Autism and the Environment

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Autism Society

ARCHIVES OF
GENERAL PSYCHIATRY

Genetic Heritability and Shared Environmental Factors Among Twin Pairs With Autism

Published online July 4, 2011

Susceptibility to ASD has moderate genetic heritability and a substantial shared twin environmental component.

Mathematical modeling suggested that the autism cases had a genetic heritability of 37% and a shared environmental component of 57%.

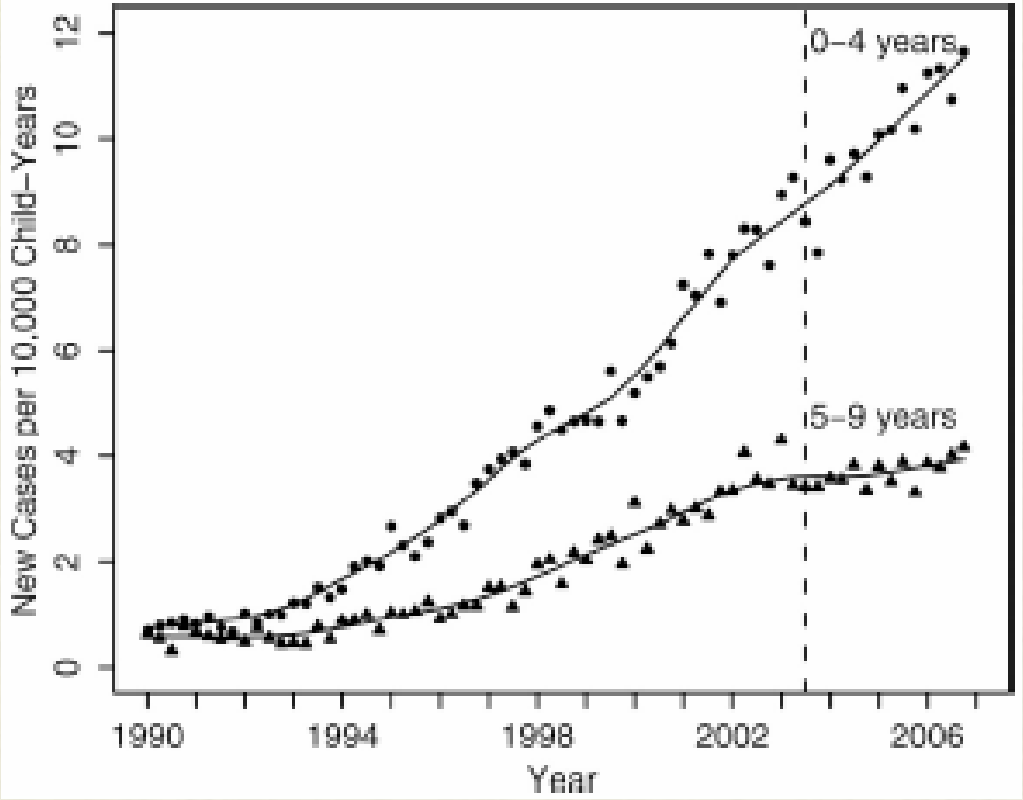
Study suggests that the influence of genetic factors to develop autism may have been previously overestimated.

Rising Rates of Autism in California

- Study led by Irva Hertz-Picciotto at the University of California Davis.
- Increased rates cannot be explained by migration to state or how and when doctors diagnosis the autism.
- Genetics don't change dramatically in such a short period of time.
- The culprits, according to Hertz-Picciotto, could be "in the microbial world and the chemical world."

Epidemiology:
January 2009 - Volume 20 - Issue 1 - pp 84-90

Rising Rates of Autism in California



In 2006, more than 3, 000 new cases of autism were reported in California.

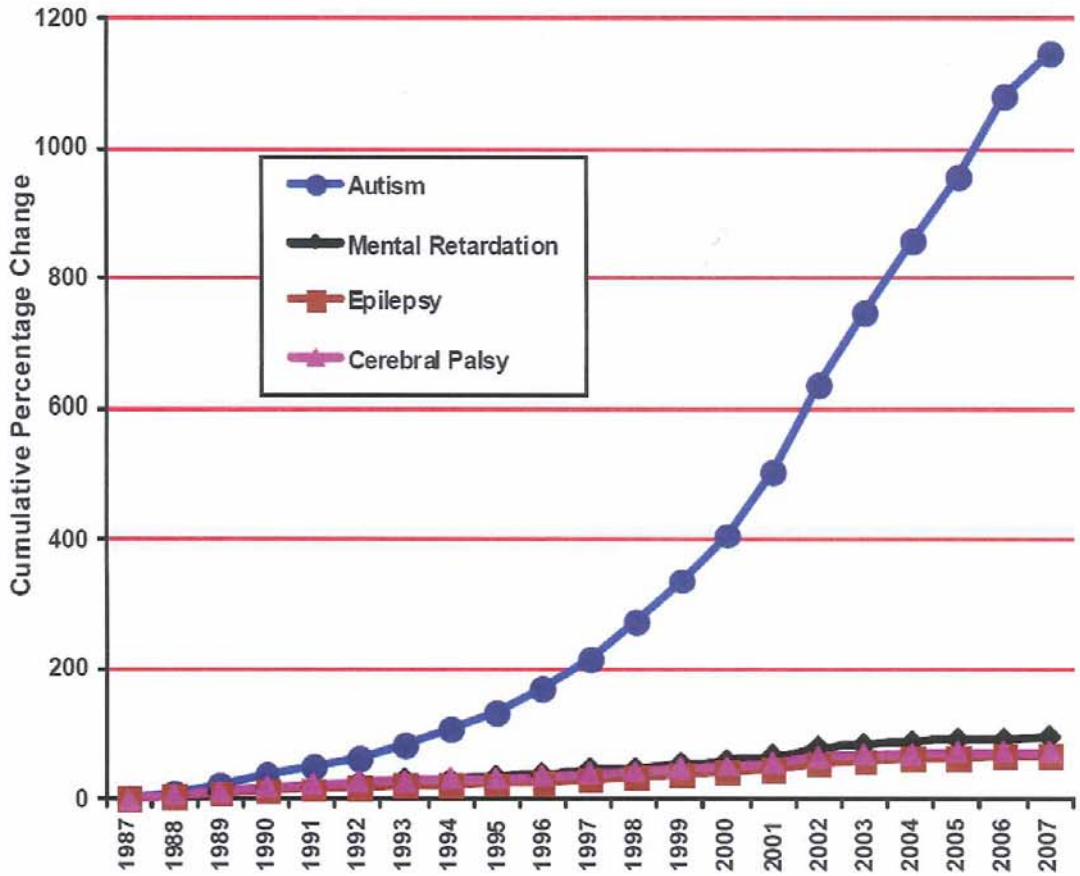
In 1990, only 205 cases were reported.

Epidemiology:
January 2009 - Volume 20 - Issue 1 - pp 84-90

Cumulative Percentage Change of Autism, Cerebral Palsy, Epilepsy, and Mental Retardation over Two Decades

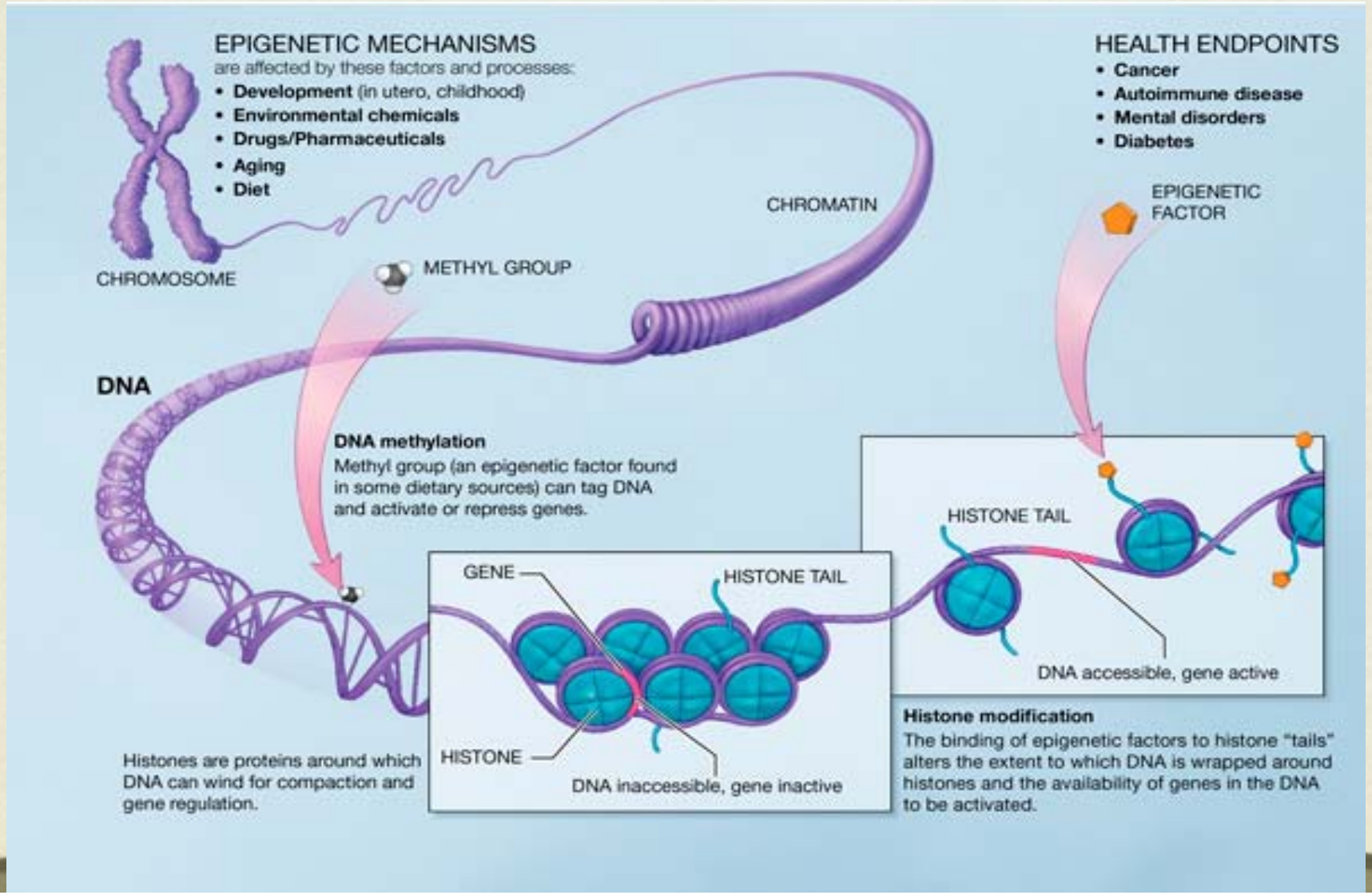
AUTISM UP 1200%

2009 California report: http://www.dds.ca.gov/Autism/docs/AutismReport_2007.pdf



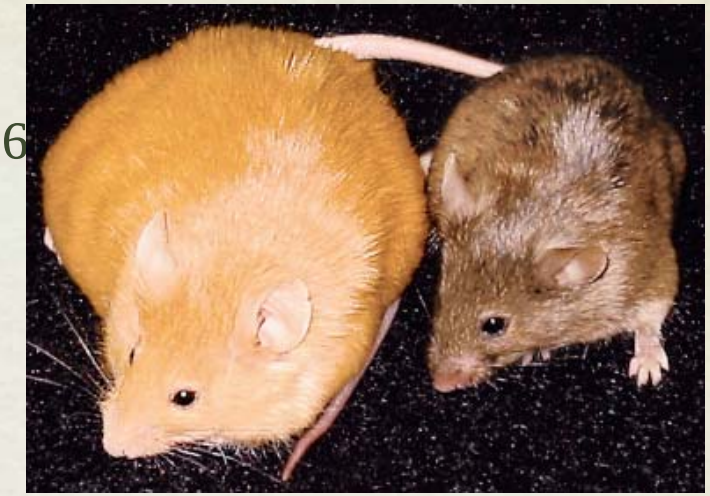
Environmental Factors Affect our Genes and Lead to Health Issues

U.S. National Institute of Health



DNA is NOT DESTINY

Jirtle and Waterland Duke University 2006



- Mice carrying the agouti gene are ravenous and yellow and prone to cancer and diabetes.

- Jirtle and Waterland's mice were slender and brown. They did not display their parents' susceptibility to cancer and diabetes and lived to an old age. The effects of the agouti gene had been virtually erased.

- How did they do this without changing a single gene????

Dietary factors can affect the expression of our genetics

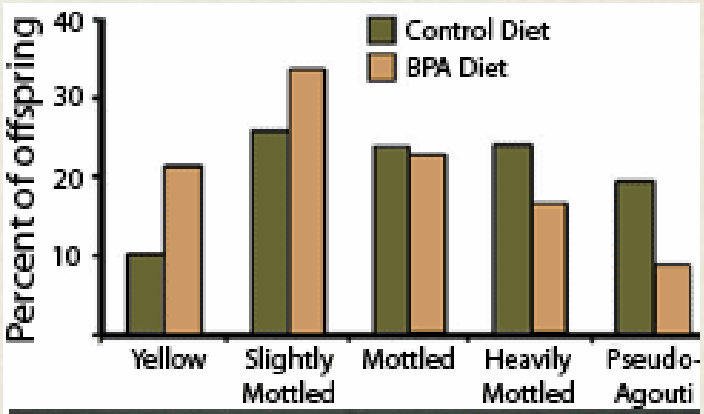
- They changed the moms' diet!!

- A diet rich in methyl donors, including onions, garlic, beets, and in B12 and folate.

- Although the mothers passed along the agouti gene to their children intact.
  Thanks to their methyl-rich pregnancy diet, the negative effects of the agouti gene were never expressed.

BPA and DNA Methylation

Exposure to BPA changed the percentage of different coat color types in the offspring (graph below). Yellow mice were more common while brown (psuedo-agouti) mice were less frequent than in litters born to mice not exposed to BPA.



BPA-exposure reduced the percentage of cells with methylation at the nine sites on the Agouti gene by 31%, from 39% methylated in controls to 27% methylated in BPA-exposed (p= 0.004). Using other statistical procedures, they were able to show that the effect of BPA on coat color was largely mediated by BPA's effect on methylation.

Dolinoy, DC, et al. Environmental Health Perspectives 114:567-572.

Evidence of Body Based Disorder

Evidence of inflammation and oxidative stress in autistic brain tissue from individuals ranging from childhood to middle age, as well as in peripheral blood and urine samples. These changes are signs not of inborn alterations of brain architecture in otherwise healthy tissue, but rather of chronic and ongoing disease processes like those found in Alzheimer's disease, Parkinson's disease or HIV.

Common patterns of non-nervous system somatic illness, particularly involving the gastrointestinal and immune systems.

Mitochondrial abnormalities milder than would be expected from clear genetic etiology. Environmental toxins are known to inhibit mitochondrial metabolism.

Evidence of an increased "excitation inhibition ratio" in the autistic brain. This could be a consequence of multiple genetic factors (e.g., GABA- or glutamate-related mutations) as well as multiple toxins (e.g., PCBs, heavy metals), which could interact to synergistically increase overall risk. It could also be related to metabolic changes that are not restricted to the brain but are systemic, including inflammation and oxidative stress.

Autism and the Environment

Dr. Martha Herbert's Core Argument

What we see in autism is a what we would expect to see in a condition heavily modulated by environment.

This modulation takes place not only prenatally but throughout the lifespan

We can improve our environment at many levels, personally and for our communities and world, and this can help health.

- From "Brain, Body and Environment in Autism: From a collection of fixed genetic deficits to an interactive web of functional challenges. May, 2011

State of the art; microbiology in health and disease. Intestinal bacterial flora in autism.

- **Finegold SM**. Anaerobe. 2011 Apr 16

  Autism of the regressive variety is selected as an example of the importance of intestinal bacterial microflora in disease other than classical infection. Our studies have indicated that intestinal bacteria play a role in this disease since it responds to oral vancomycin, a drug that is not absorbed from the GI tract. Pyrosequencing studies document an abnormal gut microflora in regressive autism subjects as compared to controls. Finally, we present preliminary evidence suggesting that Desulfovibrio may play a key role in this disease.

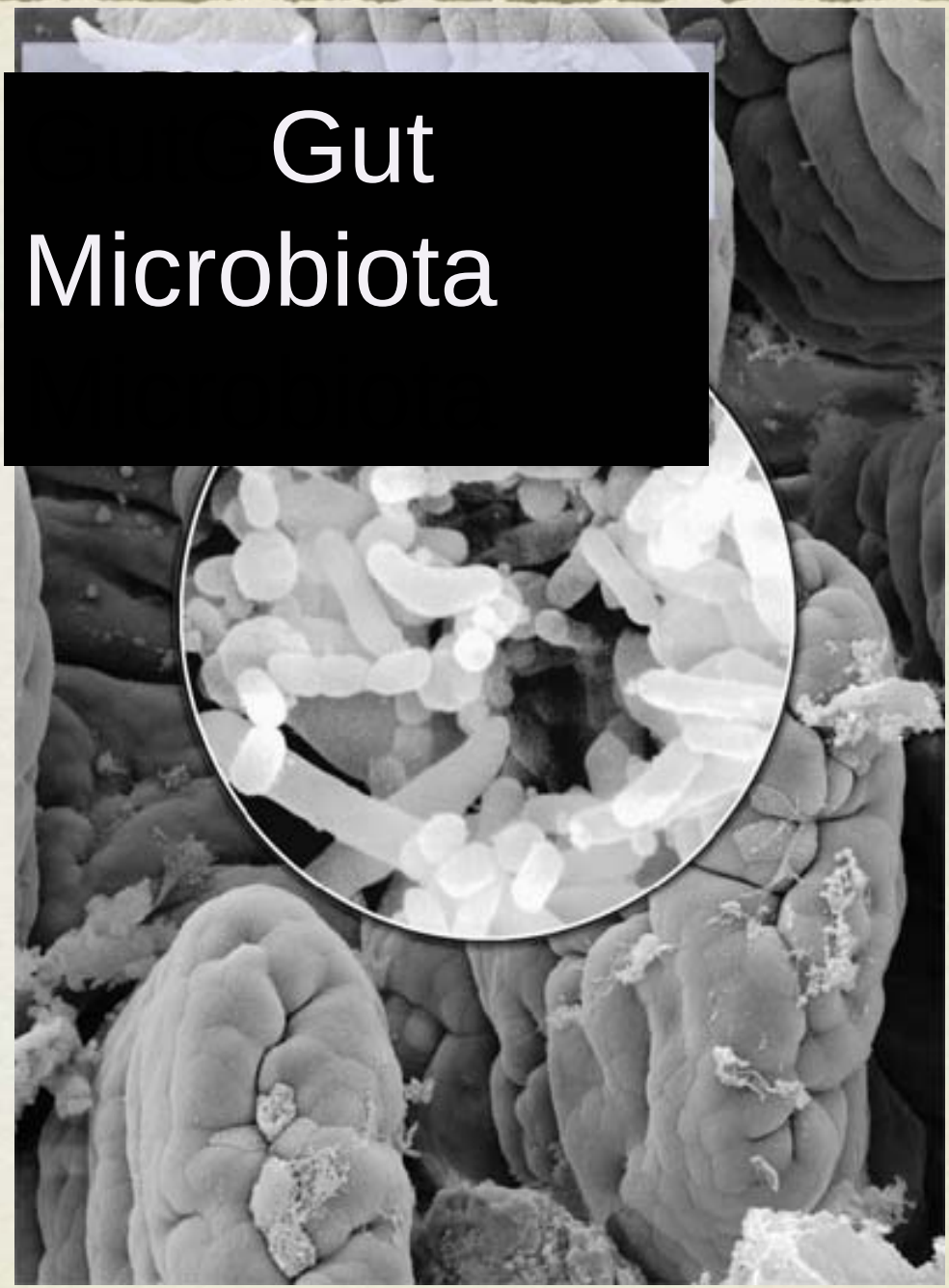
Gut Microbiota

100 trillion bacteria in the gut

Early disruption of gut flora affects later immune function causing potential allergies and autoimmunity

Good flora protects us from pathogens

Aids with digestion of carbohydrates and fiber to form SCFA which in turn fuels enterocytes



A Study in Balance: How Microbiomes Are Changing the Shape of Environmental Health

By Kellyn S. Betts. Environmental Health Perspectives.

Emerging evidence that certain microbes in the human gut can transform metals in ways that make the metals more bio-accessible to humans.

The ability of intestinal bacteria to demethylate methyl-mercury could result in exposure to toxic inorganic mercury.

“It is possible that [many people] may be internally exposed to inorganic mercury much more than we have ever calculated because of demethylation of mercury we take in through fish consumption.” Ellen Sillergeld, professor at Johns Hopkins University

Biodegrdation of chlorpyrifos by lactic acid bacteria during kimichi fermentation

- Cho KM, et al. J Agric Food Chem. 2009.

- The role of microorganisms in the degradation of the organophosphorous insecticide chlorpyrifos (CP) was examined during kimichi fermentation.

- CP was degraded rapidly until day 3 (83.3%) and degraded completely by day 9.

- Four CP-degrading lactic acid bacteria were isolated from the kimichi.

Possible Approaches to the Altered Microbiome in Autism

- Dietary changes
- Probiotics
- Prebiotics
- Herbal antimicrobials
- Digestive enzymes
- Herbal anti-inflammatories

Mitochondrial Dysfunction in Autism

JAMA. 2010;304(21):2389-2396

Impaired mitochondrial function and mitochondrial DNA abnormalities including over replication and deletions are more common in children with autism than in typically developing children.

50-80% of children with autism had one or more biomarkers for mitochondrial dysfunction. Main outcome measure included oxidative phosphorlyation capacity, mtDNA copy number and deletions, mitochondrial rate of hydrogen peroxide production, and plasma lactate and pyurvate

The cells of children with autism were exposed to higher levels of oxidative stress.

Half the children had mtDNA over replication, indicating an effort to overcome some form of damage or dysfunction.

Mitochondrial Dysfunction

- Possible Symptoms

  Easy fatigue

  Exercise intolerance

  Lack of energy

  Hypotonia

  Poor motility

  Poor coordination

  Seizures

- Physical Exam:

  Poor muscle development

  Muscle weakness

  Strabismus

  Thin, frail

  Laboratory Findings:

  High Ammonia

  Low Carnitine

  High Lactic Acid

  High Pyruvic Acid

  High AST, CK

  Abnormal Urine Organic Acids

Mitochondria and toxins

Concept of mitochondrial dysfunction secondary to environmental toxins has not been adequately explored in literature

- Heavy metals (mercury, lead, arsenic, cadmium, and aluminum)
- Propionic acid (used as a preservative in food; produced by certain clostridia species)
- Tobacco smoke
- Rotenone (chemical used in insecticides and pesticides
- Diesel exhaust
- Fat soluble chemicals with benzene rings such as hair and paint fumes.

Mitochondrial Cocktail

Coenzyme Q10

Riboflavin

Carnitine

Creatine monohydrate

Alpha Lipoic Acid

Vitamin E

Vitamin C

Precautionary Principle

- Caution in advance
- Caution in the setting of uncertainty
- “Better safe than sorry”

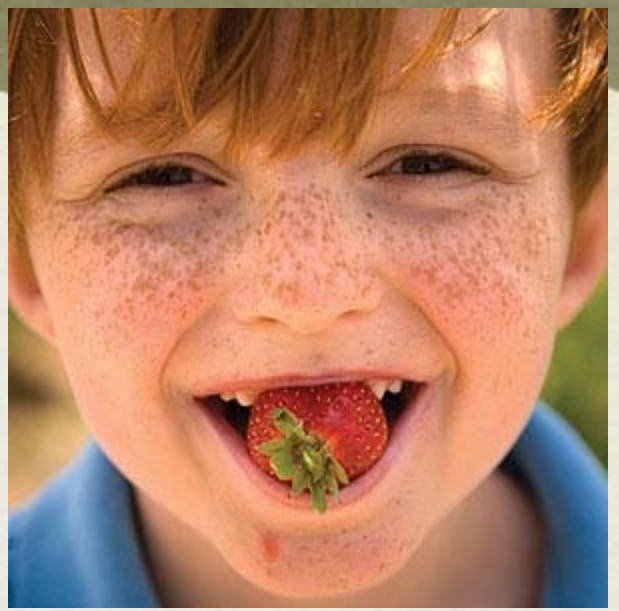
Wingspread Statement, 1998: “Therefore, it is necessary to implement the Precautionary Principle: When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established.”

Use of this approach is especially prudent for children suspected of being vulnerable to environmental toxins.

Our Challenge

How do we make wise choices to protect our children's health in the setting of an epidemic of ASD, insufficient scientific data regarding the impact of environmental toxins on health, and a deeply flawed regulatory system?

Pesticides and ADHD



Pediatrics, May 17, 2010.

Children with higher levels of organophosphate pesticides in the urine were more likely to develop ADHD

Data from 1139 children

First study to examine health effects of pesticides in a large scale study of the general population.

Organophosphates are well known to cause damage to the nerve connections in the brain. That is how they work.

Common Insecticide Use and Delayed Mental Development

After the EPA Phased out the use of chlorpyrifos and other organophosphorus insecticides in 2000-20001, pyrenthroid insecticide use became more widespread.

A recent prospective study at Columbia University investigated the potential effect of PBO compounds on development of young children.

Prenatal exposure to PBO was negatively associated with 36 month neurodevelopment.

M. K. Horton, A. Rundle, D. E. Camann, D. B. Barr, V. A. Rauh, R. M. Whyatt. **Impact of Prenatal Exposure to Piperonyl Butoxide and Permethrin on 36-Month Neurodevelopment**. *Pediatrics*, 2011

Common Insecticide Use and Delayed Mental Development

"This drop in IQ points is similar to that observed in response to lead exposure."

"While perhaps not impacting an individual's overall function, it is educationally meaningful and could shift the distribution of children in the society who would be in need of early intervention services."

-Megan Horton, lead researcher of study.

M. K. Horton, A. Rundle, D. E. Camann, D. B. Barr, V. A. Rauh, R. M. Whyatt. **Impact of Prenatal Exposure to Piperonyl Butoxide and Permethrin on 36-Month Neurodevelopment**. *Pediatrics*, 2011

Reduce Pesticide Exposure

- Buy organic fibers whenever possible.
  Cotton is heavily sprayed with pesticides.
- Don't use anti-lice treatments with lindane, malathion or other pesticides.

- Don't allow your children to play in areas that are sprayed with pesticides.
  Especially if they have been recently sprayed.
- Never spray or use pesticides in the house or on your lawn.

Alternatives:
Good sanitation - store foods in airtight containers, and keep your home clean.
Mechanical controls: fly paper and sticky traps
Low-toxicity chemicals: boric acid, diatomaceous earth, fatty acid soaps, and horticultural oils

For more information, go to Pesticide Action Network:
http://action.panna.org/

Shoppers Guide to Pesticides From the Environmental Working Group

Dirty Dozen
Buy Organic

Worst

1. Celery
2. Peaches
3. Strawberries
4. Apples
5. Blueberries
6. Nectarines
7. Bell Peppers
8. Spinach
9. Kale
10. Cherries
11. Potatoes
12. Grapes

Clean 15

Lowest in Pesticides

1. Onions
2. Avocado
3. Sweet Corn
4. Pineapple
5. Mangos
6. Sweet Peas
7. Asparagus
8. Kiwi
9. Cabbage
10. Eggplant
11. Cantaloupe
12. Watermelon
13. Grapefruit
14. Sweet Potato
15. Honeydew Melon

www.foodnews.org

Tap Water Can Be Unhealthy but Still Legal

The New York Times

December 17, 2009

Only 91 contaminants are regulated by the Safe Drinking Water Act

Well over 60,000 chemicals are used in the United States according to the EPA

Since 2004, more than 62 million Americans have been exposed to drinking water that did not meet government health guidelines

More than half of the systems analyzed had at least seven chemicals in their water

"People don't understand that just because water is technically legal, it can still present health risks." Dr. Pankaj Parekh, director of the water quality division of Los Angeles

Drinking Water

Drink filtered water instead of tap or bottled water.

If you choose to drink bottled water, spring water in a glass bottle is the best choice.

Use safe water containers. Either BPA free plastic or stainless steel bottles.

Do not discard your medications in the toilet or down the sink

Do not use fluorinated water for making infant formula

Water Filtration Systems

- Use the Environmental Water Guide's water filtration buying guide to determine what is in your water and the then best water filtration system for you.
- Always use a charcoal pre-filter before a whole house reverse osmosis filtration system. R.O. does not eliminate solvents.
- Reverse osmosis systems result in mineral depleted water.
- Aqua Sauna and Berkey make good quality and affordable water filtration systems.

Safe Water for Showering and Bathing

Showering and bathing results in exposure to chlorine and chemical vapors

Take shorter baths and showers

Use a shower filter with a two components:

Copper/Zinc media to reduce chlorine

Coconut shell carbon to reduce the amount of synthetic chemicals

Choosing Better Cleaning Agents

Read labels on cleaning agents as you would food labels

However, manufacturers are not required to list all ingredients in cleaning agents

You may have to call manufacturers of chemical and petroleum based products to get the full list of ingredients.

'Natural' cleaning products are more likely to have all of the ingredients listed on the labels.

Choose Better Cleaning Agents

Use only natural and perfume free cleaning agents.

Get rid of cleaners with the words Danger, Warning, or POISON on the labels.

AVOID: Ammonia, bleach, chlorine, formaldehyde, hydrochloric acid, lye, naphtha, nitrobenzene, petroleum, perchloroetylene, sodium laurel sulfates, propylene glycol, or trichlorethane.

Make your own cleaning agents with baking soda, vinegar, hydrogen peroxide, lemons, and essential oils.

The Effect of Endocrine Disrupting Chemicals on Brain Development

Many chemical toxins – including phthalates, polychlorinated biphenyls and polychlorinated dibenzodioxins, and biphenyl have the capacity to disrupt endocrine function in animals.

Hormone levels are critical in brain development and function, especially during the first two years of life.

Disruptions in hormonal function during this time period can impair normal brain development

Get Rid of Flame Retardants in the Home

Brominated flame retardants such as PBDEs and antimony are commonly used in synthetic textiles, children's pajamas, furniture, electronics.

Studies suggest that they can have adverse effects on development and the neurologic system.

Tips:

Purchase organic cotton, linen, wool or hemp products, which are not treated with toxic chemicals.

Prevent young children from placing materials with fire retardants in their mouths

Use the EWG list of PBDE free companies before buying electronic items.

Choose Healthier Bedding

- We typically spend 7-8 hours a day laying on bed
- Most mattresses are made with polyurethane foam and sprayed with chemical fire retardants.
- When purchasing a new mattress, choose one that has not been treated with chemicals and is made from cotton, wool, or latex foam. Some 'natural' latex foam contains fire retardants.
- Or, place an organic wool topper on top of your regular mattress.

Healthy Cookware

Glass and ceramic are the ideal cookware.

Stainless steel may be used occasionally. However, when acidic foods are cooked in stainless steel, nickel is leached out of the cookware

If iron is not an issue, a black cast iron skillet may be used

Do not use aluminum, Teflon, or Silverstone cookware.

Buying and Storing Foods

Buy food in glass containers rather than plastic or metal containers. Look for BPA free cans and bottles.

When storing foods, use glass containers, paper bags, and wax paper in place of plastics

As an extra precaution, you may remove foods that were purchased in plastic containers and store them in glass/ceramic ones.

EWG Tips for Picking Better Plastics

Avoid bispehol-A (BPA) and phthalates

Both are potent hormone disruptors

Stay away from toys marked “3” or PVC, which are often mixed with phthalates

Avoid containers marked “7” or PC as they often contain BPA

When you must use plastics, choose #1,2,4 or 5

Handle Plastics Wisely

Tips from the EWG

Don't microwave foods in plastics.

Don't place hot liquids in plastic containers.

Don't reuse single use plastics-they can break down.

Use wooden or glass cutting boards in place of plastic.

Use glass containers for storage in place of plastic.

Use a cotton shower curtain in place of vinyl.

In the tub, play with cotton toys in place of plastic bath toys and books.

Chose Better Toiletries and Beauty Products

Avoid

Fragrance

Isopropyl Alcohol

Mineral Oil

PEG (polyethylene glycol)

PG (propylene glycol)

Sodium Laurel Sulfate (SLS) & Sodium Laureth Sulfates (SLES)

Triclosan and triclocarban

Boric Acid and Sodium Borate

Dyes

Methlchlorisothaizolinone and Methyllisothiazolinone

Parabens

DEA (diethanolamine), MEA (monoethanolamine) and TEA (triethanolamine)

Imidaolidinyl Urea and DMDM Hydanotoin

Oxybenzone

Toluene

Environmental Working Group Top 6 For Kids

1. Use fewer products and use them less often.
2. Don't trust the claims.
3. Check ingredients. Buy fragrance-free products.
4. Avoid the use of baby powder on newborns and infants.
5. Do your homework at EWG's Cosmetics Database.
6. Always avoid EWG's top 7 chemicals of concern for kids:

2-Bromo-2-Nitropropane-1,3 Diol

Boric acid and sodium borate

DMDM Hydration

Triclosan

BHA

Dibutyl phthalate & toluene

Oxybenzone

EWG http://www.ewg.org

Prudent Cell Phone Use

Use a headset with an ‘air tube.’

Whenever possible, use the speakerphone function on your cell phone

Place your cell phone 2 to 3 feet away from you during use.

Use your landline whenever possible.

Do not allow your children to use the cell phone unless absolutely necessary.

Use the Environmental Working Group website list of cell phones when purchasing your next cell phone.

Adapted from Wings of Eagles Health
For more information: www.wehliving.org

Limit Your Exposure to EMFs

Turn off your wireless router when not in use or at least overnight.

Replace cordless cell phones with a landline or keep the cordless phone base at least two rooms away from your children's bedrooms.

Unplug any appliances that are within 6 feet from the bed. Eliminate wires running under your bed.

Don't sit too close to your computer or TV set.

- Adapted from Wings of Eagles Health.
  For more information: www.wehliving.org

Influence of a five-day vegetarian diet on Urinary levels of antibiotics and phthalate metabolites: A pilot study with "Temple Stay" participants.

People who adopted a vegetarian diet for just five days show reduced levels of hormone disrupting chemicals and antibiotics.

Levels of one particular phthalate breakdown product were related to number of servings of dairy products consumed in the previous 48 hours.

Levels of the measured toxins plummeted after only a short time period – we can make dramatic differences in our toxic burden when we become more mindful and make healthier choices.

K Choy. 2010. **Influence of a five-day vegetarian diet on urinary levels of antibiotics and phthalate metabolites: A pilot study with "Temple Stay" participants**. Environmental Research.

Thank you for your time!

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