

California State University, Northridge

ENVIRONMENTAL TOXINS AS AN ETIOLOGICAL FACTOR IN AUTISM

A graduate project submitted for partial fulfillment
of the requirements for the degree of
Master of Arts in Special Education,
Moderate/Severe Disabilities

by

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ABSTRACT

ENVIRONMENTAL TOXINS

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by

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There is now increasing evidence the world over that autism spectrum disorder (ASD) diagnosis is currently on the rise. In 2005, 1.5 million diagnosed cases of ASD, a staggering 1 in every 166 persons, were reported in the United States alone, and recent findings point to the possibility that the etiology of neurological developmental brain impairment disorders could be due in fact to polychlorinated biphenyls (PCBs), dioxins, and mercury, all of which are known to be neurological hormone disrupting chemical toxins. Environmental industrial chemicals such as PCB's, polybrominated diphenyls (PBDE's) and ethyl mercury, a chemical preservative by-product known as thimerosal used in vaccines, now banned in Iowa and California with similar bans under consideration in thirty-two other states in the US (Kennedy, 2005, p.7) as well as methyl mercury, a chemical by-product of most forms of combustion and numerous industrial chemical processes; most importantly coal-burning power plants, could play a vital role in the etiology of ASD. The association between ASD and genetically predisposed paternal exposure to environmental toxins is the focus of this thesis.

The intent of the handbook in Chapter 3 of this thesis project is threefold; to provide information regarding current existing literature associating the possible relationship between ASD and environmental toxins, to create awareness about this possible association, and lastly to offer a useful resource guide that provides a list of federal, state, government, University, and private organizations that are receiving federal and state funding to further research in the field of ASD.

CHAPTER I

Introduction

There currently exists a limited compilation of research literature pertaining to the possible association between environmental toxins and autism spectrum disorders (ASD). The purpose of this thesis project is to create a user friendly handbook for parents, families, educators, school administrators, Marriage and Family Therapists (MFT's), service providers and all stakeholders who contribute to the "quality of life" for individuals with ASD. This handbook is designed to provide information to access current reference materials regarding the possible role that environmental toxins may play in ASD, and subsequently help to create an public awareness regarding the role that environmental toxins may play in ASD as well as offer a useful resource guide to community, state, local and federal resources that are available for individuals with ASD.

Scientific study of autism research, has in the past, concentrated its study from the neck up; in contrast to current research pointing to new ideology based theories offering a more thorough study of the auto immune system with an emphasis on the study of the isolation of possible genetic biomarkers and their possible neurological effects on the system thus indicating that past "head up" or behaviorally autism study may have been too specific, and did not encompass the current more thorough explanation that understanding the etiology of autism requires investigation into the entire auto immune system.

Moreover, increasing evidence supports the theory that ASD may be the result of neurological damage resulting from environmental toxins assaulting the immune system of the in vitro fetus occurring long before birth. A result of this assault could be that the

entire system of the infant may be compromised, resulting in direct damage to major areas of the brain that are responsible for gross motor skills, speech and language acquisition and the processing of emotions, all diagnostic characteristics of ASD.

Throughout history, global environmental toxin assaults have been well documented. On November 13 and December 23, of 2005, the Chinese were responsible for two major environmental disasters. On these two separate occasions respectively, large chemical plant explosion spills pumped over 100 tons of carcinogenic benzene and other toxic chemical compounds into two major water ways effecting thousands of lives in China as well as large parts of Russia (Ni, 2005). The November 2005 spill into the Songhua River affected more than 62 million people covering four provinces. The Chinese government, as well as numerous other industrial countries throughout the world, currently has no environmental pollution regulations in place. Growing political and scientific global debate unanimously supports tighter rules and regulation of pollutants in industries throughout the world in order to prevent these types of devastating disasters in the future.

In May of 2005 the state of California introduced into legislature a number of chemical safety bills addressing imposing stronger chemical regulations on the production of industrial plastics (PCBs) and other known neurological toxins. Of particular concern is the demand for more stringent controls over industries that emit chemical toxins that are known to affect animals, with the subsequent theory that human development of newborn fetuses and infants either through breast milk or possibly in the fertility process may also be at risk (Rau, 2005). The legislature bills were modeled after the European precautionary chemical ban approach, where chemicals are presumed dangerous unless proven otherwise; and more specifically, the Netherlands, which for decades has been the vanguard for preemptively banning dangerous chemical substances. One such hormone

chemical-mimicking industrial compound, phthalates; found in plastics and beauty products and known to accumulate in humans, was found in the urine of 2,500 people in a US population 1999-2000 Center for Disease Control and Prevention survey reported recently in the journal, *Environmental Health Perspectives*. Phthalates was found to be a probable plausible factor in the disruption of human reproductive organs in off-spring of 85 mothers with high levels of chemicals in their urine late in their pregnancies, and sons, averaging nearly 13 months of age born in Los Angeles, Minneapolis and Columbia, Mo., resulting in changes to the reproductive organs, and manifesting in decreased testosterone, a short span between the anus and penis, smaller penises and scrotums and more instances of incomplete descent of testicles (Cone, 2005.)

Whales across the globe are losing their sonar capabilities and as a result are beaching themselves to die. Species of birds are experiencing rare diseases that cause their young to be born with deformities and abnormalities. In remote areas of the Artic circle, feeble newborn polar bears have been discovered in dens suckling; blind and toothless, all most probably a result of industrial PCBs, PBDE's (a flame retardant chemical used in high concentration in Eastern America and Europe in the manufacturing of furniture pillows) and pesticides making their way to the North Pole. These industrial chemicals could be weakening the bear's immune systems, altering their bone structure and sex hormones and possibly causing small numbers of hermaphroditic bears (Cone, 2003 & 2006).

In Eastern Slovakia a chemical manufacturing plant operating from 1959 through the mid-1980's improperly discharged massive amounts of contaminated chemical waste into the surrounding areas, the highest recorded published research of toxic exposure to

date of elevated levels of PCBs, dioxin and “dioxin-like toxic equivalents” in one given area (Hertz-Picciotto, Trnovec, Kocan, Charles, Ciznar, & Langer et al., 2003).

The U.S. Environmental Protection Agency (EPA), defines dioxin, the general term describing a group of hundreds of “at serious risk to public health” chemicals, as a family of toxic chemicals that share a chemical structure and a common mechanism of toxic action. The family includes seven polychlorinated dibenzo dioxins (PCDDs), ten of the polychlorinated dibenzo furans (PCDFs) and twelve of the PCBs. PCBs and PCDFs are found as by-products of the manufacturing of molding, electronics and burning of organic chemicals and plastics that contain chlorine (EPA, 2004).

Wars are historically the worst offender of mass toxic pollution known to mankind, with the earliest reported toxic pollution occurring in battles 5,000 years ago in the Mesopotamia that involved the breaking of dykes to flood farmland. The Indochina War, the Gulf War, the Kosovo conflict, Chechnya, Afghanistan, and ongoing conflict in Africa have in the past wrecked havoc environmentally, resulting in untold devastation to wildlife and humans alike, with research from the current war in Iraq and the environmental consequences upon humans yet to be told. The conflict in the Middle East has resulted in a number of published articles over the past two decades.

“Dr. Christine Gosden, a professor of medical genetics at the University of Liverpool in a report to the UN Institute of Disarmament Research detailed serious medical problems occurring from her study on civilian populations following the Iraqi attacks in Iraqi Kurdistan between April 1987 and August 1988. In the town of Halabja, bombed over a three day period in March 1988 with chemical and biological agents, Dr. Gosden reported findings of rare cancers, congenital malformations in children, infertility, miscarriages, recurrent lung infections and

severe neuropsychiatric disorders, noting that delayed effects following exposure may occur five to ten years later” (Pearce 2000, p. 2).

Wars throughout history have produced environmental change in the form of global warming, floods, draughts, land mines hidden in untold territories, carcinogenic and neurological fallout, all resulting in worldwide consequences that continue to plague our global world today. In the United States there have been numerous ongoing studies conducted on the post-effect of a dioxin herbicide, Agent Orange, the name derived from identifying bands of orange painted around the barrels, used in the Vietnam War to demolish foliage in enemy territory between 1965 and 1970. (See map Appendix A) Tetrachlorodibenzo-p-dioxin (TCDD), the most toxic in the family of dioxins, was the key component of the chemical compound Agent Orange. Fifteen additional untested toxic herbicides were used in Vietnam between 1962 and 1970. (See Appendix B)

Fred Pearce, a freelance environmental writer and consultant for the *New Scientist* states, “concern about the environmental impact of warfare began in earnest with Operation Ranch Hand, the U.S. campaign to defoliate Viet Nam’s jungles and flush out guerrillas during the late 1960s. American military aircraft sprayed some 70 million litres of extra-strong herbicides, mostly a formulation known as Agent Orange, over the country between 1962 and 1971, dousing 1.7 million hectares, often several times over. By the end of the war, a fifth of South Vietnam’s forests had been chemically annihilated, and more than a third of its mangrove forests were dead. Some forests have since recovered, but much of the land has turned, apparently permanently, to scrubby grassland” (Pearce 2000, p.1).

Furthermore, according to Le Cao Dai, director of the Agent Orange Victim Fund set up by the Viet Nam Red Cross, the breast milk of women in former South Vietnam

who were exposed to Agent Orange in childhood contains about ten times more dioxin than that of women in former North Vietnam or industrialized nations such as the US. And according to Professor Hoang Dinh Cau, the chairman of Viet Nam's 10-80 committee, which investigated the consequences of the use of chemicals during the war, tens of thousands of children were affected. Common symptoms of Agent Orange exposure are twisted limbs or missing altogether, and eyes without pupils. There is now growing concern that a third generation of children may be affected by Agent Orange (Pearce 2000, p. 1).

Although dioxin was banned in the US in the 1970's, since then, over 250,000 veterans of the Viet Nam war have filed suit against the herbicide manufacturers of Agent Orange, in the 1990's the United States Congress passed a law banning any future law suits filed citing the American government as a responsible agent. The current law suits against the herbicide companies cite dioxin-related diseases such as cancer, reproductive disabilities, neurological disorders, digestive disorders and other health related effects as direct results of dioxins used in the Vietnam War (Institute of Medicine, 1999). The battle between American enlisted soldiers who were participants in Operation Ranch Hand, the code name used for the spraying of herbicides to demolish foliage to flush out enemy troops and the herbicide manufacturers continues to this day.

Despite the ban on dioxin, PCBs and related PCDFs and PCDDs can still be found decades later in the environment due to their long half-lives stored in fatty acids in organisms and their continual production and recycling through industrial activities (Kimbrough, 1985). PCBs, dioxin, mercury and numerous other toxic chemical compounds continue to exist as components in herbicides, pesticides, and as by-products of plastic manufacturers, municipal waste incinerators and coal-fired power plants

throughout the world; finding their way into our soil, our food chain, our water and the air we breathe.

Moreover, the H5N1 virus strain, known as the Avian Flu, and prior to two years ago was specific only to birds in the Southeast Asian region of the globe, specifically Vietnam and Cambodia, is now circulating and has been reported extensively throughout Asia, Siberia, Kazakhstan, Germany, France, Hungary, Greece, Austria, Italy, Slovenia, India, rural eastern Turkey, Iran and Nigeria, devastating poultry populations and killing humans. The World Health Organization reports more than 162 humans have been infected by the virus and 93 people who have had direct contact with infected birds since 2003 have died. Scientist now fear that the virus could mutate into a viral form passed between birds to humans and human to human resulting in a global pandemic.

Environmental toxins may prove to have already begun their devastating genetic effect on our lives, by lowering the auto immune systems of second and third generations in war torn regions of the world resulting in the inability of the human species to ward off viruses previously only existing in poultry.

In the past decade, there have been numerous studies reporting high levels of chemical toxins found in the breast milk, umbilical cord and maternal plasma in women of childbearing age. A chemical compound of rocket fuel was recently found in high levels in the breast milk of young women in Texas (Cone, 2005). Additional studies indicate that toxins are being passed onto the embryo in the pre-natal, 20-24 day gestation periods (London & Etzel, 2000). PCBs and dioxin traces have also been reported in blood plasma collected from 394 Netherlands children tested at 42 months of age, further suggesting that exposure to toxins by the mother prior to pregnancy may result in toxins being passed to the embryo during gestation, where they may remain in the child for up to 3.5 years of age

(Lanting, Patandin, Fidler, Weisglas-Kuperus, Sauer, & Boersma et al., 1998). The long term consequences of contaminated breast milk, umbilical cord and blood plasma are yet to be seen. Furthermore, due to global toxic mercury emissions from the coal-fired-power industry, the fish we consume are so highly contaminated that the EPA has issued ongoing bulletins urging the public, specifically pregnant women and women of childbearing age, to limit their intake of fish until mercury emission levels can be reduced. The neurobehavioral deficits associated with PCBs in 7-year-old children pre-natally exposed to seafood neurotoxicants have also been isolated and documented in an important Denmark study (Grandjean, Weihe, Burse, Needham, Storr-Hansen, Heinzow et al., 2001).

In 1943, Leo Kanner first characterized autism, a neurodevelopmental disorder, as individuals with odd and disturbing language, poor human connectedness, and repetitive or disturbing behaviors (Kanner, 1943). For over a half century scientists have been studying this complex behavioral disorder which manifests in a wide spectrum of symptoms usually appearing before the age of three. Individuals with autism have difficulty interpreting the emotional states of others; failing to recognize sorrow, anger and other forms of social intent, as well as exhibit limited or nonexistent language skills, and many times display intense preoccupation with a single subject, activity or gesture. When these symptoms are all found in conjunction, resulting from a spectrum of varying degrees of neurological disabilities, the impairment is known as autism or ASD. The astounding high prevalence of ASD the world over has resulted in treatment options ranging from early behavioral interventions such as Applied Behavior Analysis (ABA), Discrete Trial (Lovaas, 1980), dietary and medication treatment as well as holistic approaches ranging from specialized custom prescriptions to hyperbaric oxygen chamber therapy which adds more oxygen to

red blood cells whereby restoring plasma tissue. Increasing evidence that ASD may not be solely a genetic disorder is growing. Recent studies of monozygotic (identical) twins, who share the same genes, and thus should have a 100 percent chance of sharing the same diagnosis; report that when one twin has autism the second twin has only a 60 percent chance of being diagnosed with the same disorder, indicating that other factors besides genes alone may be contributing to the disability of autism (Rodier, 2000). The weight of evidence concludes that autism is a complex neurological disorder presenting itself in early childhood and that the disorder could be influenced by genetic as well as environmental factors, or gene-environment interactions, which may predispose a child to ASD.

As stated prior, a diagnosis of autism requires that the individual exhibit abnormal behaviors in three categories: 1) Impairment of social interaction 2) Impairment of communication and 3) Restricted and repetitive interests and behavior. Related disorders that share features of autism but have different emphasis or additional symptoms are known as Pervasive Developmental Disorders, Not Otherwise Specified (PDD-NOS) (American Psychiatric Association, DSM, 2000). Until recently, the main research focus of autism has been solely on the behaviors caused by the disorder and psychologists have determined that early behavioral intervention is the key to behavioral modification in individuals with ASD, indicating that ASD continues to be treated from the neck up, when in fact, current scientific research concludes that the entire immune system is most likely affected by the disease (Bradstreet, Geier, Kartzinal, Adams & Geier, 2003; Herbert, 2004; James, et al., 2004; Porterfield, 1994). The effects of environmental chemical toxins resulting from modern industrialization may well be the mechanism for the biomarkers that have the potential to alter the immune system whereby causing the disability of autism in not only the present but future generations of all living organisms on the planet.

The Autism Epidemic

Review of empirical research on autism, ASD; inclusive of PDD and PDD-NOS, conclude that there has been a rapid increase in the past 15 years not only in the United States (Bertrand, Mars, Boyle, Bove, Yeargin-Allsopp, & Decoufle, 2001; Croen, Grether, & Selvin, 2002; Yeargin-Allsopp, Rice, Karapurkar, Doernberg, Boyle, & Murphy, 2003), but throughout the world (Fombonne, 2003).

Researchers agree that the autism epidemic began in 1987 and has since escalated to over 1.5 million diagnosed cases in 2005 in the United States alone. Recent studies report that the prevalence of autism in males to be four times that of females, and that the male prevalence of the disorder exceeds one in 100 (Bradstreet et al., 2003, p. 76). Using 2000 population estimates, roughly 483,000 subjects in the United States under the age of 20 and of these, 114,000 under the age of five, suffer from ASD disorder. Based on Census Bureau projections, it is forecasted that there will be a 42.7% increase in the number of under fives diagnosed with ASD in the U.S. population by the year 2050 (Fombonne, 2003).

In December of 2004, U.S. House of Representative, Dan Burton, a Republican from Indiana, addressed the 108th Congress Hearing before the Subcommittee on Human Rights and Wellness, stating that, “Today, it is reported that there are more than 1.5 million individuals in the United States afflicted with autism, and if the incidence rates of these disorders continue to increase, it is conceivable that the number of autistic children in America could reach 4 million in the next decade” (Burton, 2004, p.5). This estimate is

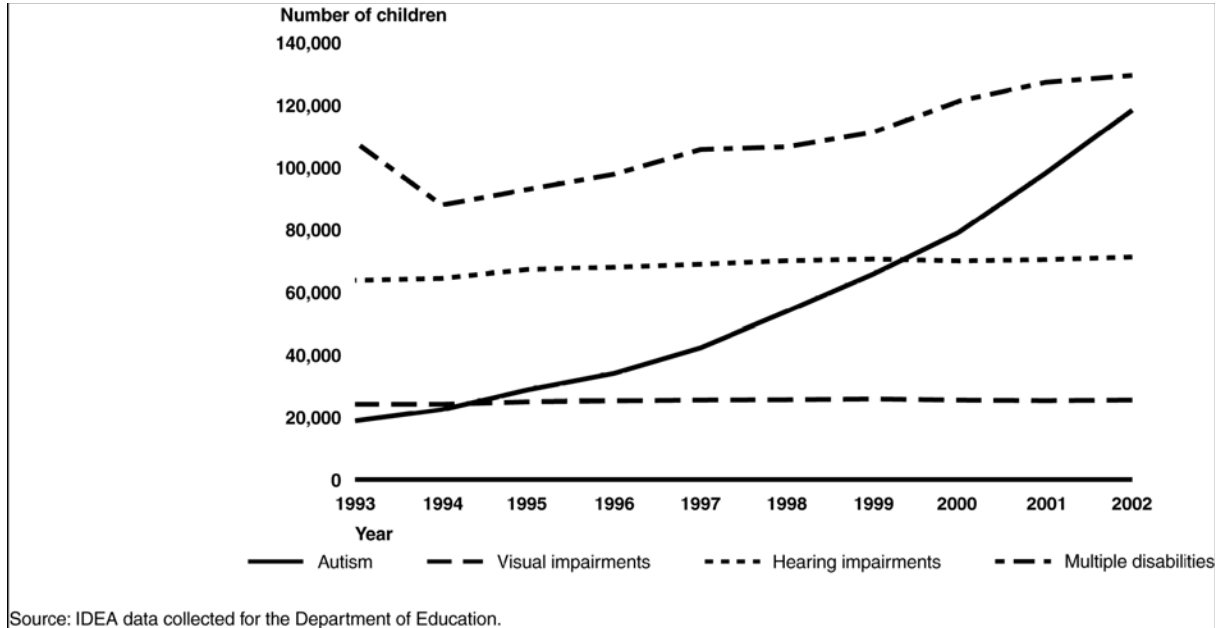
conservative according to Eric London (London & Etzel, 2000), who conclude that if mental retardation, developmental brain disorders, and Attention Deficit Disorders (ADD) are figured into the equation, the total population of individuals with developmental brain disorders in the United States is currently over 20 million people.

In a three-year study report to the legislature on the principal findings from the epidemiology of autism in California, Dr. Robert Bryd, of UC Davis' M.I.N.D. Institute (Bryd, 2002), reported that the number of autism cases served by the California Department of Developmental Services increased from 4,911 cases in 1993 to 18,460 cases as of July 2002. Of the latter number, 13,935 are children under the age of 18. Over all there was a 273% increase from 1987 to 1998, with an estimated calculable increase of nine new incidence cases per day. The weight of evidence concludes that the prevalence increase in autism is not due to more thorough diagnosis data collection by trained professionals or immigration of families with children with autism to California in order to receive services (Bryd, 2002). The number of children ages 6 through 21 diagnosed with autism receiving services under IDEA has grown at a higher rate than the number of other children diagnosed with certain low incidence disabilities (see Figure 1 pg 12).

Figure 1.

Increased Numbers of Children Diagnosed with Autism Receiving Services under IDEA

Figure 3: Trend in the Number of Children Ages 6-21 with Certain Low-Incidence Disabilities



GAO-05-220 Special Education
<http://www.gao.gov/new.items/d05220.pdf>

Etiology of Autism

The cause of the epidemic of autism is unknown, but one theory points to the possibility that the etiology of neurological developmental brain impairment disorders may be due in fact to toxins such as PCBs and dioxin, acting as hormone disruptors in the developmental stages of the embryo. Because these toxins are chemically similar in structure to thyroid hormones, they may impede and/or delay myelination of neurons that affect the cerebral and cerebellar cortex in early to mid pre-natal 12-16 week gestation, which in turn could prove to manifest in neurological developmental disorders (Herbert, 2004; James, Cutler, Melnyk, Jernigan, Janak, & Gaylor et al. 2004; London & Etzel, 2000; Porterfield, 1995; Rodier, 2000).

Albeit, both ethyl and methyl mercury (chlorine) and the 80,000 other toxic chemical compounds found in the environment could have a significant affect on neurological and physical development in all living organisms (Cone, 2003; Hertz-Picciotto et al., 2003; Palmer, Blanchard, Stein, Mandell, & Miller, 2005). The EPA reports that 48 tons of toxic mercury by-product from burning coal is emitted annually from 1,300 power plants in 45 states in the United States. Toxic mercury emitted into the air, soil, and food chain from coal-fired power plants could prove to be a key factor in developmental disabilities manifesting in the present autism incidence increase (Bradstreet, Geier, Kartzinal, Adams, & Geier, 2003; Palmer et al., 2005).

More importantly, *The Rolling Stone* magazine published a controversial article authored by Robert F. Kennedy Jr. in June of 2005 indicating that the federal government

and the Center for Disease Control and Prevention knew about the link between vaccines laced with ethyl-mercury or thimerosal, a preservative used in order to administer multiple dosages from vaccine vials as opposed to single injections, and autism or ASD (Kennedy, 2005).

Kennedy indicates that a cover up by the federal government began in June of 2000 when fifty-two attendees consisting of high level officials from the Center for Disease Control (CDC), the Food and Drug Administration (FDA), and a top vaccine specialist from the World Health organization (WHO) in Geneva along with representatives from the major vaccine manufacturers, including GlaxoSmithKline, Merck, Wyeth and Aventis Pasteur convened by private invitation only for a isolated meeting in Norcross, Georgia.

Kennedy reported that “According to a young CDC epidemiologists named Tom Verstraeten, who had analyzed the agency’s massive database containing the medical records of 100,000 children, a mercury based preservative in the vaccines, thimerosal, appeared to be responsible for a dramatic increase in autism and a host of other neurological disorders among the children. Verstraetan told those assembled that he was stunned by what he had found, citing the staggering number of earlier studies that indicate a link between thimerosal and speech delays, attention-deficit disorder, hyperactivity and autism. Since 1991, when the CDC and the FDA had recommended that three additional vaccines laced with the preservative be given to extremely young infants, in one case, within hours of birth, the estimated number of cases of autism had increased fifteen-fold, from one in every 2,500 children to one in 166 children” (Kennedy, 2005, p. 2).

During the June 2000 conference, no immediate precautions were taken to alert the public or to ban thimerosal use in vaccines; instead the officials spent the time discussing how to cover up the damaging data indicating that thimerosal could be an etiological factor in ASD. Thimerosal is a known neurotoxin, used to eliminate fungi and bacterial growth in vaccines. Animal's brains who are administered the preservative sicken, and when applied to living tissue, the cells die. The cover up was a direct result of drug companies cost effective greed; thimerosal allows the pharmaceutical companies to package vaccines in vials that contain multiple doses and the preservative thimerosal wards off contamination by multiple needle entries. The larger vials laced with thimerosal cost half as much to produce as single dose vials, making it easier for international drug companies to distribute to impoverished areas of the globe with less cost to ward off the risk of epidemics. Thimerosal has currently been banned in Iowa and California with consideration by thirty-two other states to outlaw its use in hepatitis B, haemophilus influenzae B, diphtheria-tetanus-pertussis (DTP), and the measles-mumps-rubella (MMR) vaccines.

Prior to 1989, American preschoolers received eleven vaccinations, within ten years, the number of vaccinations that American children receive has grown to a staggering total of twenty-two immunizations by the time they are in first grade. The statistical increase of individuals served in the state of California Department of Developmental Services grew by 273% between the years of 1987 to 1998, with 4,911 cases reported in 1993 to 18,460 cases reported in 2002, according to a three-year study by Dr. Robert S. Byrd of UC Davis M.I.N.D. Institute report commissioned by the California Legislature (Byrd, 2002) in direct proportion to the statistical increase in the prevalence rate of ASD. Byrd's report along with Rep. Dan Burton's report to the House of Representatives,

indicative of more than 1.5 million individuals in the United States afflicted with autism, with the possibility of the number reaching 4 million in the next decade directly parallels with the increase of thimerosal laced childhood immunizations (Burton, 2004). Of more frightening concern is the fact that although drug manufactures have begun to phase thimerosal out of injections given to American infants, they continue to export and sell off mercury based vaccine supplies to developing third world countries such as China (where more than 1.8 million cases of autism have been reported in a country where the disease was virtually unknown), India, Argentina, Nicaragua and Africa (Kennedy, 2005).

Kennedy believes that if the CDC and other world health organizations were to admit to the fact that mercury laced vaccines were responsible for the neurological poisoning of millions of individuals then their actions would be responsible for one of the biggest scandals in American medicine.

Although the etiology of autism is still debatable, many experts agree that autism most likely involves the interaction of multiple predisposed genes passed on to the infant by the parent to a child, and that genetic components combined with outside environmental factors may trigger the disorder. Moreover there is now increasing scientific evidence that autism is a complex neurological disorder presenting itself in early childhood and is a disorder influenced by genetic as well as environmental factors. Parental environmental toxin exposure, prior to conception, has been reported to remain in fat soluble cells for over 14 years after initial exposure (Guo, Ryan, Lau, Yu & Hsu, 1997). These toxins could possibly be a trigger for metabolic reactions in-vitro in infants with genetic predisposition or biomarkers, resulting in neurological developmental disorders known as ASD.

This project is designed as an attempt to expose and bring awareness to service providers for individuals with ASD, Marriage and Family Therapist's (MFT's), parents and families, educators and school administrators as to the probable implications resulting in a possible association between ASD and environmental toxins such as mercury, both ethyl mercury, a component of thimerosal and a preservative used in vaccines and methyl mercury, a by-product of coal burning power plants; as well as dioxins, a major component of Agent Orange, and still used in pesticides and herbicides, PCB's, and over 80,000 other known toxic chemicals found in our environment, that could be an etiological factor in ASD.

CHAPTER II

Literature Review

Epidemiological & Prevalence Factors in Autism

The following studies are cited in this thesis as they lend value to the possible association of the relationship between ASD and toxins.

The Fombonne Study

Eric Fombonne at the Montreal Department of Psychiatry, Children's Hospital conducted the most thorough cohort research study to date, indicating an increase in prevalence estimates of autism and PPD disorders in the last 15 years (Fombonne, 2003). Compiling and correlating epidemiological surveys conducted in 13 countries from 1966-2001, Fombonne reports that the estimated rate for all forms of PDD's are currently as high as 60/10,000.

Fombonne correlational research study sampled a population of over 5 million children. Compiling data from existing longitudinal researches from 32 countries, conducted over a 35 year period; the study correlated the total number of individuals with ASD disorder in a population of 5 million over a 35 year period measuring degrees of autism with race, immigrant status, and male to female ratio. The sample population included children from birth to early adult life with an overall median age of 8.0 years of age. The majority of the studies were conducted in predominately urban areas, with only 2

of the studies carried out in predominately rural areas. The sample population group of males to females was roughly half, with a prevalence of 4.3:1 male/female ratio. All ethnic races were represented in this 32 country global survey. The study supports existing data that autism is found to be prevalent in more males than females, is not associated with social class, immigrant status, race or ethnicity. The findings conclude that autism is associated with mental retardation in about 70% of the sampled cases (Fombonne, 2003).

Metropolitan Atlanta Study- Yeargin-Allsopp

Although there have been numerous studies outside the United States; there have been few population-based autism studies in the United States. The federal Center for Disease Control and Prevention (CDC) conducted an empirical quantitative surveillance study in Metropolitan Atlanta, Georgia, in 1996 to determine if the prevalence of autism that occurred in children in a major metropolitan area was higher than previous conducted studies in the 1980's and early 1990's and to examine the characteristics of autism within the study population. Dr Marshalyn Yeargin-Allsopp, an epidemiologist at the National Center on Birth Defects and Developmental Disabilities headed the study group (Yeargin-Allsopp et al., 2003).

The Atlanta study consisted of a sample group of 987 individuals with autism of an overall 289,456 (51% male, 58% white, 38% black, and 4% other racial group) population of 3-10 year old children in a 5-county metropolitan Atlanta area, the mean age of initial diagnosis being 3.9 years of age. The samples were assessed from data only information derived from public schools and non-school sources, such as regional centers and private doctors.

The study measured the prevalence of autism among 289,456 samples to determine the degree of autism reported as consistent with *Diagnostic and Statistical Manual of*

Mental Disorders, Fourth Edition (986 students fell within the diagnosis) to determine if the rate of autism was higher than studies conducted in the United States during the 1980's and early 1990's. The 987 sample group individuals who met the autism criteria by experts in the field, were the main outcome measure for severity levels of cognitive functioning, ratio of male to female prevalence, comparability inclusive of all ethnic groups, age and education level of maternal parent and the degree to which the control group was receiving services provided under The Individuals with Disabilities Act (IDEA). The Atlanta study reported the prevalence of autism to be 3.4 per 1000 in children aged 3-10 years of age in 5 counties in metropolitan Atlanta. Prevalence was comparable for black and white children (black 3.4 per 1000 and white 3.4 per 1,000). Sixty-eight percent of the children had cognitive impairment.

The study indicates that due to the lack of a standard universal tool for measuring degrees of autism and/or a medical or genetic screening for the disorder that arriving at a diagnosis for autism remains challenging. Albeit, the study concluded that the prevalence of autism did not vary by race. The study did indicate that children with autism of mothers with higher degrees of education were more prone to seek out services for their children at an earlier age as opposed to mothers that waited until their children were enrolled in the public school system and relied on professional assessment in order to receive services. The study also indicated that the prevalence factor for autism disorder was estimated at 425,000 Americans under the age of 18 possessing some form of autism and that the increase of autism in the Atlanta area mirrored the prevalence rate for identification of the disorder elsewhere in the United States but the explanation for the increase was stated as unknown.

A California Study- Croen

Another similar important cross ethnic population study was conducted on children with autism born in California between 1989-1994. From a sample population of 3.5 million California births, a total of 4,381 children with autism were identified (Croen et al., 2002).

Lisa Croen and colleagues at the University of California at Berkeley, identified children born with autism through service agency records and compared the data with the total population of California live births over 6 successive years. The percentage of male to female children were as follows, 85% males, 83% females, $[\chi^2] = 4.84$, $df = 1$, $p = 0.03$. Of these 87% were white, 89% Hispanic, 87% blacks, 80% Asian, and 71% other; $[\chi^2] = 92.47$, $df = 4$, $p < 0.001$. Thus these autism percentiles point toward an equal ratio among ethnic groups in the sample population.

The California study measured the increased risk factor for the 4,381 children identified with autism with correlating maternal age and maternal education and found that risk increased as maternal age and maternal education increased. Children born of immigrant mothers had similar or decreased risk to California-born mothers. The 4,381 children identified with autism represented a prevalence rate of 12.3 per 10,000 live births.

The Brick Township Study- Bertrand

In the mid-nineties a group of concerned parents asked the question as to why the increase in incidence of diagnosed cases of children with autism in their small community of 76,000. This investigation led to an important study conducted in 1998 in Brick Township, New Jersey, through the Center for Disease Control and Prevention in Atlanta, Georgia, ultimately reporting the highest rate of prevalence of autism in 3-10 year old children in one given area in the United States (Bertrand, et al., 2001).

The target population of 8,896 children diagnosed with ASD and PDD-NOS in the Brick Township study was representative of all ethnic groups but predominately white middle class, in 1998, who were residents of Brick Township. The sample population was derived from special education records, local doctors and community resource records and measured the overall existing population of 8,896 children age 3-10 (4,364 males, 4,332 females) with the sample group of children diagnosed with ASD and PDD-NOS, to determine the prevalence factor of autism in the community. Higher than any previous study, the Brick Township study found 40 per 10,000 children to have autism disorder and 67 per 10,000 of these children to be in the ASD range (Bertrand et al., 2001).

According to Yeargin-Allsopp, Croen & Bertrand's findings, a conclusion can be made suggesting that there has been an increase in prevalence of autism and ASD over the last 15 years in the United States and furthermore that the autism prevalence is not specific to age, race, immigrant status, or ethnicity. Autism occurs more frequently in males than females (Fombonne, 2003). The weight of evidence supports that due to the increased prevalence of autism, 1.5 million cases in the United States alone, further investigation is warranted measuring parental demographics, parental genetic predisposition and environmental factors, in order to determine the possible etiological of autism and the rapid increase rate.

Environmental Studies

Described are three important empirical studies conducted throughout the world contributing to the investigation of environmental toxins and the role they may play as a key factor in neurological development disorders and ASD.

The Yucheng (oil disease) Incidence- Guo Study

In 1979, a mass poisoning of more than 2000 people occurred in Yucheng, Taiwan due to consumption of rice-bran oil that was contaminated with PCBs and heat generated byproducts. This geographic toxic poisoning is referred to as the Yucheng accident. In 1992, Guo (Guo et al., 1997) from the National Cheng Kung University Center in the Republic of China, analyzed the blood serum samples of 56 women, fourteen years after toxic exposure, and their offspring were correlated to a control group of women who had no known previous exposure to PCBs or related chemicals and had never consumed rice oil. In 1985 a group of children born to mothers exposed to the contaminated rice oil were recruited and assessed yearly until 1992 for cognitive and physical development along with a control group matched by sex, age, maternal age, residential area, parents' education and socioeconomic status (Guo, et al., 1997). Both qualitative and quantitative data research collection was used in this study.

Guo and his colleagues (1997) measured the effects of breast feeding from the 56 women exposed to toxic chemicals on their young. The 56 children of the toxic exposed women were assessed for cognitive and physical development in yearly intervals along with a control group of matched children by sex, age, maternal age, residential areas, parents' education and socioeconomic status.

The Taiwan study indicated that more than 13 years after the Yucheng incident, Yucheng mothers exposed to toxins continued to have detectable serum levels of PCB/PCDF congeners that were considerably higher than that of the unexposed controls and that these toxins were passed onto their young in levels of association corresponding to duration of breast feeding.

Developmental and neurological abnormalities were documented in Yucheng breast fed children born after their mothers' consumption of contaminated rice-oil, with the exposed children scoring lower on tests of cognitive function than the children of non-exposed mothers, suggesting that the abnormalities may have been a direct result of contamination.

Pesticide Exposure in Mexico-Guillette Study

A second noteworthy comparative study was conducted by Elizabeth Guillette and colleagues at the University of Arizona, on the known variables that influence children's growth and development by comparing two groups of 4-5 year old, pre-school Yaqui children who resided in the Yaqui Valley of northwestern Mexico (Guillette, Meza, Aguilar, Soto, & Garcia, 1998). The Guillette Yaqui Indian Mexican study assessed and measured physical and neurological development of two groups of children, exposed and non-exposed to pesticides, and the concentration levels of pesticide toxins collected from the cord blood and breast milk in the mothers' at the time of birth. The two sample groups shared criteria for child selection of genetic backgrounds, diets, water mineral contents, cultural patterns, and social behaviors but the control group differed in its' demographic exposure to agricultural pesticides. Group 1, the valley group, consisted of 33 Mexican 4-5 year old children that lived in an agrarian region where heavy use of pesticides, applied up to 45 times during planting and harvesting per crop, had been documented since the 1940's. In contrast, Group 2, the foothill group, was comprised of 17 children of the same age range, was sampled from children living in the foothills where residents maintained traditional intercropping for pest control in gardens and bug control. Qualitative research was conducted using a 30-minute in-home interview in Spanish with the mothers and a 30-minute evaluation of the children. A Rapid Assessment Tool for Pre-School children

(RATPC) questionnaire was developed e.g., the children were asked to draw a picture of a person. Cognitive functional development in the pre-schoolers was evaluated and analyzed from the drawings they constructed. (See drawings Appendix C). Quantitative research was used to compare the findings and percentage rates of exposed versus non-exposed children to environmental pesticides.

The study found the two groups to be similar in physical growth patterns but a comparison of functional abilities indicated differences among the study groups. The foothill group had more stamina and outperformed the valley group in gross motor skill activities and memory skills. The most striking difference between the exposed and unexposed children was in their ability to draw a person. The valley children averaged 1.6 body parts to a drawing, whereas the foothill children drew 4.4 body parts indicating mental and neurological functioning impairment. The children exposed to high levels of concentrated pesticides or industrial contaminants may have experienced hormonal disruption that modified their physiological development and functioning.

The Netherlands Study- Lanting

The possible neurological effects of environmental exposure to chemicals was also reported in a study that measured the toxicity of PCBs and dioxin in breast milk and maternal blood plasma and the blood serum of infants at 42 months or 3.6 months of age (Lanting et al., 1998). This 1990-1992 study, at the University of Groningen, Groningen, Netherlands, consisted of the evaluation of the neurological condition of 394 infants in the Netherlands. The study was comprised of 418 mother-infant pairs, of which 209 were in the breast-fed group and 209 in the formula-feeding group. At birth, 382 cord blood samples were taken from the two sample groups. The Lanting study measured two infant

control groups for neurological quantitative appraisal of brain function after 42 months of age. All the mothers' were predetermined to have been exposed to PCBs and dioxin as was indicated by their blood serum. The infants were divided into two groups, a breast fed control group and a formula fed group. Using a quantitative measure, the study concluded that there was no relationship to the neurological condition of the children at 42 months of age and exposure to prenatal or post natal PCBs and dioxin. However the infants at two weeks of age, with the combination of high prenatal and high lactational exposure, were found to exhibit adverse effects in the neurological area of the brain, displaying hypotonia, or decreased muscle tone, mimicking the Guillette Yaqui Indian Mexican study findings (Guillette et al., 1998).

Although no clear relationship can be made to PCBs and dioxin exposure in the Netherlands study group of children at 42 months of age, using an age-adequate technique focusing on motor functions, the researchers concluded that when the infants reached the age of 18 months, a negative impact of pre-natal PCB exposure revealed itself in motor impairment, one of the initial age indicators of a diagnosis of autism. The study further supports the theory that toxic exposure remains in the blood serum for long periods of duration, and that the accumulation of these toxins requires further research in order to determine at what stage of development they may contribute to neurological impairment.

Association between Autism and Environmental Mercury in Texas Study-Palmer

Texas rates 4th among the states with the highest reported mercury release from coal-fired power plants next to California, Oregon, and West Virginia. Ray Palmer's (Palmer et al., 2005), University of Texas Health Science Center, study is the most current study to date investigating the association of legal amounts of environmentally released mercury pollution and autism rates at the county and school district level.

Environmentally released mercury is a major source of methyl mercury exposure. Mercury is released into the environment largely from fossil fuel (mainly coal) combustion by electrical utilities and from municipal and medical waste incinerators. This inorganic mercury becomes airborne and may be carried for miles before being deposited on soil or water. The inorganic form of mercury is then converted to a toxic form (methylmercury) by chemical reactions or by bacteria, which is absorbed by aquatic microorganisms that are eaten by fish, and in this manner accumulates up the aquatic food chain (Palmer et al., 2005, p.2). Humans are primarily exposed through fish consumption (Meyers et al., 2000) and transmission from mothers to infants is well documented in animal models (Newland et al., 1994) and human studies (Ramirez et al., 2000; Grandjean et al., 1995). Results from several studies show that maternal mercury exposure during pregnancy is associated with neuropsychological deficits in children and that this association is most evident in women with stable exposure throughout pregnancy” (Ramirez et al., 2003; Grandjean et al., 2003).

The EPA currently reports 48 tons of neuro-toxin mercury is released annually. The Bush administration’s proposed Clear Skies Act, which was defeated in March 2005, would have cut the emissions to 15 tons annually by 2018, a 70% reduction, over a 13 year period. Critics and local air-pollution regulators state that repercussions from a long term delay are too great and call for steeper reductions to be put in place far sooner (Miller, A., & Hamburger, T., 2005).

The 2005 Palmer study is the first association research study to examine the mercury levels from industries scattered throughout Texas and to make a relationship between environmental toxins and developmental disorders and the special education rates of 1,200 school districts in 254 counties. Palmer used emission levels reported by the

government Toxic Inventory Program (TRI), a division of the United States Environmental Protection Agency (USEPA). The TRI database was established by Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (EPCRA). Under the EPCRA, industrial facilities are required to report environmental releases and waste management practices annually to the EPA.

The Palmer study measured the recorded prevalence of autism and ASD derived from data provided by county, local and school records in 1,200 school districts with a total of 4 million children between K-12 grades, to the mercury emission levels released from power plants per pound in the years 2000-2001.

Palmer's association study found that for each 1,000 pounds of environmentally released mercury, there was a 43% increase in the rate of special education services and a 61% increase in the rate of autism; supporting the hypothesis that a correlation could exist between environmental released mercury and increased autism rates.

Metabolic studies

That gene and environmental factors may line-up to possibly cause brain damage to the cerebral cortex, the two large hemispheres responsible for language, thought and interaction with the outside world, has proven to be a valid research topic for ongoing scientific investigative studies over the recent years. The correlation between toxic chemical compounds and the possible role they may play in altering pre-natal disposition of neurological development has been the basis for a number of important metabolic biomarker empirical research studies in the United States.

Free Radicals & Autism - James Study

Chronic biochemical imbalance is often a primary factor in the development of many complex diseases as well as a possible metabolic basis for autism. A number of researchers have focused on metabolic biomarkers in the brain for the answer. Dr Jill James from the University of Arkansas believes that because individuals with autism share a chronic flaw in the body's natural defense against oxygen free radicals and as a result the free radicals bombard the brain and cause havoc which manifests in autism (James, et al., 2004). Individuals with autism have been found to have a lower than normal or neutralized oxygen free radical system which in turn lowers the binding ability of a chemical (glutathione) produced by all cells in the body, to alter the electron balance and expel free radicals. If this process does not occur, then the maturing neurons and synapses are vulnerable to bio-molecular invasion which James believes may be a trigger for autism.

Glutathione functions as an antioxidant, the body's tool for detoxifying and excreting metals. James suggests that environmental mercury contaminants, including a mercury preservative known as thimerosal used extensively in vaccines from 1988 through 2002 in the United States, alter the glutathione balance whereby interfering with the body's ability to neutralize toxic heavy metals, leading to increased risk in the developing brain and nervous system. As a result the unopposed free radicals may affect the gastrointestinal tract and the immune system, common pathology reported to occur in individuals with autism.

James and colleagues measured blood samples from 20 United States, Caucasian autistic children (6-8 years old, 14 males and 6 females), and 33 United States, Caucasian control children to determine the levels of protective antioxidant (glutathione). The study determined a correlation between abnormally low antioxidant levels and children with

autism, further indicating that there may be a possible connection between brain tissue damaged by mercury concentration whereby interrupting the elimination of toxins, causing a metabolic or “biomarker” imbalance, resulting in characteristics of autism.

Concentration of Mercury in Urine- Bradstreet Study

At Arizona State University, Jeff Bradstreet et al. (2003) conducted a case control study of thimerosal mercury, first added to childhood immunization vaccines in the 1930's, autism was first described in 1943 among children who were born in the 1930's, suggesting that autism may indeed be an iatrogenic (doctor caused) effect of (thimerosal) burden in children. Two hundred and twenty one children were analyzed with the diagnosis of established ASD comparing mercury excretion after a three-day treatment with an oral chelating agent, meso-2,3-dimercaptosuccinic acid (DMSA) to a matched control group of 18 children without an autism diagnosis among themselves or a sibling or a first-degree family member. The male:female ratio was 4.88:1 and the ages ranged from 3-15 years of age in the cases and 3-16 years of age in the controls. The Bradstreet study (Bradstreet et al., 2003) measured the mercury buildup in the tissues of children to determine if children with autism accumulate a higher concentration level of mercury in their bodies and if so, could the presence of mercury accumulation be due to pre-existing genetic conditions and possibly produce a toxic effect in pre-natal neurodevelopment causing autism.

Bradstreet indicated a strong association between increased urinary mercury concentrations after a three day treatment of DMSA and the diagnosis of ASD. Because mercury concentrations in the human brain are six times greater than in the blood, it is possible that thimerosal binds to a free radical and is not excreted from the body. The lack of the ability of the children with autism to excrete mercury may affect the immune system

and the central nervous system possibly causing neurochemical and neurophysiological damage which could manifest in degrees of neurological disorders, including Attention Deficit Disorder (ADD), learning difficulties and speech delay. The analysis confirmed that children who developed ASD had significantly greater accumulated mercury than the controls. The Bradstreet study is in line with previous published epidemiologic reports indicating a direct association between increased mercury from thimerosal-containing childhood vaccines and neurodevelopment disorders (Geier & Geier, 2003).

Environmental Insults to the Thyroid System-Porterfield Study

Susan Porterfield (Porterfield, 1994), Medical College of Georgia, indicates that the PCB's and dioxins are structurally similar to the thyroid hormone and depending on the amount of toxin exposure, either mimic or decrease the biological action of the thyroid hormone in the body. If either effect occurs during brain development in utero and/or as infants, neurologic development may manifest in behavioral disorders. If there is an absence of the thyroid hormone, myelinization (growth of sheath-like insulating material in the spinal cord developed during the 2nd trimester and continuing until the second year of life, protecting the nervous system and serving as an electrical insulator in development of fine motor control) is delayed along with normal biochemical maturation of neurons, effecting the cerebral and cerebellum cortex if superimposed on a pre-existing maternal or fetal thyroid disorder.

If toxins change the thyroid function, they may cause permanent neurological damage including impaired learning and memory, hyperactivity (reported in mice, rats and monkeys), delayed auditory processing (reported in rats and mice), decreased birth weight

and litter size in rodents and possible decrease in birth weight in humans (Porterfield, 1994, p. 5). The effects of prenatal and perinatal PCB and dioxin exposure to the neurological system in humans, resembles those associated with fetal or perinatal hypothyroidism. Porterfield concludes that the possibility exists that toxins, may at low levels, be altering neurological development via their action on thyroid hormones available during critical brain development periods of gestation.

Molecular Defects in the Autistic Brain

White Brain Matter & Autism- Herbert Study

Dr. Martha Herbert, pediatrics neurologists at Massachusetts General Hospital at Harvard Medical School, reports that although various brain, biochemical, immunological and genetic abnormalities have been found in individuals with ASD, at present there is no reliable biomarker, making it a syndrome rather than a disease (Herbert, 2004).

Dr. Herbert rejects the ideology that conflicting measurement tools and methods for screening is a validity problem in measuring individuals with autism and ASD, but suggests that the variability in studies may be due to the fact that autism may not be a specific biological entity but rather a “final common pathway”(Purcell, Jeon & Pevsner, 2001; Herbert 2004). Furthermore, Herbert argues that environmental toxins are most likely the cause of 20% of US children being diagnosed with some form of PDD, with millions more added each year.

Rather than trying to eliminate the variability, Herbert poses the question of just how it can be that such a presumably heterogeneous set of underlying biological abnormalities can eventuate in the same syndrome of behavioral abnormalities. How can

we characterize the cognitive neuroscience of the phenomenon of a final common pathway? Herbert hypothesizes that autism is a disorder of systems alteration or disruption and that systems can be impacted in multiple ways and yet yield a similar syndrome of behaviors (Herbert, 2004, p.4).

Through Magnetic Resonance Imaging (MRI) and a new procedure known as morphometric analysis (post-mortem brain tissue is divided into small parcels and examined), Dr Herbert measured individual parts of the brain to determine why autistic brains are bigger than normal, specifically the white matter, the color of the fatty material that insulates the nerve cell fibers in the brain (Schumann, Buonocore & Amaral, 2001). White matter develops later in gestation and does not mature until the second year of life. Herbert found that the increase in the white matter, or inflammation, is greatest in the area that transmits information between the brain regions that are closest to each other and on the same side of the brain. As opposed to the white matter transmitters that are long distance and transmit information to and from opposite sides of the brain. Herbert reported the long distance white matter to be relatively unchanged in individuals with autism. More importantly, Herbert discovered that the volume change in white matter is greatest in the front of the brain, which is the area of the brain most connected to all other areas of the brain, and where the most abstract higher-level thinking is believed to take place.

Dr. Herbert measured the size of 48 areas of the brain on both sides with MRI. In individuals with autism she found a reversal of brain asymmetry, more areas are bigger on the right side than the left indicating that there is a bias on the right side of the brain, opposite of a typically developing child. Of most interest is the fact that the enlarged brain area of individuals with autism are the areas associated with higher-order thinking and are responsible for tying together information from all other locations in the brain.

Herbert also reported a correlation with increased white matter and the right side of the brain, the non-verbal hemisphere, asymmetry and the brains of children with Developmental Language Disorders. Indicating that the anatomical problem may underlie the inability to process complex information such as language and furthermore, that the language disability in autism may be a part of a much more widespread abnormality i.e. there is no difference in a specific Learning Disability (LD) and autism, they are the same disorder but the degree of the disability is how it will manifest as an autism disorder, LD or other neurological disability.

“Overall, Herbert suggests that in autism, parts of the brain may not be talking to each other normally. Because white matter grows normally until 9 months of age in the individual with autism, says Herbert, then it goes haywire and by two years of age, excessive white matter is found in the frontal lobes, the cerebellum and higher level processing areas. The reason the enlargement of the brain is not seen in mature individuals with autism is because the brain grows rapidly from 1 to 2 months of age, with another spurt between 6 months and 2 years. A 5 year old with autism has the same size brain as a normal 13 year old child. By mid-adolescence, when normal developing children catch up, the individual with autism’s brain is comparatively smaller” (Blakeslee, New York Times, 2005, p. 1).

Also of interest is the fact that individuals with autism process the alphabet in that area of the brain where shapes are normally processed, suggesting that they are using a basic sensory region of the brain to process higher-level concepts. The analogy that Dr Mathew Belmonte, an autism researcher at the University of Cambridge in England refers to as a computer analogy, “ think of the white matter as fibers that connect neurons in separate

areas of the brain and grey matter contains the neurons themselves, white matter are the cables and the grey matter is the circuit board. Even if the circuit board is intact, if the computer cables are disrupted then the computer can't function (Blakeslee, 2005).”

Although it is not known what causes the enlargement or overgrowth of the brain, the clues to the etiology of autism may well lie in the anatomy of white matter in the brain. Understanding the source of physiological and toxicological autism may be the key to addressing autism and to understanding the ideological role of genes and genetic research in contemporary America.

Problem Statement

Although the etiology or cause of autism is still unknown, many experts agree that ASD most likely involves the interaction of multiple genes that together predispose a child to the condition, and that these genetic components combined with an outside environmental factor, toxins, may trigger the disorder.

The Industrial Revolution, which began in England in the mid- 1800's as a result of a “power crisis,” is responsible for jumpstarting modern civilization as we know it today. And albeit, although it made man's life on this planet far more comfortable, The Industrial Revolution is directly responsible for the environmental concerns which now plague our civilization in the form of global warming as well as other various human atrocities. With the growth, expansion and comfort came catastrophe.

Environmentalists, scientists and informed individuals across the globe are now advocating for immediate alternative forms of energy. The European Union (EU) has made substantial progress in environmental energy reform by enforcing stronger rules and

regulations on toxin emissions, and has seen avocation of windmills as a source of alternative energy replacing coal burning power plants in many areas.

Due to the fact that civilization has made enormous progress in the last 200 years, the price to pay has resulted in the form of the safety for humanity. Scientific study has, in the past, and remains, the touchstone for human progress whereby all standards of human development are measured, evaluated and concluded as to the benefit of our sociological evolution. We are now being faced with the dilemma of how to progress forward after the Age of the Industrial Revolution without causing destruction to humankind itself.

CHAPTER III

A Handbook on Autism Spectrum Disorders (ASD) and Environmental Toxins

by

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This handbook is designed to provide information and create awareness regarding the current existing literature associating the possible relationship between ASD and environmental toxins; and to offer a useful resource guide of federal, state, government, University, and private funded organizations that are furthering research in the field of ASD and environmental toxins.

The handbook is intended to be used for individuals with ASD, service providers, Marriage and Family Therapist's (MFT's), parents and families, educators and school administrators, with the hope of creating awareness as to the probable implications resulting in a possible association between ASD and environmental toxins such as mercury, both ethyl mercury, a component of thimerosal and a preservative used in vaccines, and methyl mercury, a by-product of coal burning power plants; as well as dioxins, a major component of Agent Orange, and still used in pesticides and herbicides, PCB's, and over 80,000 other known toxic chemicals found in our environment, that could be an etiological factor in ASD.

Section I addresses toxins and the possible role they may play in ASD. Section II lists advocacy ASD organizations references.

Introduction

As of May 2005, the UC Davis M.I.N.D Institute reported that Autism Spectrum Disorder (ASD) affects one in every 166 children. Recent studies report that the prevalence of autism in males to be four times that of females, the male prevalence of ASD exceeds one in 100 (Bradstreet et al., 2003, p. 76). In a three-year study report to the legislature on the principal findings from the epidemiology of autism in California, Dr. Robert Bryd, of UC Davis' M.I.N.D. Institute reported that the number of autism cases served by the California Department of Developmental Services increased from 4,911 cases in 1993 to 18,460 cases as of July 2002. Of the latter number, 13,935 are children under the age of 18. Over all there was a 273% increase from 1987 to 1998, with an estimated calculable increase of nine new incidence cases per day. The weight of evidence concludes that the prevalence increase in autism is not due to more thorough diagnosis data collection by trained professionals or immigration of families with children with autism to California in order to receive services (Bryd, 2002).

In 1943, Leo Kanner, first characterized autism, a neurodevelopmental disorder, as individuals with odd and disturbing language, poor human connectedness, and repetitive or disturbing behaviors (Kanner, 1943). For over a half century scientists have researched this complex behavioral disorder which manifests in a wide spectrum of symptoms usually appearing before the age of three. That these symptoms have been well diagnosed is common knowledge; individuals with autism have difficulty interpreting the emotional states of others, failing to recognize sorrow, anger and other forms of social intent. Individuals with autism exhibit limited or nonexistence language skills, and many times display intense preoccupation with a single subject, activity or gesture. The disability of

autism has presently been diagnosed in children in astounding numbers the world over. Why the sudden increase of incidence of autism is the question scientist, researchers, parents, educators and therapists are asking.

It is safe to say that the majority of Americans, as well as the world population as a whole is familiar with the disability of autism and Autism Spectrum Disorders (ASD). Over the past decade there has been a flood of media coverage; newspaper and magazine articles, television specials and films, and numerous non profit organizations seeking federal and state funding for ASD research, all alerting the public to the astounding rise in numbers of individuals diagnosed with ASD. Until recently, the general public watched, read, and donated to charitable organizations, as by-standers shaking their heads at the misfortune of the parents whose lives had been changed by the diagnosis of a son or daughter with the disorder of ASD. Albeit, in the course of the past five years, autism has now come close to home for those very people. These same individuals are now asking; how could it be possible that they have a child, a niece, a nephew or a grandchild with autism.

There is increasing evidence that our environment may play a key role in the disability of autism and ASD. And furthermore, that if we, the citizens of the world do not become advocates demanding that our governments of the world rid our environment of toxic waste in the form of PCB's, dioxin, toxic mercury and over 80,000 over known chemical toxins on our planet, then our future generations are certain to reap the neurological disadvantages that could possibly ensue.

Section I : Autism & Toxins

“Our lives begin to end the day we become silent about things that matter.”

Dr Martin Luther King, Jr.

The Environmental Protection Agency (EPA) & Toxins

Currently there are over 80,000 known and identified toxins in the form of PCB's, pesticides, herbicides, plastics, dioxins, affecting us daily. The United States Environmental Protection Agency or EPA was formed in 1969 and is an independent federal agency established to permit coordinated and effective governmental action, for protection of the environment by the systematic abatement and control of pollution, through integration of research monitoring, standard setting, and enforcement activities. The purpose and mission of the EPA is to coordinate programs aimed at reducing pollution and protecting the environment. Shortly after the EPA was formed a number of Acts soon followed, the most important Act passed by Congress was the Clean Air Act in 1970. The Clean Air Act is the federal law designed to ensure that all Americans have air that is safe to breathe.

Toxins are defined a poisonous substance, especially a protein, that is produced by living cells or organisms and is capable of causing disease when introduced into the body tissues but is often also capable of inducing neutralizing antibodies or antitoxins.

The EPA defines Dioxin as a family of toxic chemicals that share a chemical structure and a common mechanism of toxic action and is a general term used to describe a group of hundreds of chemicals that are found in our environment. The most toxic compound is 2,3,7,8-tetrachlorodibenzo-p-dioxin or TCDD. It is important to know that the toxicity of all other dioxins and chemicals like Polychlorinated biphenyls (PCB's) that act like dioxin

are measured in relation to TCDD. Dioxin is formed as an unintentional by-product of many industrial processes that involve chlorine such as waste incineration, chemical and pesticide manufacturing and pulp and paper bleaching. Dioxin was the primary component of Agent Orange, a major herbicide used during the Vietnam War (See Appendix A&B).

Dioxin exposure has been linked to birth defects, learning disabilities, inability to maintain pregnancy, decreased fertility, reduced sperm count, endometriosis, diabetes, immune system suppression, lung problems, skin disorders, lowered testosterone levels and many more health problems.

“In the United States, pesticides are regulated by a myriad of laws and agency rules. No less than fourteen different Federal Acts control some aspect of the manufacture, registration, distribution, use, consumption and disposal of pesticides. The bulk of pesticide regulation falls under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). This legislation governs the registration, distribution, sale and use of pesticides. The Environmental Protection Agency is responsible for the administration of this Act and for establishing rules and regulations consistent with the intent of the ACT.

Other acts govern the presence of pesticides in water and air, the clean up of spills and releases, the concentrations of pesticide residues in raw and processed food, their impact on endangered species, their transportation, working conditions for manufacturers and applicators, and their disposal.

The three broad categories of concern with pesticide regulation focus on (a) the registration of new pesticides and the re-registration of existing pesticides and on (b) the establishing and monitoring of pesticide levels in food products and on (c) the

monitoring of pesticide levels in the environment and especially in ground and surface water.” (Exttoxnet, 1993)

Polychlorinated biphenyls (PCB's) are a class of chemicals that are entirely man-made and do not occur naturally. PCB's, first solely manufactured commercially in the U.S. by a company known as Monsanto in 1929, were used in many different types of products including hydraulic fluid, casting wax, pigments, carbonless copy paper, plasticizer, vacuum pumps, compressors, heat transfer systems and many other industrial products. The primary use of PCB's was as a dielectric fluid in electrical equipment. Because of their stability and resistance to thermal breakdown as well as their insulating properties they were the fluid of choice for transformers and capacitors. And because of their fire resistance, they are now used in furniture manufacturing and are even required by some fire codes.

During the 1970's, the health risks associated with PCB's became a major consideration due to several well publicized incidents. One of the most noted of these is known as the Yusho Incident which took place in Japan when a rice oil plant had an equipment leak of PCB fluid into the product, resulting in many people being adversely affected. Among the health affects of PCB's are skin ailments known as chloracne, reproductive disorders, liver disease and neurological problems in children. PCB's are a suspected human carcinogen and a known animal carcinogen. They are resistant to degradation and therefore can persist for many years in the environment. Furthermore, they bioaccumulate or remain in the food chain and are stored in the body fat of animals and humans. Due to the health and environmental risks associated with PCB's, an Act of Congress in 1978, the Toxic Substances Control Act of 1976, directed the U.S.

Environmental Protection Agency to ban the manufacture of PCB's and now regulates their use and disposal. And although the manufacturing of PCB had been banned, the EPA allowed existing equipment containing PCB's to continue in use for the remainder of their useful lives.

Consequently, PCB contamination from historic uses and dumping is widespread throughout the U.S. and the world. Disposal into waterways has caused PCB contamination of rivers, oceans, soils and even the polar ice cap. As a result, many forms of wildlife, fish, birds, and polar bears have become contaminated with PCB's. There have been bans on fishing in various locations throughout the world and The U.S. Food and Drug Administration, along with numerous United States Department of Public Health agencies, have issued advisory warnings against eating certain fish containing PCB's, tuna being the most noted because of the high fat content resulting in extended storage of toxins in the fish. Currently, many states have established maximum contaminant levels for PCB's in drinking water as well.

PCB's, along with ethyl mercury (a chemical component of thimerosal, used as a preservative in vaccines for infants) and methyl mercury (a by-product of coal burning power plants) and dioxins, are all toxic chemicals known to be associated with adverse health effects in humans manifesting in learning disabilities, immune system suppression, birth defects, the inability to maintain pregnancy, decreased fertility, reduced sperm counts, endometriosis, diabetes, lung problems, and skin disorders.

Dioxin, the major component of Agent Orange, used during the Vietnam War, was outlawed in the 1970's, but despite the ban, these PCBs and related PCDFs and PCDDs are still found decades later in the environment due to their long half-lives and continual production and recycling through industrial activities (Kimbrough, 1985). PCBs, dioxin,

mercury and other toxic chemical compounds continue to be found in herbicides, pesticides, plastic manufacturers, municipal waste incinerators and coal-fired power plants throughout the world. These toxins are finding their way into our soil, our food chain, our water and the air we breathe, and may prove to have devastating effects on our lives, as well as those of our unborn future generations. That a chemical compound of rocket fuel was recently found in high levels in the breast milk of young women in Texas is a clear indication that our environment is no longer safe (Cone, 2005) and the long term consequences of contaminated breast milk are yet to be seen. In the past decade, there have been numerous studies reporting high levels of chemical toxins (PCBs and dioxins) found in the breast milk, umbilical cord and maternal plasma in women of childbearing age and scientists know that these toxins are being passed onto the embryo in the pre-natal, 20-24 day gestation periods (London & Etzel, 2000). PCBs and dioxin traces were found in blood plasma collected from 394 Netherlands children tested at 42 months of age suggesting that exposure to toxins by the mother prior to pregnancy may have resulted in these toxins being passed onto the embryo during gestation where they may remain in the child for up to 3.5 years of age (Lanting et al., 1998).

In Eastern Slovakia, a PCB chemical manufacturing plant operating from 1959 through the mid-1980's, improperly discharged massive amounts of contaminated waste into surrounding areas, the highest recorded exposure to date, of elevated levels of PCBs, TCDD and a dioxin-like toxic equivalence (TEQ) in one given area (Hertz-Picciotto et al., 2003). The on-going Slovakia cohort study is regarded as one of the most important and is currently in place at The UC Davis M.I.N.D. (Medical Investigation of Neurodevelopmental Disorders) Institute.

The Yucheng Incident. In 1979, a mass poisoning of more than 2000 people occurred in Yucheng, Taiwan due to consumption of rice-bran oil that was contaminated with PCB's and heat generated byproducts. This geographic toxic poisoning is referred to as the Yucheng accident. In 1992, Dr Guo from the National Cheng Kung University Center in the Republic of China, analyzed the blood serum samples of 56 women, fourteen years after toxic exposure, and their offspring were correlated to a control group of women who had no known previous exposure to PCBs or related chemicals and had never consumed rice oil. In 1985 a group of children born to mothers exposed to the contaminated rice oil were recruited and assessed yearly until 1992 for cognitive and physical development along with a control group matched by sex, age, maternal age, residential area, parents' education and socioeconomic status (Guo, et al., 1997).

Guo and his colleagues measured the effects of breast feeding from the 56 women exposed to toxic chemicals on their young. The 56 children of the toxic exposed women were assessed for cognitive and physical development in yearly intervals along with a control group of matched children by sex, age, maternal age, residential areas, parents' education and socioeconomic status.

The Taiwan study indicated that more than 13 years after the Yucheng incident, Yucheng mothers exposed to toxins continued to have detectable levels of PCB's that were considerably higher than that of the unexposed controls and that these toxins were passed onto their young in levels of association corresponding to the duration of breast feeding.

Developmental and neurological abnormalities were documented in Yucheng breast fed children born after their mothers' consumption of contaminated rice-oil, with the exposed children scoring lower on tests of cognitive function than the children of non-

exposed mothers, suggesting that the abnormalities may have been a direct result of contamination.

The Yaqui Indian Mexican Study. Another important study conducted in 1998 by Dr Elizabeth Guillette in rural Mexico measured two groups of pre-school, 4-5 year old children in rural agrarian Mexico. The Yaqui Indian Mexican study (Guillette et al., 1998), assessed and measured the physical and neurological development of the two groups of children, one group exposed to mass amounts of pesticides, living in a valley region and the other non-exposed group residing in the foothills with little exposure to pesticides. The concentration levels of pesticide toxins were collected from the cord blood and breast milk in the mothers' at the time of birth.

The Yaqui Mexican study found the two groups of children to be similar in physical growth patterns, but a comparison of cognitive functional abilities indicated differences among the study groups. The foothill group had more stamina and outperformed the valley group in gross motor skill activities, had more stamina, gross and fine eye-hand coordination, and 30 minute memory patterns. The most striking difference between the exposed and unexposed children was in their ability to draw a person. The valley children averaged 1.6 body parts to a drawing, whereas the foothill children drew 4.4 body parts indicating mental and neurological functioning impairment. The children exposed to high levels of concentrated pesticides or industrial contaminants may have experienced hormonal disruption that modified their physiological development and functioning (See Appendix C).

The Netherlands Study. A study conducted in the Netherlands in 1998 measured two infant control groups for neurological quantitative appraisal of brain function after 42 months of age. All the mothers' were predetermined to have been exposed to PCBs and

dioxin as was indicated by their blood serum. The infants were divided into two groups, a breast fed control group and a formula fed group. The Netherlands study (Lanting et al., 1998) concluded that there was no relationship to the neurological condition of the children at 42 months of age and exposure to prenatal or post natal PCBs and dioxin. However the infants at two weeks of age, with the combination of high prenatal and high lactational exposure, were found to exhibit adverse effects in the neurological area of the brain, displaying hypotonia, or decreased muscle tone.

The Palmer Mercury Study. The EPA reports that 48 tons of toxic mercury by-product from burning coal is emitted annually from 1,300 power plants in 45 states in the United States. Toxic mercury emitted into the air, soil, and food chain from coal-fired power plants could prove to be a key factor in developmental disabilities manifesting in the present autism incidence increase (Bradstreet, Geier, Kartzinal, Adams, & Geier, 2003; Palmer et al., 2005).

In 2005, Dr Raymond Palmer conducted the most recent study to date measuring the toxicity of methyl mercury emission levels released from coal burning power plants and ASD. Palmer measured the recorded prevalence of autism and ASD derived from data provided by county, local and school records in 1,184 school districts in Texas with a total of 4 million children between K-12 grades, to the mercury emission levels released from power plants per pound. Texas rates 4th among the states with the highest reported mercury release from coal-fired power plants next to California, Oregon, and West Virginia.

Palmer found that for each 1,000 pounds of environmentally released mercury, there was a 43% increase in the rate of special education services and a 61% increase in the

rate of autism; supporting the theory that a correlation could exist between environmental released mercury and increased autism rates.

Mercury in Vaccines. *The Rolling Stone* magazine published a controversial article written by Robert F. Kennedy Jr. in June of 2005 indicating that the federal government and the Center for Disease Control and Prevention knew about the link between vaccines laced with ethyl-mercury or thimerosal, a preservative used in order to administer multiple dosages from vaccine vials as opposed to single injections, and autism or ASD (Kennedy, 2005).

Kennedy indicates that a cover up by the federal government began in June of 2000 when fifty-two attendees consisting of high level officials from the Center for Disease Control (CDC), the Food and Drug Administration (FDA), and a top vaccine specialist from the World Health organization (WHO) in Geneva along with representatives from the major vaccine manufacturers, including GlaxoSmithKline, Merck, Wyeth and Aventis Pasteur convened by private invitation only for a isolated meeting in Norcross, Georgia.

Kennedy reported that “According to a young CDC epidemiologists named Tom Verstraeten, who had analyzed the agency’s massive database containing the medical records of 100,000 children, a mercury based preservative in the vaccines, thimerosal, appeared to be responsible for a dramatic increase in autism and a host of other neurological disorders among the children. Verstraetan told those assembled that he was stunned by what he had found, citing the staggering number of earlier studies that indicate a link between thimerosal and speech delays, attention-deficit disorder, hyperactivity and autism. Since 1991, when the CDC and the FDA had recommended that three additional vaccines laced with the preservative be given to extremely young infants, in one case, within hours of birth, the estimated number of cases of autism had

increased fifteen-fold, from one in every 2,500 children to one in 166 children”
(Kennedy, 2005, p. 2).

During the June 2000 conference, no immediate precautions were taken to alert the public or to ban thimerosal use in vaccines; instead the officials spent the time discussing how to cover up the damaging data indicating that thimerosal could be an etiological factor in ASD. Thimerosal is a known neurotoxin, used to eliminate fungi and bacterial growth in vaccines. Animal’s brains who are administered the preservative sicken, and when applied to living tissue, the cells die. The cover up was a direct result of drug companies cost effective greed; thimerosal allows the pharmaceutical companies to package vaccines in vials that contain multiple doses and the preservative thimerosal wards off contamination by multiple needle entries. The larger vials laced with thimerosal cost half as much to produce as single dose vials, making it easier for international drug companies to distribute to impoverished areas of the globe with less cost to ward off the risk of epidemics. Thimerosal has currently been banned in Iowa and California with consideration by thirty-two other states to outlaw its use in hepatitis B, haemophilus influenzae B, diphtheria-tetanus-pertussis (DTP), and the measles-mumps-rubella (MMR) vaccines.

Prior to 1989, American preschoolers received eleven vaccinations, within ten years, the number of vaccinations that American children received grew to a staggering total of twenty-two immunizations by the time they were in first grade and remains as the provisional requirements as set forth by the Center for Disease Control (CDC) in the United States. The statistical increase of individuals served in the state of California Department of Developmental Services grew by 273% between the years of 1987 to 1998,

with 4,911 cases reported in 1993 to 18,460 cases reported in 2002, according to a three-year study by Dr. Robert S. Byrd of UC Davis M.I.N.D. Institute report commissioned by the California Legislature (Byrd, 2002). This report along with Rep. Dan Burton's report to the House of Representatives, indicative of more than 1.5 million individuals in the United States afflicted with autism, with the possibility of the number reaching 4 million in the next decade directly parallels with the increase of thimerosal laced childhood immunizations (Burton, 2004). Of more frightening concern is the fact that although drug manufactures have begun to phase thimerosal out of injections administered to American infants, the United States drug manufacturers continue to export and sell off mercury based vaccine supplies to developing third world countries such as China (where more than 1.8 million cases of autism have been reported in a country where the disease was virtually unknown), India, Argentina, Nicaragua and Africa (Kennedy, 2005).

Kennedy believes that if the CDC and other world health organizations were to admit to the fact that mercury laced vaccines were responsible for the neurological poisoning of millions of individuals then their actions would be responsible for one of the biggest scandals in American medicine.

United States recommended childhood and adolescent immunization schedules can be viewed and downloaded from the Center for Disease Control's (CDC) National Immunization Program website at <http://www.cdc.gov/nip/publications/acip-list.htm>. or by going directly to <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5316-Immuniza...>

Instructions on the use of Vaccine Information Statements are available at <http://www.cdc.gov/nip/publications/vis/vis-instructions.pdf>. In addition, guidance on how to obtain and complete a Vaccine Adverse Event Reporting System (VAERS) form is available at <http://www.vaers.org> or by telephone, at 800-822-7967.

Conclusion

Although the etiology or cause of autism is still unknown, many experts agree that ASD most likely involves the interaction of multiple genes that together predispose a child to the condition, and that these genetic components combined with an outside environmental factor, toxins, may trigger the disorder.

The Industrial Revolution, which began in England in the mid- 1800's as a result of a "power crisis," is responsible for jumpstarting modern civilization as we know it today. And albeit, although it made man's life on this planet far more comfortable, The Industrial Revolution is directly responsible for the environmental concerns which now plague our civilization in the form of global warming as well as other various human atrocities. With the growth, expansion and comfort came catastrophe.

Environmentalists, scientists and informed individuals across the globe are now advocating for immediate alternative forms of energy. The European Union (EU) has made substantial progress in environmental energy reform by enforcing stronger rules and regulations on toxin emissions, and has seen avocation of windmills as a source of alternative energy replacing coal burning power plants in many areas.

Due to the fact that civilization has made enormous progress in the last 200 years, the price to pay has resulted in the form of the safety for humanity. Scientific study has, in the past, and remains, the touchstone for human progress whereby all standards of human development are measured, evaluated and concluded as to the benefit of our sociological evolution. We are now being faced with the dilemma of how to progress forward after the Age of the Industrial Revolution without causing destruction to humankind itself.

It is no longer a question as to whether or not environmental toxins may be the cause of neurological damage but more importantly what are we going to do to prevent the pandemic of neurological disorders that is currently plaguing children across the globe. And although the EPA would like to weaken rules and regulations on toxic reporting, and claims that it lacks the authority to step in and regulate greenhouse gases responsible for global warming (Los Angeles Times Editorials, 2006) they have made one step in the right direction by recently banning the PCB chemical compound, PFOA, used in the manufacturing of Teflon, waterproof clothing, phone cables, building materials and many more products in our environment that was found to be present in 96% of Americans and has been detected around the globe, finding its way into polar bears in Greenland, Alaska and Canada, and ultimately. In animal tests, PFOA has been found to cause birth defects, cancer, and immune suppression. It is known to accumulate in the female and is passed on to the fetus during pregnancy.

Section II: Advocacy Autism Organizations

In April of 2005, the Combating Autism Act of 2005 (S. 843) was sponsored by Congress and is supported by all major autism organizations and currently awaits a majority vote by both the senate and the house to become a bill. The Combating Autism Act of 2005 will, if passed, authorize \$860 million in federal funds over five years to research, screening, intervention and education in the field of autism.

The Combating Autism Act of 2005 builds on the provisions of the Children's Health Act of 2000 and will, if passed, authorize \$860 million in federal funds over the

next five years to combat autism through research, screening, intervention and education. It also reauthorizes the National Institutes of Health Centers of Excellence Program in autism originally created in 2000, doubling the number of authorized centers.

The Combating Autism Act of 2005 must be co-sponsored by a majority of members in the Senate and House. This is the first and most important step toward making this bill a law, which would enable the federal government to pick where the Children's Health Act of 2000 will leave off when it expires later this year.

The Combating Autism Act of 2005 is supported by all major autism organizations, including Cure Autism Now, Autism Speaks, The Center for Outreach and Services for the Autism Community (COSAC), First Signs, the Dan Marino Foundation, the National Alliance for Autism Research (NAAR), the Organization for Autism Research (OAR), Southwest Autism Research and Resource Center, Talk Autism, and Unlocking Autism.

Non-profit Autism Organizations

Athletes Against Autism
www.athletesagainstautism.org

Autism Speaks
www.autisminfo.com

Autism Society of America
www.autism-society.org

Autism Society of America Los Angeles Chapter
www.asalosangeles.org

Cure Autism Now CAN
www.cureautismnow.org

DAN- Defeat Autism Now
www.DANconference.com

Dan Marino Foundation
www.danmarinofoundation.org

First Signs
www.firstsigns.org

Southwest Autism Research and Resource Center (SARRC)
www.autismcenter.org

Talk Autism
www.talkautism.com

Talk About Curing Autism Now (TACA)
<http://www.tacanow.org>

TASH
www.tash.org

The Autism Education Network
www.autismeducation.net

The Center for Outreach and Services
for the Autism Community (COSAC)
www.njcosac.org/

Unlocking Autism.org
www.unlockingautism.org

US Autism and Asperger Association
<http://www.usautism.org>

Research Funded Organizations

Autism Genetic Resource Exchange (AGRE)
www.agre.org/

Autism Tissue Program
<http://www.brainbank.org>

Center for Disease Control (CDC)
www.cdc.gov

Child Health & Human Development (NICHD)
www.nichd.nih.gov

Collaborative Programs of Excellence in Autism (CPEA)
www.nichd.nih.gov/autism/cpea.cfm

Human Biological Data Interchange (HBDI)
www.hbdi.org/

Interagency Autism Coordinating Committee (IACC)
www.nimh.nih.gov/autismiacc/index.cfm

National Autistic Society
www.nas.org.uk/

National Alliance for Autism Research (NAAR)
www.naar.org

National Institute of Mental Health (NIMH)
www.nimh.nih.gov/

National Institute of Neurological Disorders and Stroke (NINDS)
www.ninds.nih.gov/

UC Davis M.I.N.D Institute
www.ucdmc.ucdavis.edu/mindinstitute/

National Institute of Environment Health Sciences (NIEHS)
www.niehs.nih.gov/

National Institute of Mental Health (NIMH)
<http://www.nimh.nih.gov>

National Research Council (NRC)
www.nationalacademics.org/nrc/

Office of Special Education Program (OSEP)
www.ed.gov/osers/osep

Studies to Advance Autism Research and Treatment (STAART)
www.nimh.nih.gov/autismiacc/staart.cfm

Political Organizations

AUTISMBILL.org
www.autismbill.org/

EPA Pesticides Program Updates
<http://www.epa.gov/pesticides>

Senator Boxer (D) California
<http://www.boxer.senate.gov>

Conferences

International Meeting for Autism Research (IMFAR)
<http://www.cevs.ucdavis.edu/Cofred/Public/Aca/confHome.cfm?>

US Autism & Aspergers Association International Conference
www.usautism.org

DAN (Defeat Autism Now)
www.DANconference.com

Journey to Solutions
www.jaynolan.org/solutions2006

CHAPTER IV

Discussion and Evaluation

As the autism epidemic continues, over the past decade, the factors that may play a role in ASD are of worldwide debate; albeit scientific research continues to point to known neurological toxic environmental factors such as PCB's and mercury, in conjunction with predisposed genetic structure as the probable key factor in the etiological cause of autism and ASD. A gene mutation is defined as a permanent structural alteration in DNA and in most cases; such DNA changes either have no effect or cause harm and in some cases a mutation can improve an organism's chance of surviving by passing the beneficial change on to its descendants. But what is to be said of the mutation of permanent structural alteration of DNA that may cause harm? And when these mutations manifest in the human species, is it not likely that ASD may also indeed be the result? In the past, scientific investigation of the human genetic structure has led to breakthroughs in the cause of complex genetic disorders such as Downs syndrome, Tay-Sachs, Cystic Fibrosis, Huntington's Disorder, Turner's Syndrome, epilepsy, diabetes, Sickle Cell Anemia, only to name a few.

For example, the association between existing gestational diabetes in mothers and the Hepatitis B vaccine (with or without thimerosal) administered to American infants in the first six months of life as a probable co-existing mechanisms for biomarkers directly assaulting the auto-immune system that could be a factor in neurological disabilities resulting in ASD should be further investigated in the future. The association of gestational diabetes of mothers and premature delivery is well documented; numerous reports have found a high incidence of diabetes in young infants with autism whose mothers have documented in their initial physical pregnancy reports to have had

gestational diabetes. Furthermore, it is a widely known fact that pre-mature infants are pre-disposed to neurological disabilities resulting in ASD. There may well be an association between gestational diabetes in mothers and ASD, with the environmental pre-disposition probable factor unknown as of yet. Research indicates that the more severe cases on the ASD spectrum indicate Hepatitis B vaccine as being administered during the first 24 hours of birth followed by the second and third dose administered all within the first six months of the life of the infant. Hepatitis B is given to preemies, as a precautionary, which is the Center for Disease Control's (CDC) way of warding off hepatitis pandemics in pre-schoolers in the US. The Hepatitis B vaccine is given to HMO and Medicaid infants as a national immunization precautionary requirement at birth without the consent of the parent.

If the Hepatitis B vaccine is being administered to preemies (with or without thimerosal or ethyl mercury) of mothers with gestational diabetes, and that because these infants already exhibit pre-existing compromised systems of the liver (a precursor to diabetes), might we well be setting up a second neurological biomarker disaster, by administering Hepatitis B inoculations in already compromised auto immune systems in these newborns? Hepatitis B and gestational diabetes both equate to liver malfunction which could manifest as a probable brain biochemical metabolic imbalance (James et al., 2004) resulting in a cause-effect ASD factor in enlarged white matter in the brain (Herbert, 2004).

If scientific progress is to be made in the cause and ultimately the isolation of the mechanisms resulting in a cure for the factors that contribute to ASD and autism, not only in the research of the results, it is our responsibility to determine the factors (albeit

political) and then set about a plan to alter the medical vaccination program and environmental toxin factors in this country that may be contributing factors.

Future studies are warranted in order to determine the possible gene-environmental association to individuals with ASD. Existing flaws that exist in the literature reviewed lie predominately with the diagnosis fluctuation of autism and ASD within the various sample groups. A wide degree of variation exists as to the exact definition used to define and test individuals who fall within the ASD category. The definition tools rely largely on the professional individual administering the tests, suggesting that a sampling bias could create data misrepresentation. Diagnosis of ASD relies on construct validity; various tests are used to assess individuals with autism as opposed to one universal assessment criterion-related validity, thus measurement of content validity of the sample groups remains subjective. This could bias the reported increase in prevalence of incidence in autism rates, resulting in a skewed representation of actual prevalence of autism where it may or may not occur.

Metabolic and genetic biomarkers, could, in the future, eliminate these discrepancy variables as well as lead to the understanding of the cause of autism, and more importantly, a cure.

Thai Binh province in Vietnam presently reports the highest rate of incidence of the prevalence of the Avian Flu virus in Asia which is carried by birds. It could it be a possibility that the effects of dioxin in Agent Orange used during the Vietnam War, the toxic pollution explosion disasters in China and surrounding areas, has weakened the immune system of now two generations of humans so that they are no longer able to ward off viruses that only birds were vulnerable to in the past.

Our most threatening current political dilemma concerns our current United States Bush Administration's stand on emissions regulations of 1,300 coal-fired power industry plants in 45 states throughout the United States emitting 48 tons of mercury neurotoxin annually. The "hot spots," are the 100 mile radius areas of high mercury concentration, known to be linked to neurological and developmental disorders, in lakes, rivers and oceans within the vicinity of the big power plants.

"In 2000, shortly before leaving office, the Clinton administration had concluded that mercury should be regulated as toxic under the Clean Air Act. This would have mandated curtailing emissions at every plant by the maximum amount possible, which proponents said could bring a 90% reduction in three years using existing technology" (Miller & Hamburger, 2005).

The Bush Administration present Clear Skies Act proposal continues to be of debate, with the EPA estimating that "enforcement of existing toxic air pollution" protections in the existing Clean Air Act would limit mercury pollution to 5 tons per year by 2008. The Bush Administration's Clear Skies Act plan weakens the limit to 26 tons per year by 2010, allowing 520 percent more mercury pollution. The Bush Administration's failure to address and tighten the EPA controls on mercury emissions could quite possibly be one of the factors in the autism epidemic that we are now experiencing.

As a result, the EPA has issued alert warnings, to limit consumption of fish from our lakes and rivers with the fear of causing severe harm to our unborn children. Young women the world over live in panic of having a neurologically disabled child because our current administration is more concerned with economics and big business and promoting its political agenda than it is with the poisoning of children and pregnant women in this country and the world. We can no longer find comfort in the hope that our "global regime"

will protect us from mercury, PCBs, dioxin and the other 180,000 man-made chemical toxins in our air, soil, water and food chain. Autism, ASD, neurological developmental disorders plaguing our world is all our responsibility and warrants a pro-active “human consciousness of environmental health” approach. If progress is to be made in the isolation and understanding of autism then we must direct our focus to the global patterns of industrial production and consumption. Our future generations depend on all our understanding of the connection between our present day human pandemics and what is happening to the fish in the sea, the birds in the air and the animals on earth.

In 2002 over 60 million dollars were allocated to The Collaborative Programs of Excellence in Autism (CPEA). CPEA is a network of study groups of 8 sites in collaboration with Studies to Advance Autism Research and Treatment (STAART) for the ongoing study for the genetic research of autism. Childhood Autism risks from Genetics and the Environment (CHARGE) at the M.I.N.D. Institute at UC Davis, the Center for Disease Control, currently conducting an 18 state autism survey, and a newly organized professional society, the International Meeting for Autism Research (IMFAR) are all committed to the advancement of the study of autism research. At the 4th International meeting for Autism Research (IMFAR) conference held in May of 2005, funded through the collaboration between UC Davis M.I.N.D. Institute, Cure Autism Now and the National Alliance for Autism Research, the M.I.N.D. Institute reported two new studies that appear to take scientists closer than they have ever been to developing a blood test for the detection of autism at birth (UC Davis M.I.N.D, 2005).

“To cling to a genetic explanation for autism, to insist that the epidemic is a consequence of methodological rather than toxicological effects, is the desperate attempt to maintain the illusion that one lives in a comfortable and rational world

where all is basically well, new chemicals and technologies always mean progress, experts are always objective and thorough, and authorities can be trusted. This form of genetic reductionism is a road block to developing the forceful science and social policy called for by the epidemic, it sustains taboos within the scientific community against potentially controversial ideas about environmental factors, and it distracts governments from addressing the financial and social demands that this epidemic creates. In short, it weakens our response to a disaster that has already begun (Silverman & Herbert, 2003, p. 6).”

Ultimately, genetic/environmental studies in association with increased MRI and post-mortem neurological research could possibly lead to the isolation of the gene(s) for autism possibly resulting in a treatment to overcome impairments and subsequently resulting in not only preventative measures but also a cure, in the form of a vaccine or an immunization that could be administered in-vitro to the developing fetus or during early prognosis.

Future research should include smaller sample studies conducted from the exposed subgroup to detect if age of parents may play a factor in genetic pre-disposition of autism; as was found in Down syndrome, and to determine if within this subgroup, the length of years of exposure has any correlation to the genetic pre-disposition. Subsequently, measuring the years of exposure to toxins with the degree of disability of autism to determine if the variable of length of exposure has an association on biomarkers or if the exposure itself is the trigger for autism, negating the length of exposure and supporting that exposure itself is the factor (James et al., 2004). The results from this study, degree of exposure to degree of disability could then be extended to across country longitudinal

cohort correlation study to determine if the areas of greatest exposure to toxins in our environment are indeed the areas with the highest reported prevalence of autism.

An additional longitudinal study would require larger test sample size in order to test causality. Toxic exposure cohort studies should be investigated to possibly determine exact chemical toxins that are causing neurological impairment. By isolating specific toxins and ruling out others that may play a role in autism, future flaws in this research would be minimized.

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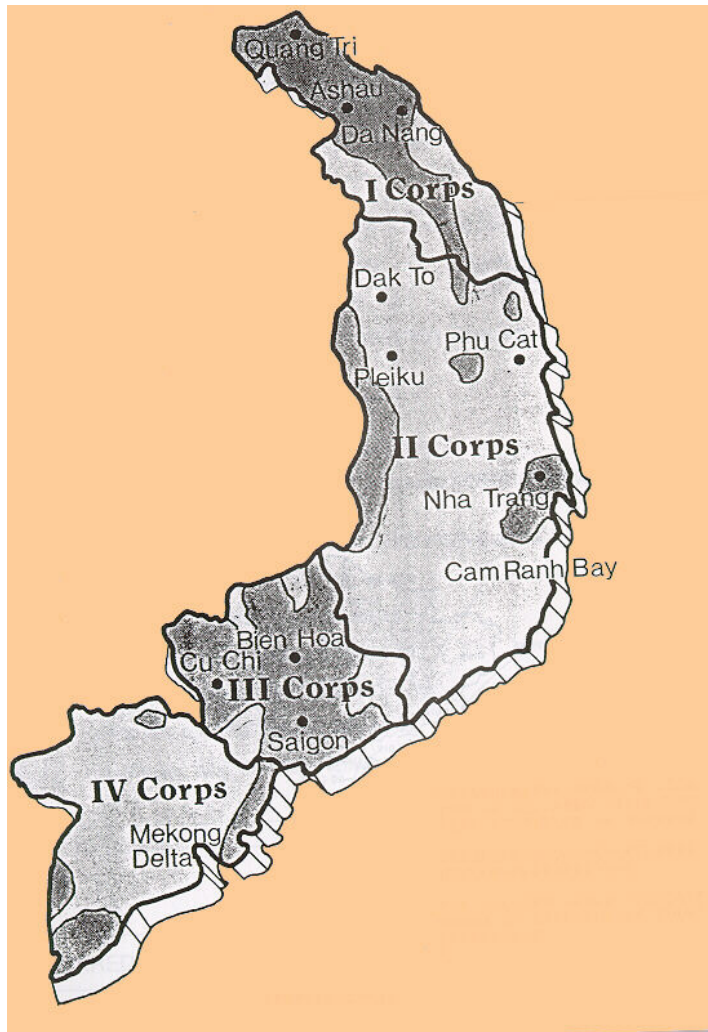
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Appendix A

This map is a representation of herbicide spray missions in Vietnam. The dark areas represent concentrated spraying areas. This map only represents fixed-wing aircraft spraying, and does not include helicopter spraying of perimeters, or other spray methods. The III Corps area received the heaviest concentrations of spraying, followed by I Corps, II Corps and IV Corps.



<http://www.lewispublishing.com/map1.htm>

Appendix B

The Fifteen Herbicides Used in Vietnam

- PURPLE:** A formulation of 2A-D and 2,4,5,-T used between 1962 and 1964
- GREEN:** Contained 2,4~5-T and *was* used 1962-1964.
- PINK:** Contained 2,4,5-T and was used 1962-1964.
- ORANGE:** A formulation of 2A,-D and 24 5-T used between 1965 and 1970.
- WHITE:** A formulation of Picloram and 2,4,-D.
- BLUE:** Contained cacodylic acid.
- ORANGE II:** A formualtion of 2,4,-D and 2,4,5-T used in 1968 and 1969 (also sometimes referred to as “Super Orange”)
- DINOXOL:** A formulation of 2,4,-D and 2 4_S-T. Small quantities were tested in Vietnam between 1962 and 1964.
- TRINOXOL:** Contained 2.4,5-T. Small quantities tested in Vietnam 1962-1964.
- Bromacil:
Diquat:
Tandex:
Monuron:
Diuron:
Dalapon:
Small quantities of all of the above were tested in Vietnam, 1962-1964

<http://www.lewispublishing.com/herbs1.htm>

Appendix C

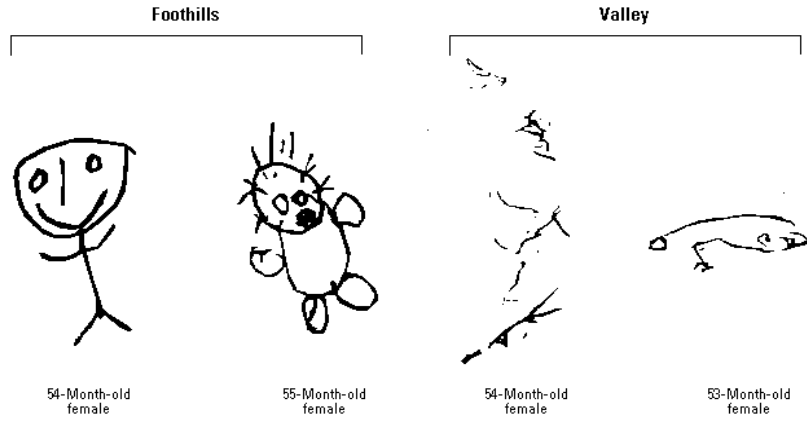


Figure 1. Representative drawings of a person by 4-year-old Yaqui children from the valley and foothills of Sonora, Mexico.

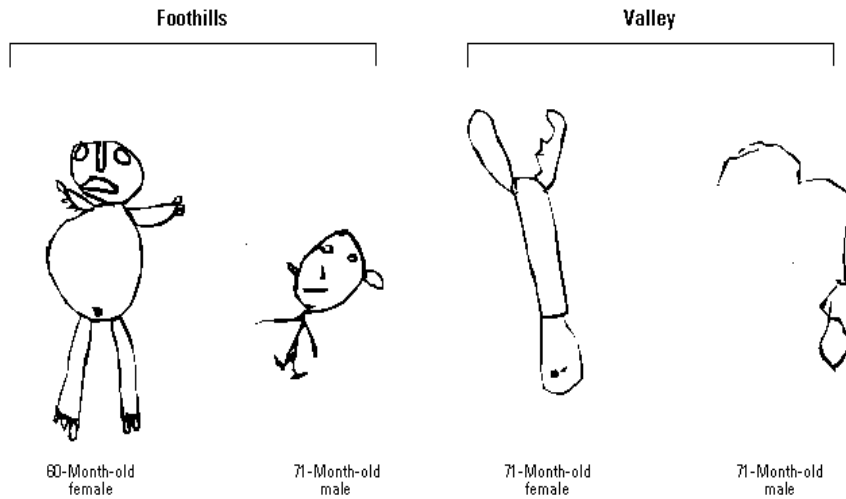


Figure 2. Representative drawings of a person by 5-year-old Yaqui children from the valley and foothills of Sonora, Mexico.

<http://www.ehponline.org/members/1998/106p347-353guillette/guillette-full.html>