals are tested for toxicity to early brain development, knowledge of infants' and children's special vulnerabilities and unique exposures is scant, and paradigms for environmental risk assessment have only begun to address the hazards confronting infants and children.

Treatment for autism under this theory is to apply chelating agents to extricate the toxic agents, including mercury. Utilization of the body's own detoxification mechanisms is also important. Endogenous enteric bacteria are argued to be the largest detoxification component of the body, providing an enormous detoxification reservoir, which can be constantly and safely replenished. High-dose probiotics have been used as an adjuvant for detoxification protocols among individuals with autism, whatever the toxic cause may be (Brudnack, 2002; #30).

Secretin. Secretin is a 27 peptide hormone, produced in the intestines, and commercially marketed as an aid to endoscopy. The interest in secretin began in 1996, when Dr. Karoly S. Horvath, director of the pediatric gastrointestinal and nutrition laboratory at the University of Maryland, Baltimore, administered intravenous secretin while examining an autistic child with chronic diarrhea. Several weeks later, the child's mother, Victoria Beck, called with surprising news: her 3-year-old son Parker had started to talk and had good eye contact [1]. Subsequent infusions, obtained by the parents against medical advice, led to further gains.

Dramatic improvement has been reported for some autistic children who receive secretin. Typically a dose of 2-3.5 International Units per kilogram of body weight is administered intravenously every 3-7 weeks, depending upon the child's response and when the effects of the secretin appear to wear off. Victoria Beck switched to transdermal administration for her child in which the secretin is applied daily to the skin and soaks into the body through a vehicle such as DMSO. Typically a dose of 3 to 7.5 International Units is used each day.

Dr. Horvath and associates gave secretin while assessing gastrointestinal complaints in two other autistic children, and reported "a dramatic improvement in their behavior, manifested by improved eye contact, alertness, and expansion of expressive language," in the next several weeks along with relief of gastrointestinal symptoms [2].

In December 1999, Dr. Bernard Rimland of the Autism Research Institute in San Diego, California, reported that one-half of 100 treated children improved in behavior, sleep, and/or digestive symptoms--based on questionnaires returned by self-selected parents.

In another series, 70% of 200 children responded positively, according to the treating physician, with a dramatic effect among 10%. These reports did not control for concurrent treatment, nor was diagnosis rigorously established.

The results of a randomized, controlled trial of one dose of secretin was reported in the New England Journal of Medicine's December, 1999, issue by Dr. Sandlin and colleagues. Children were randomized to receive either secretin in an appropriate dose or placebo. Change was measured on the Autism Behavior Checklist. Both placebo and treatment group improved equally

over the course of one month. Opponents of secretin have used this study to argue that secretin is ineffective in autism. Secretin proponents have argued that the study was of insufficient length to draw serious conclusions and that important variables that change in response to secretin were not measured. The Autism Behavior Checklist, for example, changes more slowly than one month. We administer it every six months. This study showed no adverse reactions to secretin, which was suspicious to me, since I see about 15% of children reacting to secretin infusion with hyperactivity and/or increased aggression.

I have presented a case series of secretin infusions lasting over one year among 35 patients. About 70% of patients improved, some quite dramatically -- again a figure within the range of what could be expected with enthusiastic placebo. What is more remarkable to me is how much some of these children improved. If secretin is working only because of a change in parental expectations, we have good news. Such a finding could open a new awareness for the need to expect more from autistic children. If secretin is not biologically active, then what do parents do who believe in secretin to foster such dramatic improvements in their child? Knowing this and being able to train parents in how to influence the course of autism would be as significant as finding an active biological agent. Unfortunately, the developmental disorders community tends to overlook behavioral therapies, much as most illness communities. We modern 21st century people are still searching for pills that will change everything. While autism may respond in this way, it is as likely that it is a complex illness that requires multiple, synergistic treatments, not all of which are biological.

Secretin may open the pathway for searching for other neurohormonal therapies that activate brain receptors. We know that secretin receptors are found in the brain, especially in the temporal lobe speech areas. Brain-imaging studies in one of Horvath's original cases showed a "marked" post-infusion increase in cerebral blood flow to these areas. Secretin may also activate receptors for a related hormone, vasoactive intestinal polypeptide or VIP, which is more widely distributed in the brain. Secretin also stimulates pituitary adenylate cyclase which increases intracellular cyclic adenosine monophosphate (cAMP), a messenger molecule for brain biochemical reactions. Opioid-like peptides are known to lower levels of cAMP. Perhaps secretin prevents this or replenishes the missing cAMP.

Lectins may also be important in explaining the mechanism of action of secretin. Lectins are molecules that bind to cholecystokinin (CCK) receptors and other glycosylated (meaning attached to long-chain sugars) membrane proteins. CCK is another gut hormone with receptors in the brain. Lectins inhibit CCK-8-induced alpha-amylase secretion by the pancreas. This inhibition does not occur after administration of secretin.

There are two divergent opinions on secretin--one that high doses are necessary to obtain binding of secretin to receptors in the brain; the other, that only small concentrations are required. The final verdict on secretin is not yet out.

Anti-virals.

Returning to the inflammatory theory of autism brings us to anti-viral therapy. Proponents of this theory argue that signs of long-term or chronic viral infection exist among autistic children, and that treatment with anti-viral agents can improve autism.

Perinatal exposure to infectious agents and toxins is linked to the pathogenesis of neuropsychiatric disorders, but the mechanisms by which environmental triggers interact with developing immune and neural elements to create neurodevelopmental disturbances are poorly understood. Among animals, a model for investigating disorders of central nervous system development based on neonatal rat infection with Borna disease virus, a neurotropic noncytolytic RNA virus. Infection results in abnormal righting reflexes, hyperactivity, inhibition of open-field

exploration, and stereotypic behaviors. Architecture is markedly disrupted in hippocampus and cerebellum, with reduction in granule and Purkinje cell numbers. Neurons are lost predominantly by apoptosis, as supported by increased mRNA levels for pro-apoptotic products (Fas, caspase-1), decreased mRNA levels for the anti-apoptotic bcl-x, and in situ labeling of fragmented DNA. Although inflammatory infiltrates are observed transiently in frontal cortex, glial activation (microgliosis > astrocytosis) is prominent throughout the brain and persists for several weeks in concert with increased levels of proinflammatory cytokine mRNAs (interleukins 1alpha, 1beta, and 6 and tumor necrosis factor alpha) and progressive hippocampal and cerebellar damage. The resemblance of these functional and neuropathologic abnormalities to human neurodevelopmental disorders suggests the utility of this model for defining cellular, biochemical, histologic, and functional outcomes of interactions of environmental influences with the developing central nervous system.

The most commonly used agent is Valtrex, though some also have used Zovirax, which is known best for its use in treating herpes virus infections. Some parents have even reported improvements in their autistic children from the use of antibiotics. At this time, I know of no trials that show true biological efficacy of anti-virals for autistic children. Nevertheless, we can't yet discount this therapy. It may also be that autistic children have immune defects and are more prone to chronic viral infections. Treatment of these viral infections could relieve some of the physiological stress of infection and result in an improvement. Chronic illnesses (including autism) or so much more complex that most physicians would like to acknowledge. Once a disease process is started, effects follow upon many other organ systems. Even if viral infection is not the precipitating insult of autism, it may be important once autism is established, and treating chronic viral illness may be helpful. If this is so, however, it would only be helpful for those children who have a chronic virus. There are risks to anti-viral medications, and there are herbal alternatives. Herbs boost the immune system instead of attacking the virus directly. Common immune boosting herbs include echinacea, astragalus, garlic, plant tannins, uva ursi, and berberis. These herbs can also treat Candida, again by strengthening the immune system.

Immunotherapy. We know that autistic children have defects in their immunity, especially cellular immunity (the kind that involves the direct action of cells; as opposed to humoral immunity which involves immunoglobulin molecules released into the blood stream.). The white blood cells (lymphocytes, macrophages, natural killer cells) of autistic children can be sluggish and weak. Antibodies to brain proteins (especially myelin basic protein) are also more prominent among autistic children, suggesting an auto-immune process, in which the body is attacking itself. Levels of substances which indicate excess immune activity directed at the self have been found elevated among autistic children. These include gamma-interferon, alpha-interferon, interleukin 6 and 12, alpha tumor necrosis factor and others.

Immunological studies of autistic patients have revealed features also found in patients with other autoimmune diseases. Autoimmune diseases, including Grave's thyroid disease, rheumatoid arthritis, and insulin-dependant diabetes, show some genetic predisposition. Similarly, autism is higher among identical twins than in the normal population. Autism is four to five times more prevalent in boys than in girls - a gender factor also found in other immune diseases, including systemic lupus erythematosus, Grave's disease, and ankylosing spondylitis. Autoimmune disease may be triggered by infections with bacteria or viruses. In autism, coincidental findings indicate infections with congenital rubella and cytomegalovirus. ,

Treatment is more difficult. The most popular treatment is intravenous immunoglobulin G, given in varying protocols. The most aggressive protocol gives the immunoglobulin approximately every other day, in progressively increasing dosages, starting at 1 gm/kg, and increasing to 5 gm/kg. The more conservative protocol begins with 1 gm/kg, increasing to 2-7 gm/kg at monthly doses. An intermediate intensity protocol is 5 gm/kg, administered monthly. Several studies have shown benefit to treating children with immunoglobulin, though it is uncertain if all children would benefit, or only those with chronic viral infections, frequent bacterial infections, fungal infections, or other

immune deficiencies. Dr. Gupta at the University of California, Irvine, is conducting clinical trials on the use of immunoglobulin therapy for autistic children, and will have more data soon.

Other immune enhancing therapies include vitamin C, oligoprocyanthocyanidins (OPC-3), and anti-inflammatory fatty acids, along with the herbs already discussed.

Homeopathy.

I have also used homeopathy to treat the symptoms of autism. Homeopathy is controversial among conventional physicians, but is occasionally very effective in my experience. Is this effectiveness due to the remedy, to the placebo effect, or to the Pygmalion Effect? I cannot say, but have especially used sulfur for hyperactive and aggressive behavior, along with a variety of other remedies as appropriate to homeopathic theory. Homeopathy has the advantage of having minimal risk. It either works or it doesn't. When it doesn't work, it doesn't harm. The debate will continue for some time about whether homeopathy works, though a recent analysis published in *The Lancet*, reviewed all of the recent clinical studies of homeopathy and concluded that it is significantly more effective than placebo. The downside noted by the review was that homeopathy was not as reliable as some other treatments. This has also been my clinical experience. When it works, it's wonderful, but it isn't always predictable whether or not it will work.

Homeopathic detoxification is popular with some parents and physicians. In this approach, small amounts of toxic substances are used to stimulate the body to heal itself from these substances. The approach may be combined with dietary modifications to facilitate the release of toxins. For example, alkaline diets seem helpful for agitated children, at times, and are thought to aid detoxification. Alkalinizing agents in the diet include spinach, cucumber, carrot, beet, and celery. These are juiced and used alongside food or used instead of food in an alkaline fast. Avoiding acidic foods can also be helpful. These foods include tomatoes, red meats, and simple carbohydrates, to name a few.

Allergic theories and treatments.

Lurking in the background throughout complementary and alternative medicine lies the question of allergies. Though some physicians feel allergies are over-stressed, the concept is important. I typically use the ELISA/ACT Test from Serammune Physicians Laboratories in Virginia, to test for food allergies. The acronym stands for Enhanced Lymphocyte Immunostimulation Assay. Blood is drawn and the patient's lymphocytes are incubated with various substances to determine what cell-mediated reactions the patient is having. Cell-mediated reactions are more important for food allergies than humoral reactions (immediate antibody reactions in the blood stream).

Some more alternative physicians use applied kinesiology or an off-shoot called Neuro-emotional technique, or N.E.T., to test for allergies. Others place the substances within the patient's "energy field," and test for changes in Chinese Meridians using pulse diagnosis. Offending substances are identified and eliminated from the diet or the environment. Nambuprihad Allergy Elimination Technique (N.E.A.T.) aims to reduce the patient's allergic reaction by balancing the energy meridians with the offending substances in the patient's energy field.

I have seen these approaches work and not work. We are all impressed when they work. We are not so impressed, when they are ineffective. I know of no rigorous clinical studies of the role of allergy treatment in autism, but suspect that some will some be forthcoming. Certainly eliminating foods and other substances that produce allergic responses in the autistic child can't be harmful, and may be helpful in other ways, even if these approaches show no effect on autism in rigorous trials. These approaches can help the gastrointestinal problems of autistic children, which is no small feat. Perhaps that will be where their utility will lie.

Body therapy and manipulative therapies.

A study from the University of Miami showed effectiveness of touch therapy for autistic children. Children's attentiveness and receptivity increased after treatments. In a subsequent study, 20 children with autism, ages 3 to 6 years, were randomly assigned to massage therapy or to a reading attention control group. Parents in the massage therapy group were trained by a massage therapist to massage their children for 15 minutes prior to bedtime every night for 1 month and the parents of the attention control group read Dr. Seuss stories to their children on the same time schedule. Conners Teacher and Parent scales, classroom and playground observations, and sleep diaries were used to assess the effects of therapy on various behaviors, including hyperactivity, stereotypical and off-task behavior, and sleep problems. Results suggested that the children in the massage group exhibited less stereotypic behavior and showed more on-task and social relatedness behavior during play observations at school, and they experienced fewer sleep problems at home.

Other studies have also reported positive results for massage therapy for autism and developmental delays. Generally, the massage therapy has resulted in lower anxiety and stress hormones and improved clinical course. Having grandparent volunteers and parents give the therapy enhances their own wellness and provides a cost-effective treatment for the children.

One popular form of touch therapy is craniosacral therapy, in which the bones of the skull are adjusted along with subtle adjustments of the spine, all the way to the sacrum. Craniosacral therapy, or CST, is different from chiropractic manipulation in that the adjustments are very subtle and are aimed at improving the flow of cerebrospinal fluid down the spinal canal. This fluid has been demonstrated to cycle with a pulse of 12 beats per minute. This pulse can be felt in the area of the sacrum (near the tail bone). The goal of craniosacral therapy is to improve the ease with which the cerebrospinal fluid circulates and to help hold the skull bones and the spine in adjustment. The study showed improved concentration, socialization, and less self-stimulation behavior after a course of craniosacral therapy. This has been my experience, as well, watching children receive the therapy.

Chiropractic manipulation has been used for autistic children. I know of no formal clinical studies on its effectiveness, but have referred children for this therapy and been pleased with the results. Naturally, without clinical studies, the results could be do to the parents expecting it to work, so we cannot say for sure that the technique works of its own. Sometimes techniques work by giving opportunities for natural healers and patients to interact. Unlike drugs, which can be more obviously separated from the prescriber, body therapies are more fused with the person administering the treatment. Some body therapists are more inspired than others. Nevertheless, a developing literature is finding body therapies very effective for many medical conditions.

Holding children with autism, even when they resist, has been reported effective in improving social interaction and responsiveness. In one study, 7 autistic children were selected at random from a group of 14 and treated with modified holding therapy (MHT) for 4 weeks. The remaining 7 children (control group) were not treated during this 4-week waiting period. Four of these children were then treated with MHT. The children's parents assessed positive behavior changes (increases in desirable behavior and decreases in undesirable behavior) and negative changes on a behavior rating scale. Significantly more positive changes in behavior problems were reported for the treatment group than for the untreated group in each of the four symptom categories assessed (disturbances in perception, speech, social interaction, and obsessive-compulsive or ritualistic behavior). The 4 children in the control group who were later treated with MHT showed behavior changes that correlated highly with those reported for the experimental group.

We have been doing a pilot study of reiki massage for autistic children. The preliminary results are encouraging, especially when the parents are taught to do the reiki along with visualization in

between formal appointments with the therapist. The use of reiki by parents and therapist appears to encourage communication, especially non-verbal communication. Children are more calm and have less self-stimulation.

Important to remember with healing methods that are non-pharmacological, is that their effectiveness is a complex mixture of technique, therapist, expectation, and communication.

Sensory Integration Therapy

Once considered alternative and innovative, sensory integration therapy's use is becoming more and more common among occupational therapists who treat children with autism. In this treatment, children receive multiple, simultaneous stimuli in different sensory modalities, pushing them to integrate these disparate inputs. Sensory processing disturbance is a predictor of response to sensory integration therapy. In one study, 10 autistic children, ages 3-1/2 to 13 years (mean, 7.4 years), were evaluated in regard to their hypo-, hyper-, or normal responsivity to visual, auditory, tactile, vestibular, proprioceptive, olfactory, and gustatory stimuli. After evaluation, each child received therapy that provided somatosensory and vestibular stimulation and elicited adaptive responses to these stimuli. At the end of one year of therapy, each child's progress was judged in relationship to that of the others, and the group was divided into the six best and the four poorest respondents. Stepwise discriminant analysis identified which initial test variables predicted good or poor responses to therapy. The good respondents showed tactile defensiveness, avoidance of movement, gravitational insecurity, and an orienting response to an air puff. The children who registered sensory input but failed to modulate it responded better to therapy than those who were hypo-responsive or failed to orient to sensory input.

Another report dealt with simultaneous communication and multisensory input in the treatment of six autistic and communication disordered children. The children, aged 5 to 12, were taught manually signed English and speech using a multisensory-intrusion approach. The hypothesis was that such a technique would serve to alleviate the children's difficulties in information processing, organization of experience, and affect. The dependent measures were behavioral ratings derived from both structured (teaching) and unstructured (free play) sessions. The results indicate that the children manifested a consistent acquisition of sign language, which in some cases transferred into verbal communication skills. Moreover, statistical analyses of some of the observed socioaffective behaviors (i.e., nonsolitary play, interaction with peers and adults, exploration, and detachment) revealed tendencies supportive of the hypothesis. The variability of the data preclude any categorical statement in relation to the hypothesis. However, the preliminary results strongly support the continuation of the study.

Psychological Therapies, including Behavior Therapy.

A tactile prompting device (the Gentle Reminder) has been studied as a means for prompting children with autism to make verbal initiations about play activities. The device served as an effective, unobtrusive prompt for verbal initiations during play contexts and during cooperative learning activities. More importantly, it showed that learning received from the use of the device would generalize to other contexts and activities.

Seeing adults imitate the behaviors of children with autism leads to increased social behavior in the children. Twenty children were recruited from a school for children with autism to attend three sessions during which an adult either imitated all of the children's behaviors or simply played with the child. During the second session the children in the imitation group spent a greater proportion of time showing distal social behaviors toward the adult including: (1) looking; (2) vocalizing; (3) smiling; and (4) engaging in reciprocal play. During the third session, the children in the imitation group spent a greater proportion of time showing proximal social behaviors toward the adult including: (1) being close to the adult; (2) sitting next to the adult; and (3) touching the adult. These data suggested the potential usefulness of adult imitative behavior as an early intervention.

Music Therapy. Music has been an element in medical practice throughout history. There is growing interest in music as a therapeutic tool. There is no generally accepted standard for how, when and where music should be applied within a medical framework. Traditionally, music has been linked to the treatment of mental illness, and has been used successfully to treat anxiety and depression and improve function in schizophrenia and autism. The role of music in medicine is primarily supportive and palliative. Music is well tolerated, inexpensive, with good compliance and few side effects.

Naturalistic Behavior Therapy. Most practitioners in the autism world have heard of Lovass' technique of applied behavioral analysis. This approach is based upon teaching the child skills through interaction in discrete trials in which the child is rewarded for the correct response. Rewards often include food, sometimes, unfortunately, foods to which the child may be allergic (M and M candies are frequently used!). Studies from the Autism Research Center at the School of Education at the University of California at Santa Barbara, have shown that naturalistic behavior therapies are better than the applied behavioral analysis at changing autistic behaviors. This approach incorporates natural situations in which the child is already interacting and rewards the child through creating opportunities to do more of what the child already enjoys doing. Non-autistic children may be recruited to be part of the therapeutic process. Examples of therapies in the classroom include a teacher developing a game for the entire class when her autistic student was obsessed with maps. The game consisted of the children dividing into teams and drawing states on sidewalks with chalk as fast as possible, including locating the capitol of the state. The autistic student was excellent at this game and was soon desired as a team member, thereby improving his opportunities for interaction with other children. A book has been published about this approach, entitled Teaching Children with Autism. We are more excited about this method than the applied behavior analysis, though ABA as it is often called, has helped many children.

Other more permission therapies exist such as those offered by the Options Institute in Western Massachusetts, in which parents are helped to appreciate the special talents and uniqueness of the autistic child, and to learn to love the child as he or she actually is. These are often healing for families, especially when coupled with naturalistic behavior therapy and the other therapies mentioned here.

Stem cells.

Hyperbaric oxygen

Conclusions. Many options exist within complementary and alternative medicine for the treatment of autistic children. We have not discussed drugs that can help autistic children, but rather have focused upon non-drug therapies. This is not to say that medications cannot be helpful, because they can. But many parents are interested in alternatives to medications, especially when there are side effects, and other parents have found that the medications are not helpful or that alternative therapies can add much benefit beyond what medications can do.

My approach is to present this menu to parents, suggesting that they decide what makes the most sense to try first. If parents don't know or can't decide, I proceed in an orderly fashion through nutritional therapies, to body therapies (craniosacral and reiki, especially), through educational and behavior therapies, and through Chinese medicine. By the time we have reached Chinese medicine, parents have learned more about these alternatives, and typically have definite opinions about what will work.

I monitor the outcomes of treatments carefully, asking parents to record daily counts of desirable behaviors (eye contact, appropriate use of language, etc.) and undesirable behaviors (self-stimulations, non-responsiveness, aggression). I use the Achenbach Child Behavior Checklist and the Autism Behavior Inventory on a regular basis also to document progress. With any

therapy, conventional or alternative, accurate data are needed to prove that the treatment is worth the expense and the side effects (if there are any). Fortunately, the majority of the alternative therapies have no side effects.