



# The First Seven Years

## Children's Brain and Immune Development in Today's World

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# Intro to Dr. Murray Clarke

## Medical Training



**DNM. Naturopathic Medicine:**

Food, Diet, Nutrition, Herbal



**D.Hom. Homeopathic Medicine:**

Homeopathic remedies



**L.Ac. Oriental Medicine:**

Acupuncture, Herbology

**Opened medical clinic in 1988, Los Angeles, California.**

**Founded ChildLife Essentials® in 1998.**



# Introduction

## The Current Status of Childhood Health and Development

In this educational session, ChildLife will dive into the impact of nutrition and the environment on a child's immune system and brain development, during the critical first seven years of life.

Attendees will learn about the factors that impact a child's immune system, and strategies to bolster immune health acutely and over the long term. Additionally, the session explores brain health, elucidating the markers of normal brain development and factors that impact optimal cognitive growth.

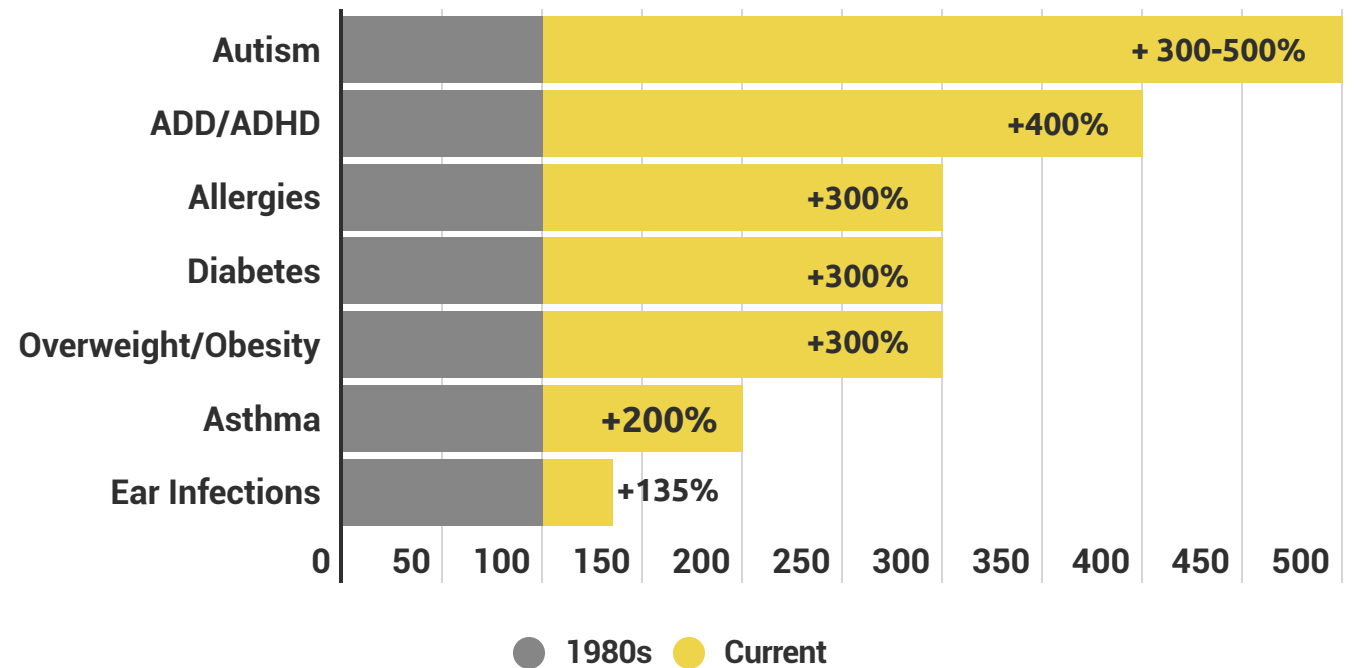
## Today's Most Common Childhood Conditions

- Allergies
- Eczema
- Asthma
- ADD/ADHD (attention deficit, hyperactivity)
- Otitis Media (ear infections)
- Upper Respiratory Infections, Cold/Flu
- Gastro-intestinal disorders
- Autism, Asbergers, Autistic Spectrum Disorder

## Modern Day Phenomenon of Childhood Disorders

## Worldwide Statistics

### Increase in Childhood Disorders Since 1980's



## Current Statistics for American Children

The number of children suffering from chronic medical conditions has **increased from one in fifty, to one in five over the past forty years.\***

- **Eczema – 10.8%**
- **Asthma – 10.2%**
- **Environmental Allergies – 18.9%**
- **Food Allergies – 5.8%**
- **ADD/ADHD – 9.5%**
- **Autism- 2.8%**
- **Developmental Disability- 17%**



## WHY?

### What is Going On? What is Affecting Today's Children's Health So Much?

#### Epigenetics

Today's world is not the same as 10, 20 or 30 years ago. Children are faced with many more challenges to their health these days:

- **Worldwide decline in mineral content of soil** with subsequent decline in the quality and nutritional content of the food.
- **Worldwide decline in the quality of children's nutritional and dietary habits** (fast foods, junk foods, processed foods, chemical food additives).
- **Extreme increase in exposure to environmental toxicity and pollution** from air, water and food, creating immediate and long term epigenetic effects.



# Declining Nutritional Content

## Analysis of 43 fruits and vegetables, U.S.A., 1950-1999

Nutrient	% Decline
Calcium	-16%
Phosphorous	-9%
Iron	-15%
Potassium	-6%
Vitamin C	-15%
Riboflavin	-38%

## Percentage Decline in Mineral Content of U.S. & British Crops in the Last Sixty Years\*

Mineral	U.S. 1963-1992 (13 fruits & vegetables)	Britain 1936-1987 (20 fruits & 20 vegetables)
Calcium	-29	-19
Magnesium	-21	-35
Sodium	N/A	-43
Potassium	-6	-14
Phosphorus	-11	-6
Iron	-32	-22
Copper	N/A	-81

N/A, not analyzed. \*U.S. (Berginer, 1997) and British (Mayer, 1997) data.

# Decline in the Quality of Children's Dietary Habits

Ultra processed foods, chemical food additives



**CHEMICALS UNDER THE MICROSCOPE**

Additive	Where used	Potential problems
<b>E102</b> Tartrazine	Sweets, biscuits, mushy peas	Hyperactivity, asthma, rashes
<b>E124</b> Ponceau 4R	Sweets, biscuits, drinks	Allergy, intolerance
<b>E110</b> Sunset Yellow	Sweets, drinks, ice cream	Gastric upset, allergy
<b>E122</b> Carmoisine	Biscuits, jelly, sweets, ready meals	Allergy, intolerance
<b>E104</b> Quinoline Yellow	Sweets, smoked haddock, pickles	Hyperactivity, asthma, rashes
<b>E129</b> Allura Red	Soft drinks, cocktail sausages	Some evidence of hypersensitivity
<b>E211</b> Sodium benzoate	Soft drinks, baked goods, lollies	Hyperactivity, asthma

## Environmental Toxicity

In the first study of its kind, conducted by the Environmental Working Group (an American-based research organization) in 2005, *an average of 285 toxic pollutants were found in the umbilical cord blood of each newborn baby at the moment of birth.* The blood samples came from babies born in U.S. hospitals in August and September of 2004.



## Body Burden: The Pollution in Newborns

**“Of the 287 chemicals** we detected in umbilical cord blood, we know that **180** cause cancer in humans or animals, **217 are toxic to the brain and nervous system**, and **208** cause birth defects or abnormal development in animal tests.”

*Environmental Working Group. 2005 Jul 14.*

Consequences:

**Immune disruption, brain disruption, hormonal disruption**

## Today's Dilemma

Nutritional Deficiencies  
Compounded By  
Greater Environmental  
Toxicity Burden



# Epigenetics: What Counts

## Genetics vs Epigenetics

- Where you live
- How you live
- What you eat
- What you do
- What you are exposed to in the environment
- How your body, mind, and genes respond to your environment



Start thinking about what percentage of your genes vs your environment determines your health and longevity.

*Later, we will look at studies and answer this!*

# Solutions

## Essential Nutrients

The essential vitamins and minerals are the building blocks required for healthy growth, development and proper function.

- Essential Vitamins
- Essential fatty acids
- Essential Minerals
- Essential amino acids

*(U.S. National Academy of Sciences, 1941, first RDA's issued)*

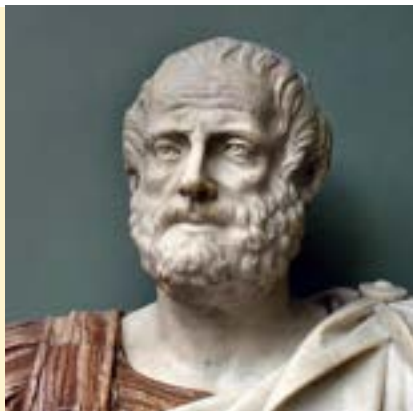
## Nutritional Supplementation for:

1. Healthy growth and development
2. Environmental protection and detoxification
3. Immune support and health
4. Brain and mind development

**Even more critical in children as they grow and develop (lb per lb)**

## Why the First 7 Years Are So Important

- The first 7 years of a child's life is a critical period for immune and neurological development and has a lasting impact on lifelong health.
- Children's immature organ systems are more vulnerable to environmental pollutants.
- A well-balanced diet and incorporating key supplements during this period is crucial to support optimal growth and development, and establish a healthy foundation for life.



***“Give me a child until he is 7 and I will show you the man”***

***-Aristotle (384-322 BCE)***





# Immune System

# The Importance of the First 7 Years on Immune System Development

- The immune system serves to defend the body against pathogens, toxins, and other harmful substances.
- Once the mother's umbilical cord is cut, a newborn's immune system must begin training to protect itself.
- As infants grow, their immune system strengthens and learns to defend against new germs and environmental toxins.



# The Prevalence of Immune Conditions in Children

## **Allergy Disorders:**

In 2021, nearly 1 in 5 U.S. children (27.2%) reported having a seasonal allergy, eczema, or food allergy.

- Eczema: Increased from 8% to 15% since 1997.
- Food Allergies: Increased by 50% between 1997-2011.
- Environmental Allergy: 18.9% of children have a seasonal allergy.

## **Autoimmune Disorders:**

- Type 1 diabetes: Increase of 34% between 2001-2017

## Innate Immune System: The Front Lines - The Soldiers You Are Born With

### The Body's First Line of Defense

- Physical barriers like the skin and mucus membranes
- Non-specific defense mechanisms such as inflammation and phagocytosis by immune cells like neutrophils



Adapted from BioNinjaImmunity Course Material, Created with BioRender.com

## Adaptive Immune System: Reinforcements - The Soldiers With Specialized Training

### The Body's Second Line of Defense

- T cells, B cells, and major histocompatibility complex (MHC) molecules
- Specific response through the production of antibodies and memory cells

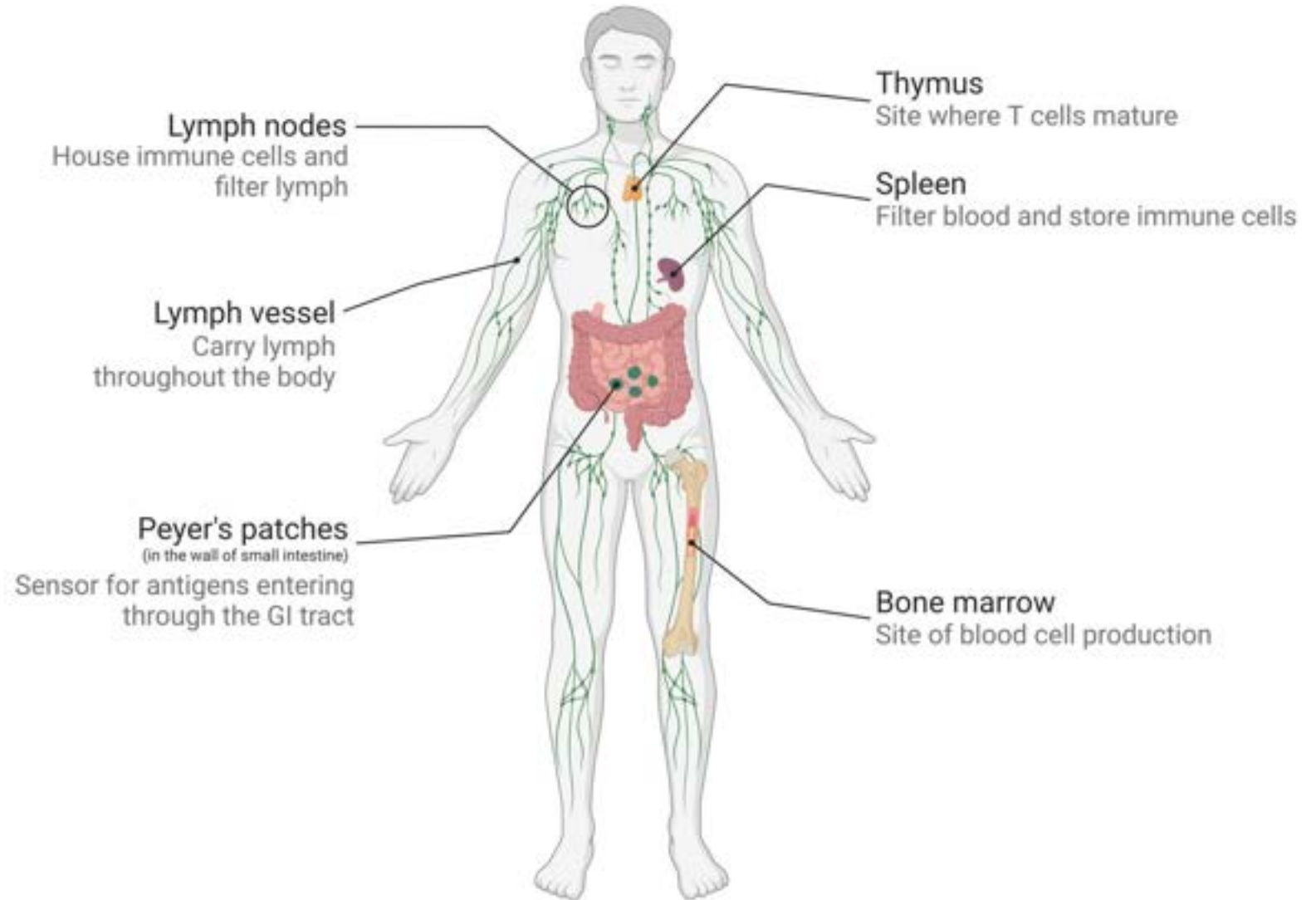


Adapted from BioNinjaImmunity Course Material  
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# Mapping Out the Immune System

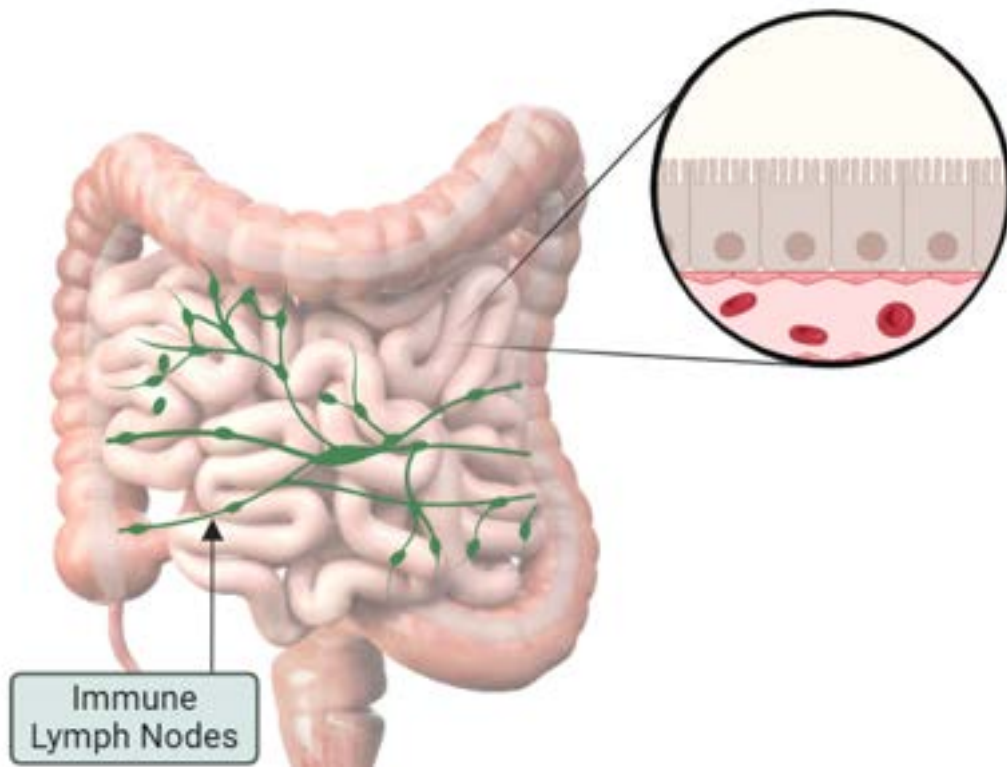


**Home Bases for the Soldiers**



## Lymph Nodes

### Ecosystem - Symbiosis vs Dysbiosis (Peace or Chaos)

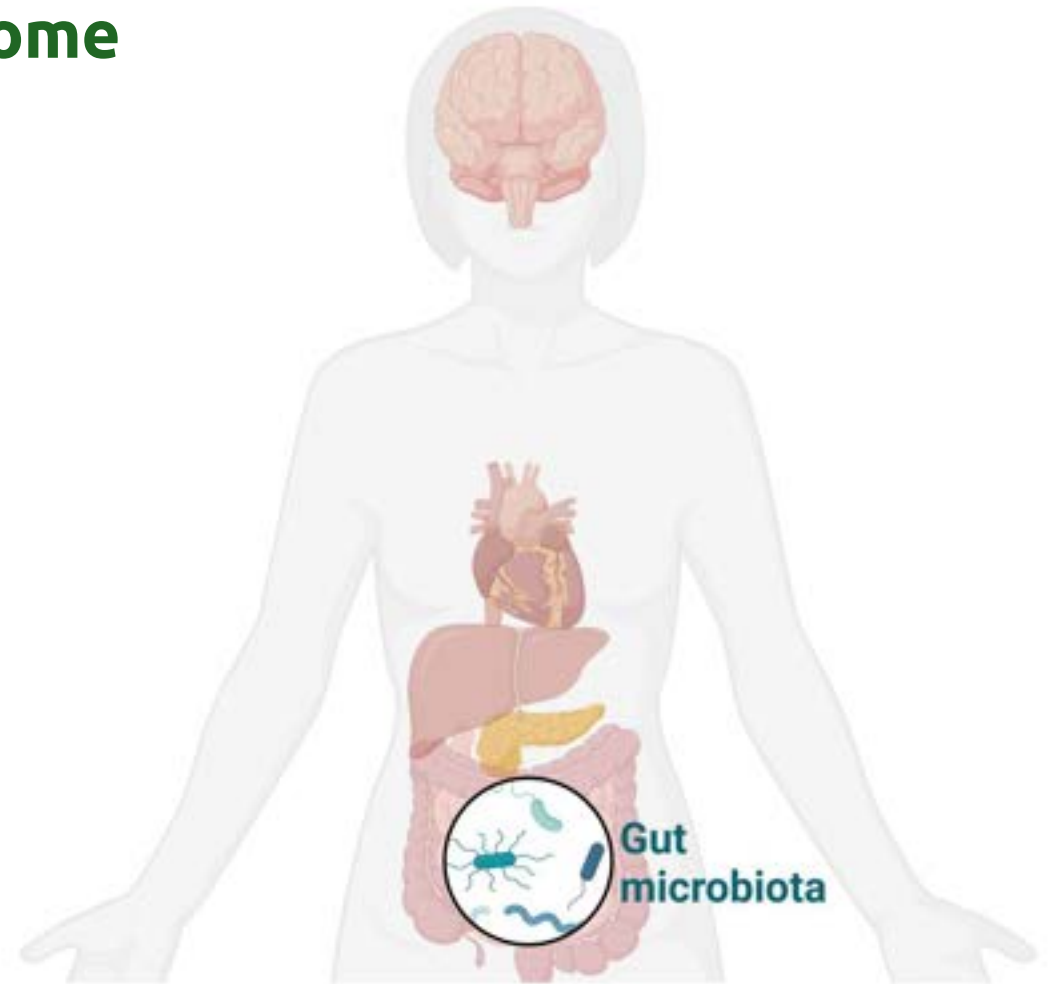


- About 90% of nutrient absorption takes place in the small intestine.
- Lymph nodes in the gut are the foreign invader's first contact with the internal environment.
- Lymph nodes filter viruses and bacteria and contain immune cells that fight infection.

# Mapping Out the Immune System

## Microbiome

- The microbiome is made up of all the microorganisms living in and on your body.
- In the human body, there are **30 trillion** human cells, and the microbiome contains **38 trillion** bacteria.
- There are approximately 300 to 500 bacterial species in the human microbiome.





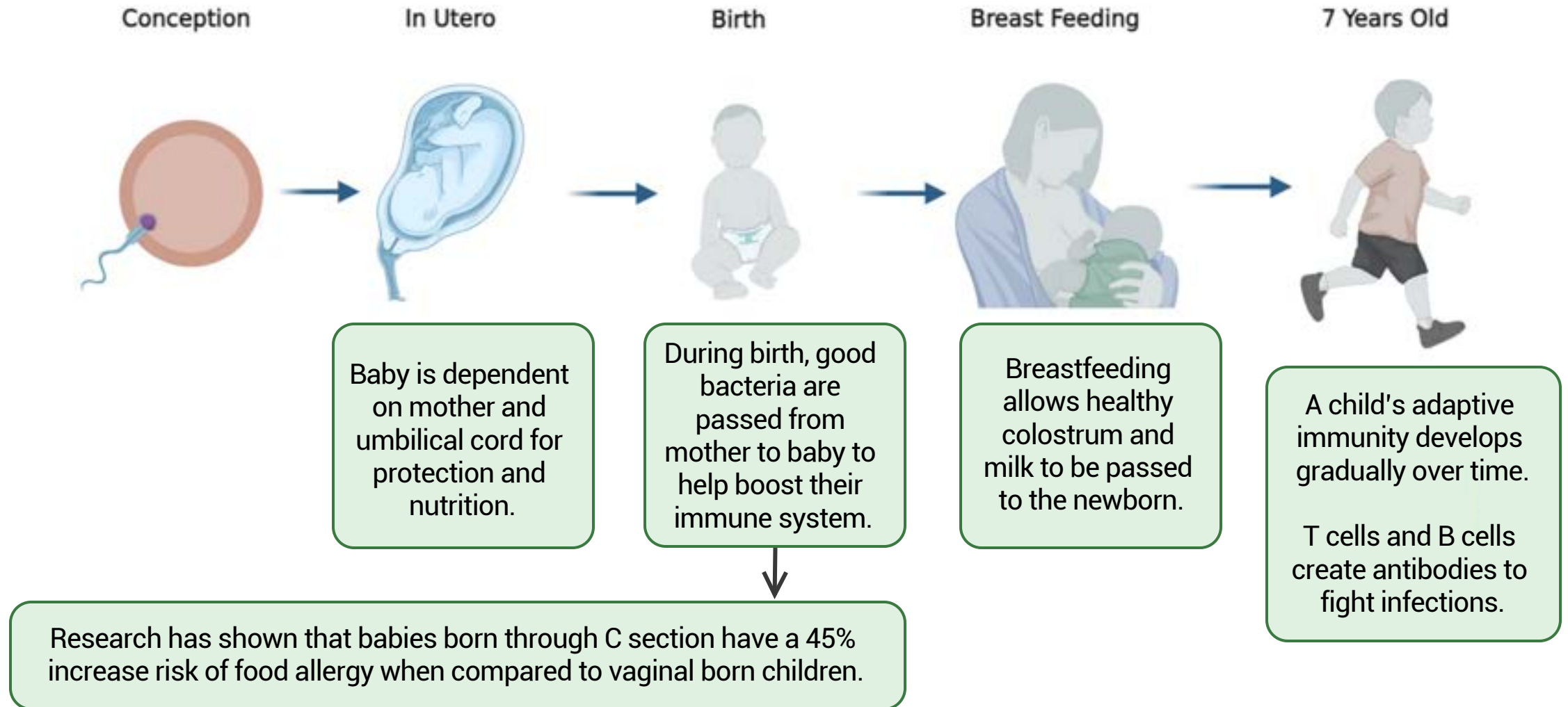


**“All diseases begin in the gut”**

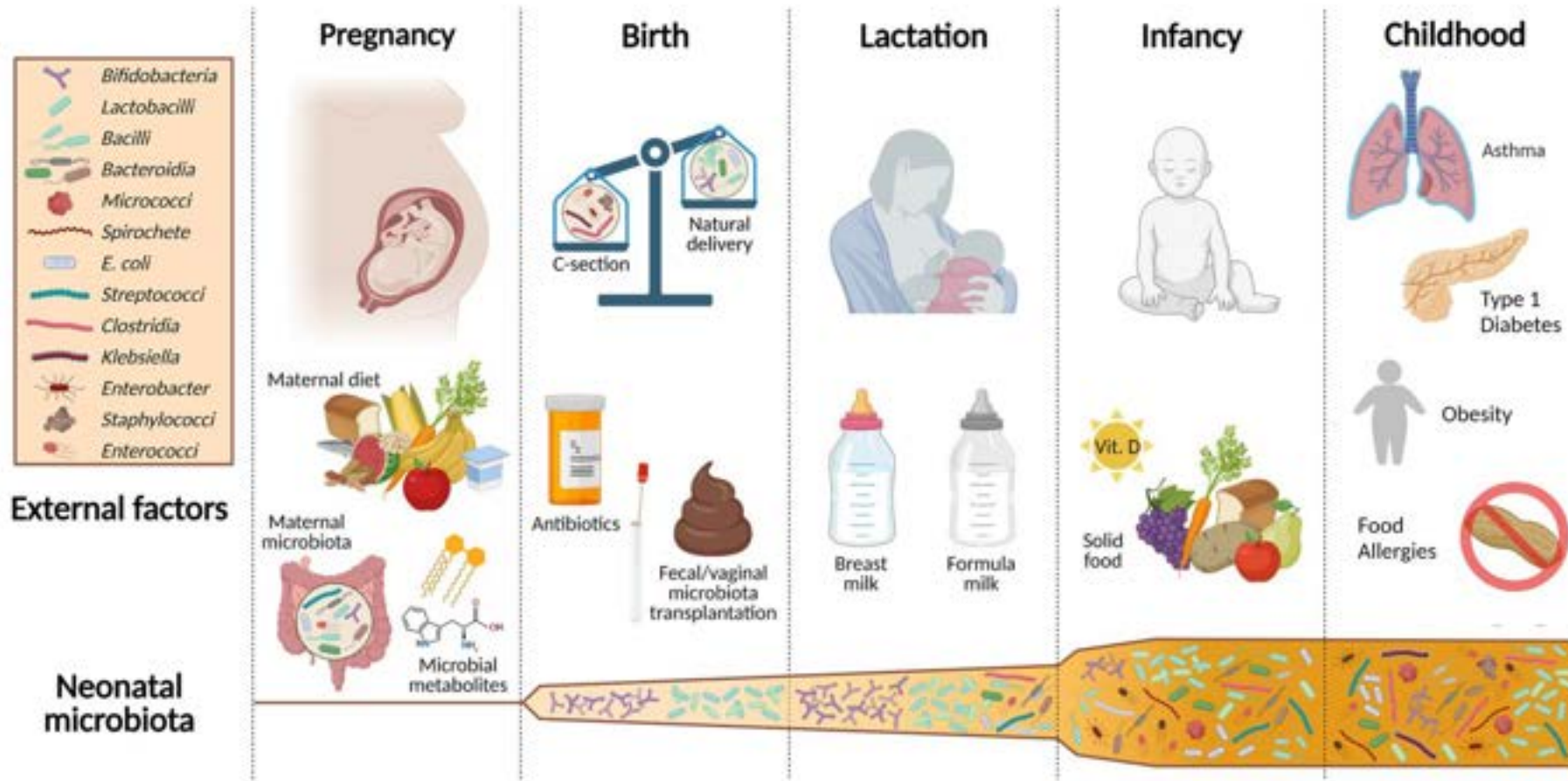
**- Hippocrates (460-375 BC)**

**A founding principle of modern-day Naturopathic medicine**

# How the Immune System Develops

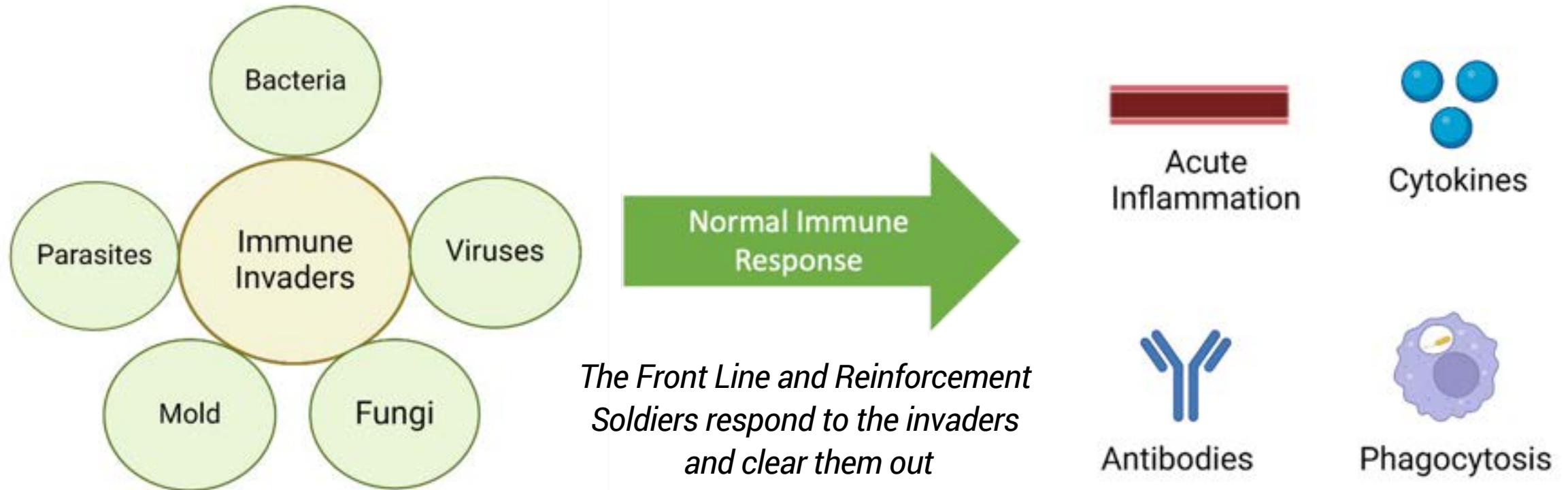


# How the Immune System Develops



**Each day most people can encounter roughly 60,000 germs\***

# What Compromises, Inhibits, & Challenges Healthy Development



# What Compromises, Inhibits, & Challenges Healthy Development

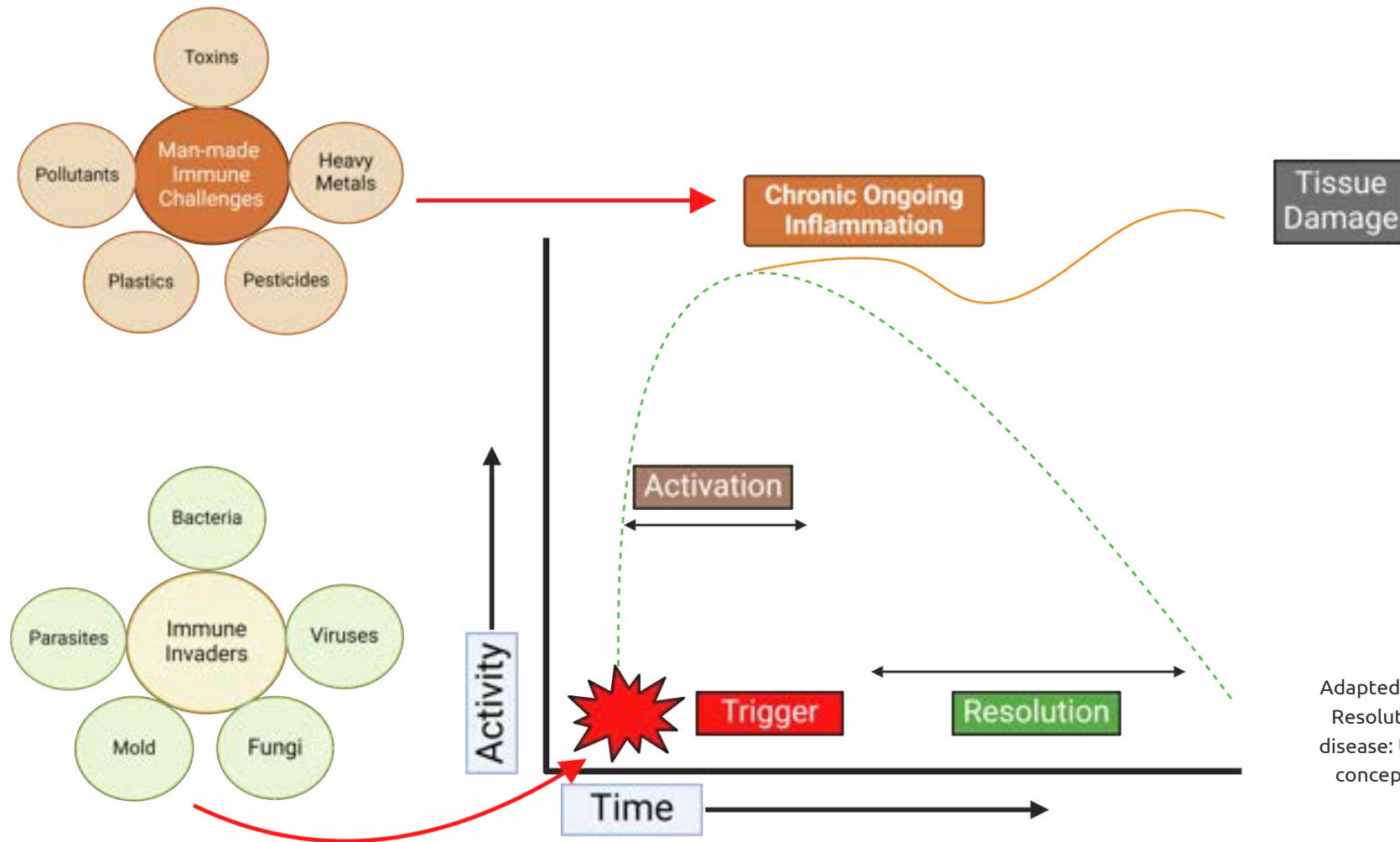


*The Front Line and Reinforcement Soldiers respond to the invaders but are unable to clear them out completely*



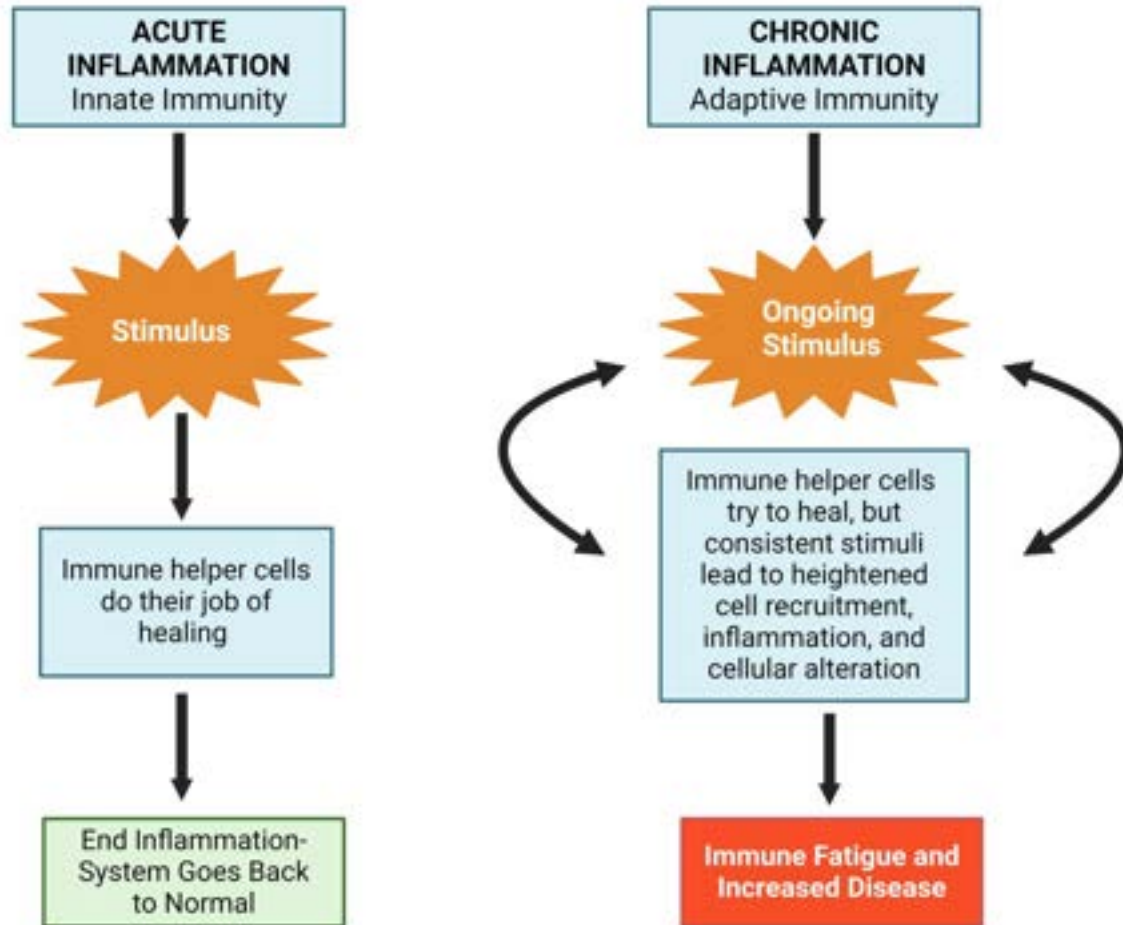
Chronic Inflammation

# What Compromises, Inhibits, & Challenges Healthy Development



Adapted from: SchettG, Neurath MF.  
Resolution of chronic inflammatory  
disease: Universal and tissue-specific  
concepts. Nature Communications.  
2018;9(1). Figure 1.

# Result of Inflammation: Short Term vs Long Term



**Short Term:** Beneficial immune response for healing.

**Long Term:** Can lead to chronic allergies, increase risk of Alzheimer's and dementia in adulthood.

Chronic inflammation can lead to **leaky gut**, where the intestinal lining becomes more permeable, allowing toxins and bacteria to leak into the bloodstream.

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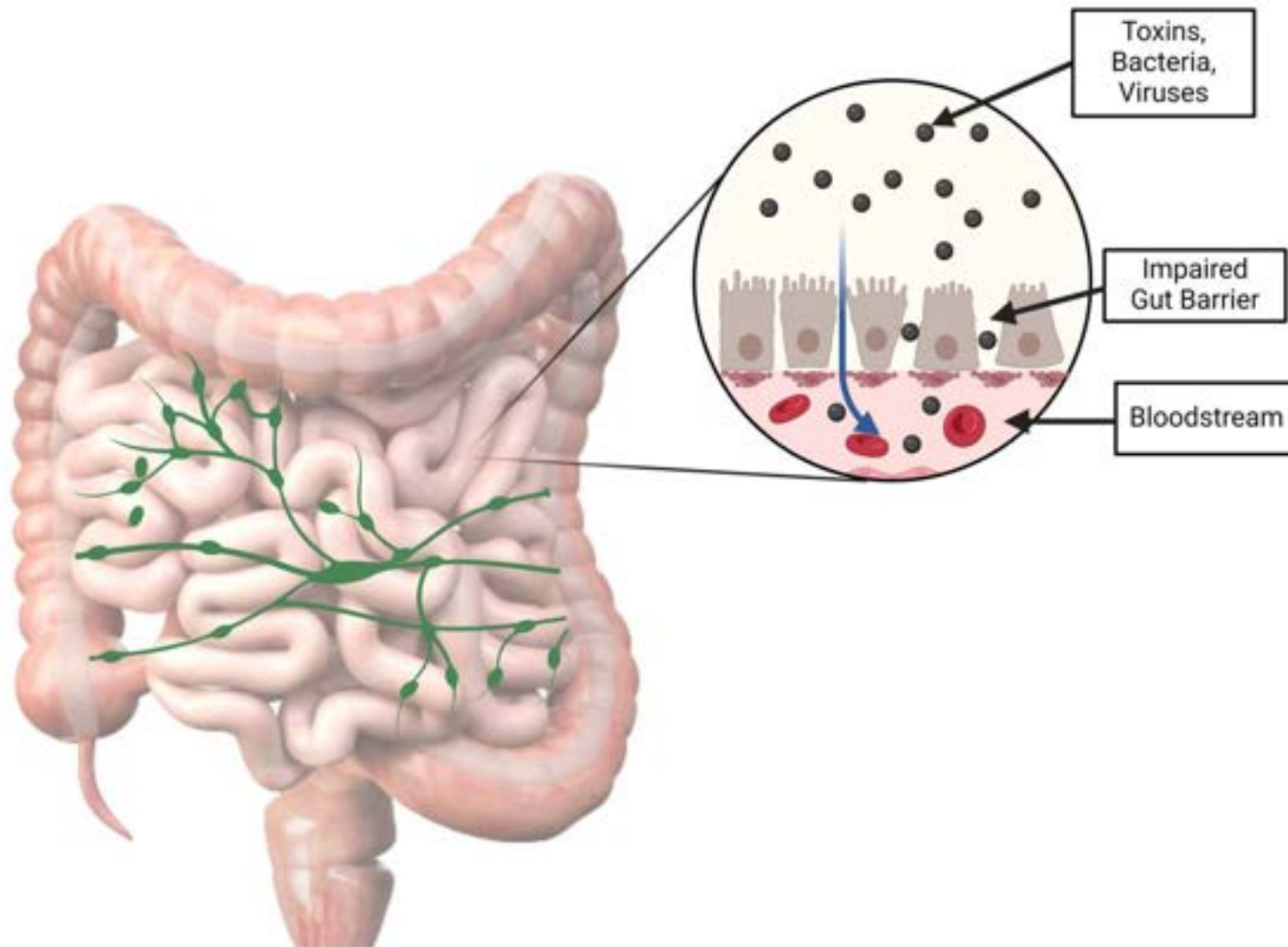
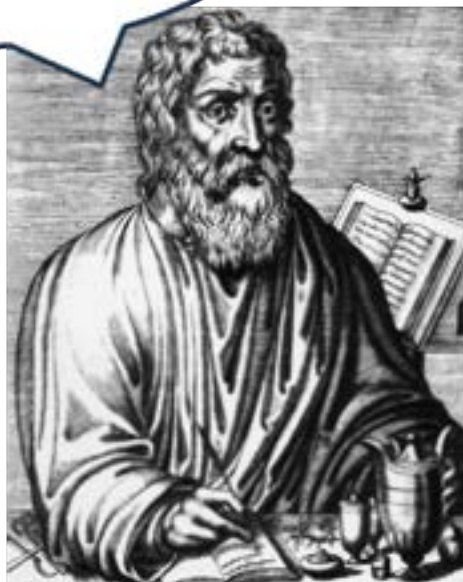
Reference: 2-3, 17-18

**A 2024 study revealed that long-term brain fog from Covid infection involved "leaky" blood vessels and "leaky" BBB with increased inflammation in the brain.**

Greene, C., Connolly, R., Brennan, D. et al. Blood-brain barrier disruption and sustained systemic inflammation in individuals with long COVID-associated cognitive impairment. Nat Neurosci 27, 421-432 (2024).

# Leaky Gut - Extreme Increase in Immune Burden

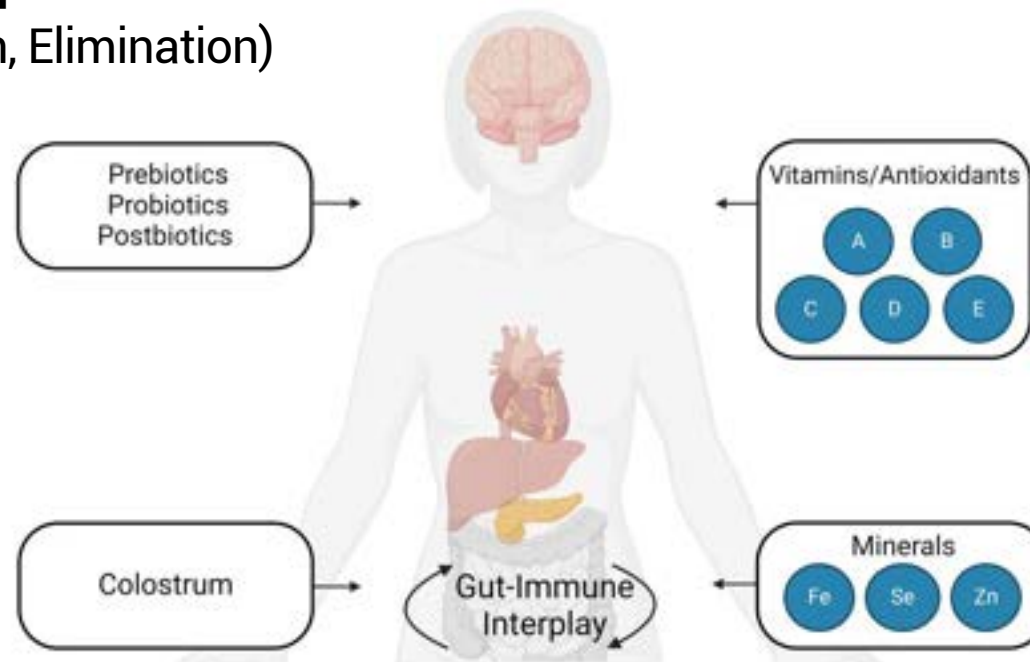
"All diseases begin in the gut"  
- Hippocrates (460-375 BCE)





## Environmental Immune Support (Neutralization, Detoxication, Elimination)

- All the essential vitamins and minerals, especially:
- Antioxidants such as Vitamins A, C, and E
- Minerals: Zinc and Selenium
- Probiotics
- Colostrum



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## Viral/Bacterial Immune Support

- Primary Immune Response with:
  - Vitamins: Vitamin C, E, and D
  - Minerals: Zinc and Selenium
  - Probiotics
  - Colostrum
  - Herbal support: Echinacea, Elderberry, Grindelia, St. John's Wort, Larch arabinogalactan, Olive leaf

Reference: 11, 20-26

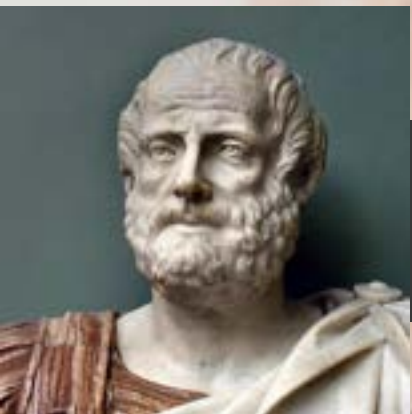
**Vitamin C contributes to immune defense by supporting various cellular functions of both the innate and adaptive immune system.**

Carr AC, Maggini S. Vitamin C and Immune Function. *Nutrients*. 2017;9(11):1211. Published 2017 Nov 3.

***A randomized, controlled 5-year trial suggests that vitamin C supplementation significantly reduces the frequency of the common cold.***

Sasazuki S, Sasaki S, Tsubono Y, Okubo S, Hayashi M, Tsugane S. Effect of vitamin C on common cold: randomized controlled trial. *Eur J Clin Nutr*. 2006;60(1):9-17.

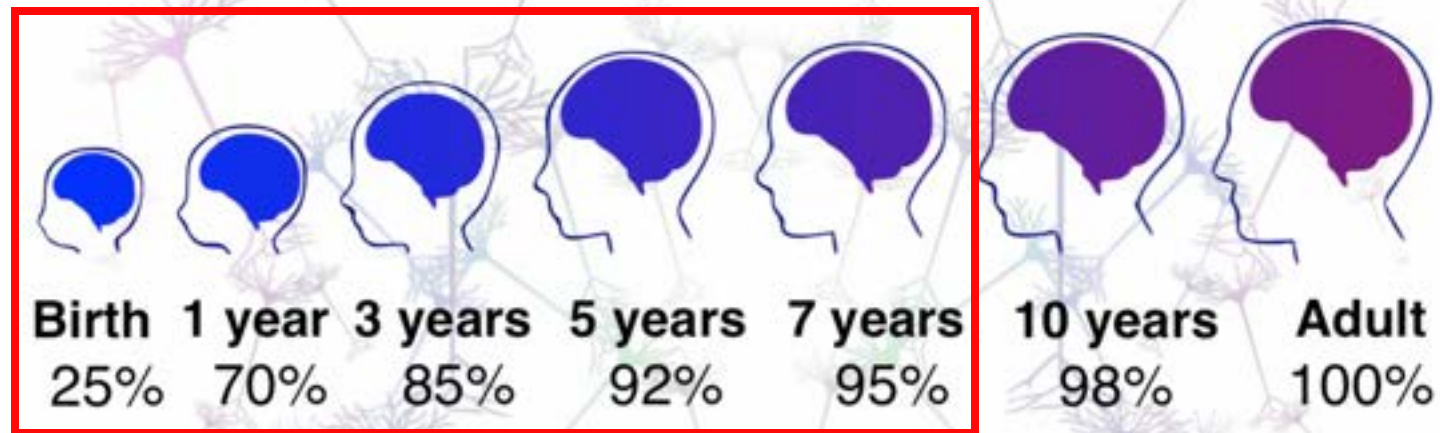
# Brain Development



*"Give me a child until he is 7 and I will show you the man" -Aristotle (384-322 BCE)*

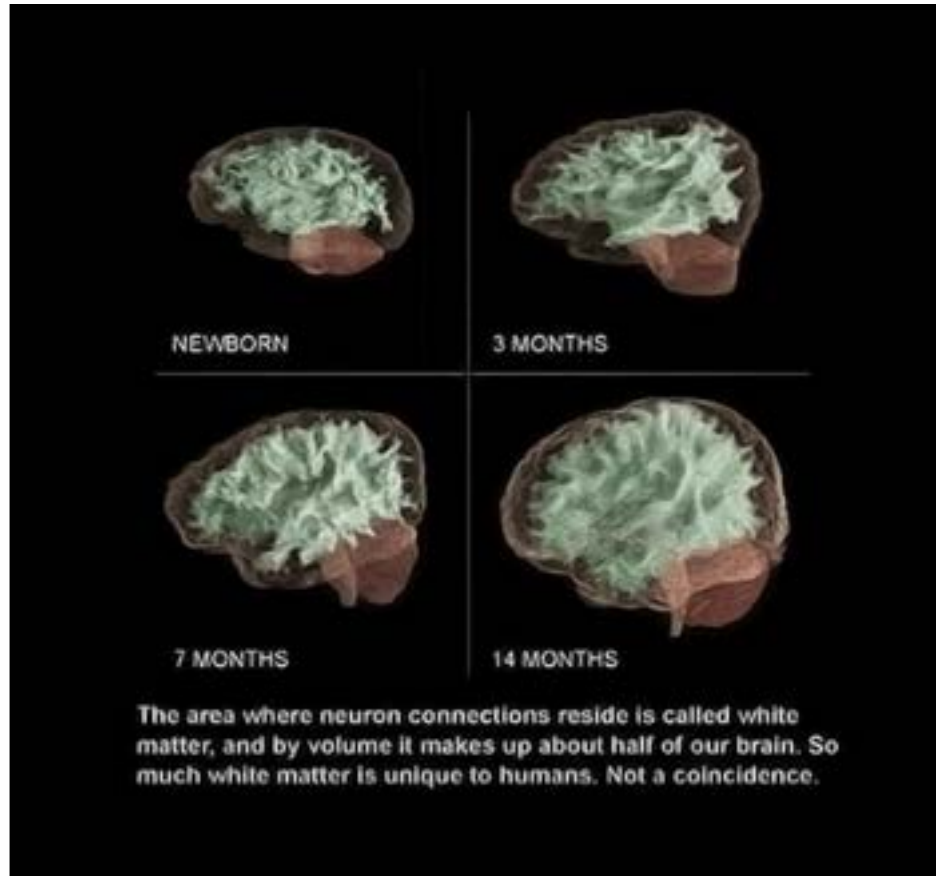
# The Importance of the First 7 Years on Brain Development

*"By the end of their first year of life, a child's brain is about 70% of adults size.  
By five years, a child's brain is about 90% of adult size."*

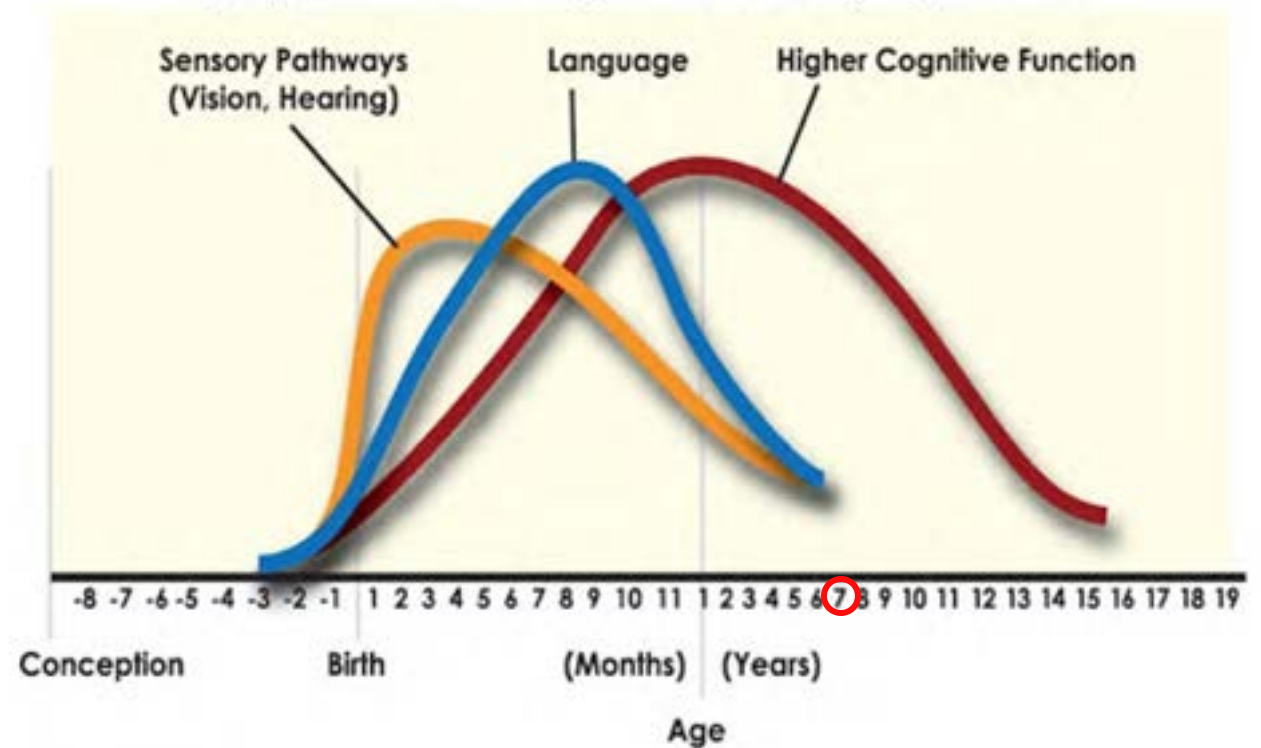


## Brain Growth from Birth to 14 Months (White Matter)

Image by TheVisualMD



## Human Brain Development Synapse Formation Dependent on Early Experiences



**In the U.S, between 13% to 20% of children suffer from psychological disorders (1 in 5 children)**

## **ADD/ADHD (Attention Deficit Hyperactivity Disorder)**

- Increase of 18% from 2008-2013

## **Depression**

- Increased from 3.1% to 4.0% between 2016-2020

## **Anxiety**

- Increased from 7.1% to 9.2% between 2016-2020

# Prevalence of Autism and Autism Spectrum Disorder

**During the past four decades, the number of children suffering from Autism has increased dramatically.**

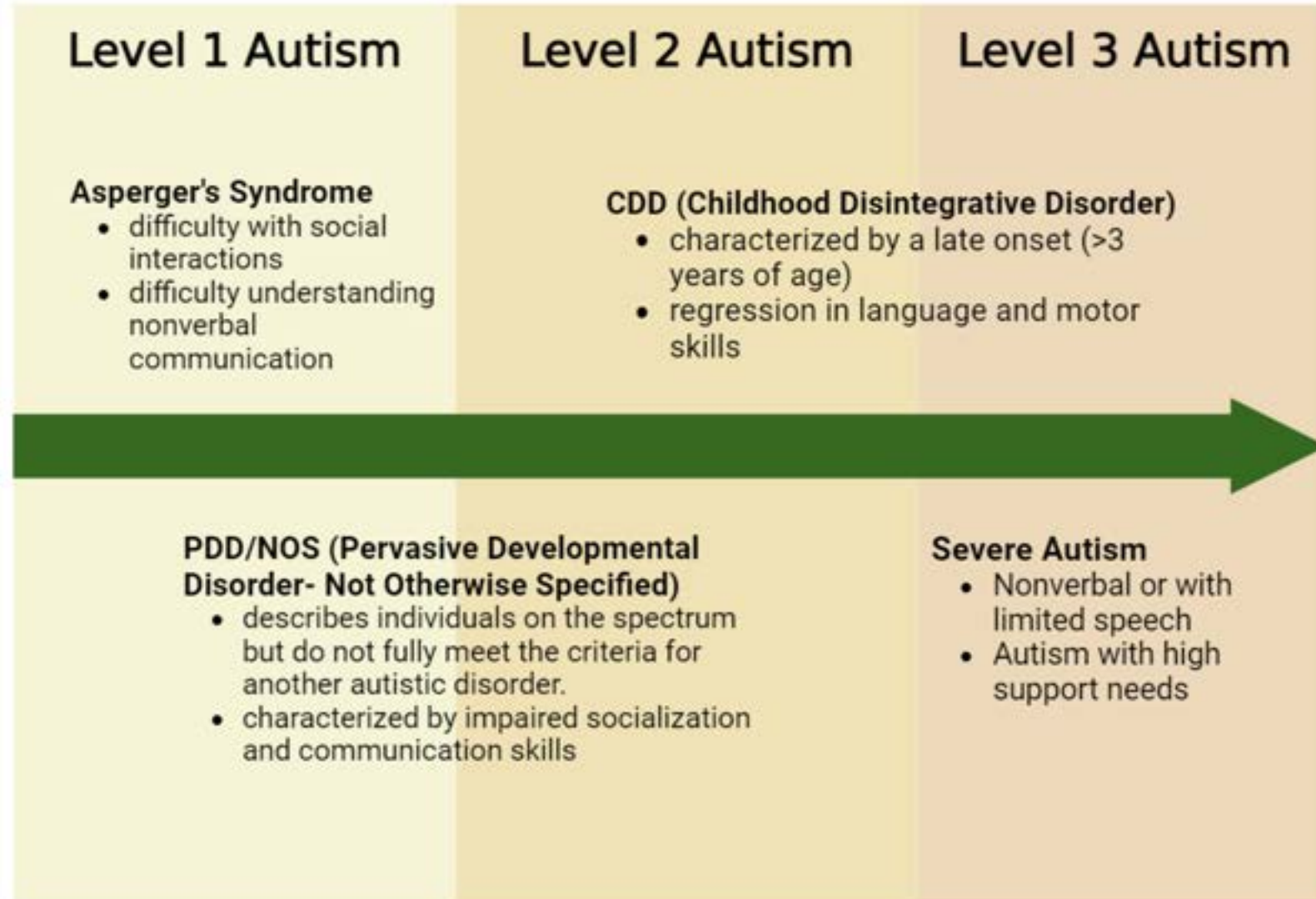
**1979:** First study on autism prevalence reports 1 in 500 children have autism.

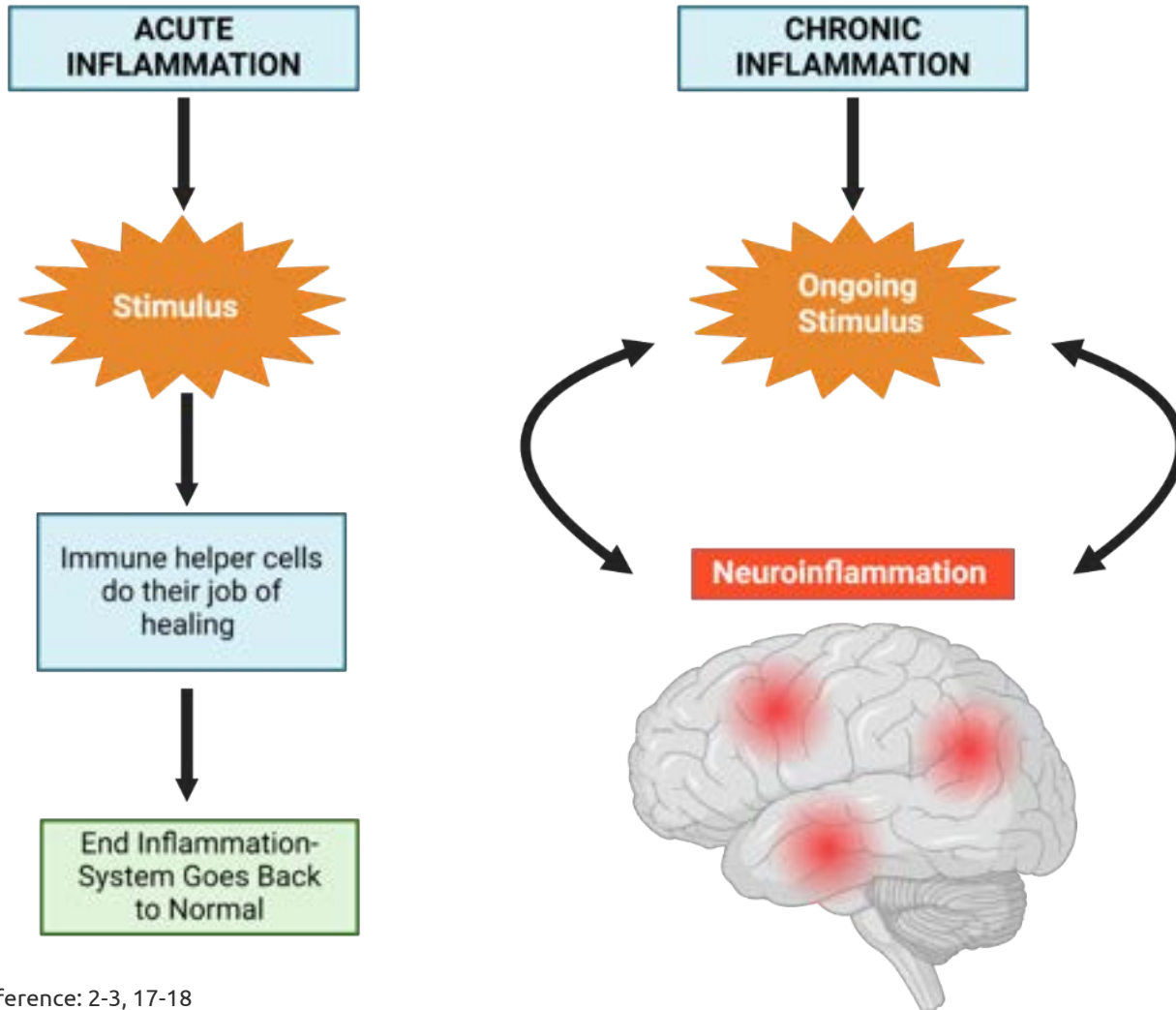
**2000:** CDC's ADDM Network reports **1 in 150 children** have been identified with autism.

**2021:** WHO reports global prevalence of autism to be 1 in 100 children.

***Today in America: 1 in 36 children has been identified with autism***

# Autism and Autism Spectrum Disorder





**Short Term:** Beneficial immune response for healing.

**Long Term:** Can lead to neurological and developmental challenges.

***Severe inflammation in early childhood is a clinically known risk factor for developing autism***

Siniscalco D, Schultz S, Brigida A, Antonucci N. Inflammation and neuro-immune dysregulations in autism spectrum disorders. *Pharmaceuticals*. 2018;11(2):56. doi:10.3390/ph11020056



## The brain is protected by:

The **skull** protects the brain from physical injury.

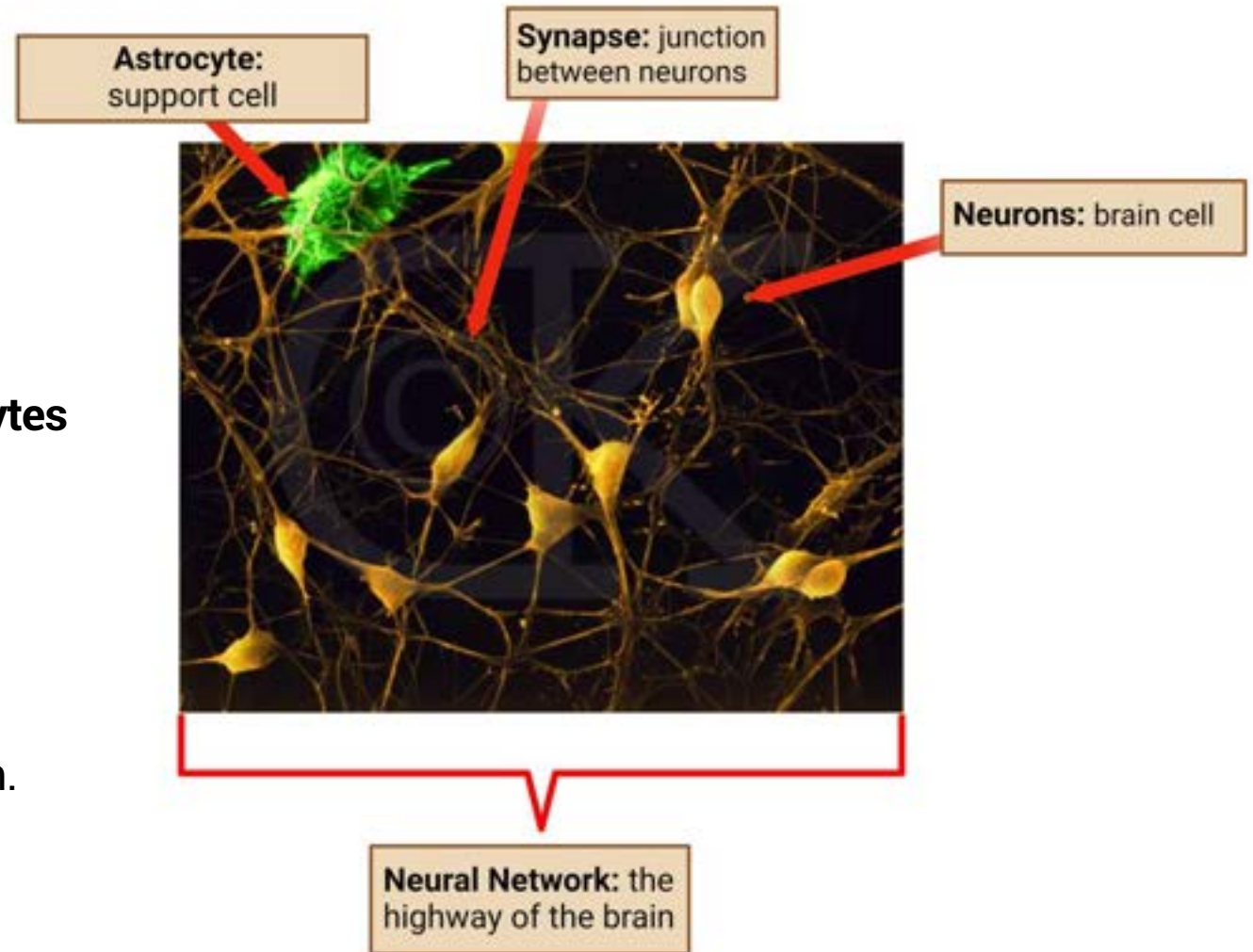
- **Specialized Armor Protection**

**Microglia** removes debris after injury and **astrocytes** help reform the blood brain barrier.

- **Specialized Immune System**

The **blood brain barrier** is a semi-permeable membrane that protects the brain from harmful substances that can enter from the bloodstream.

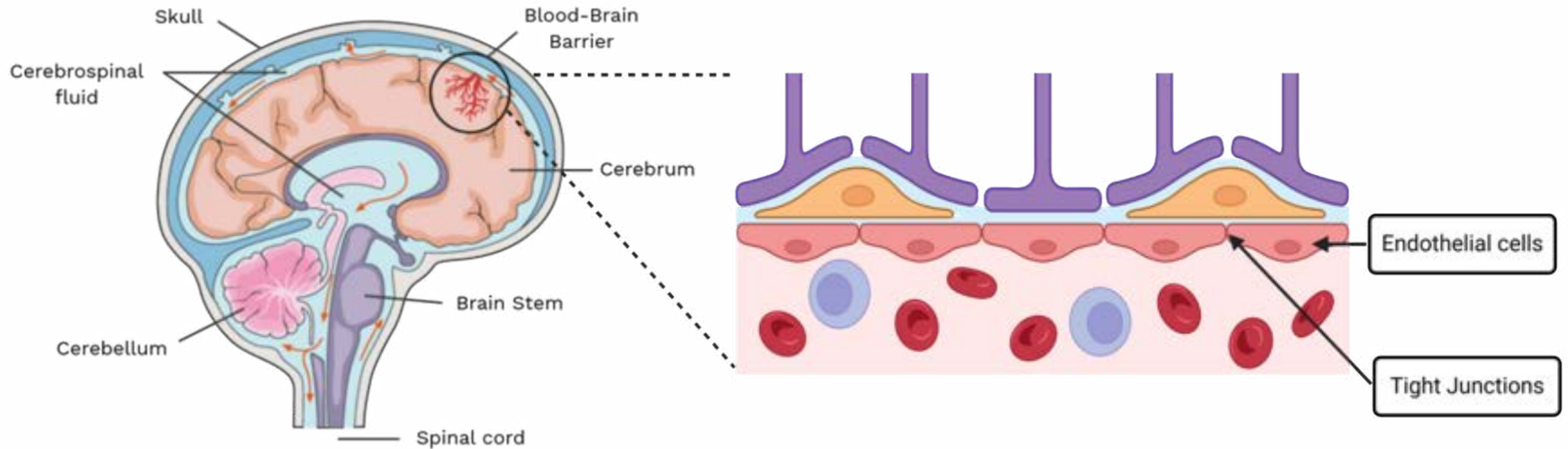
- **Specialized Security System**



# The Blood Brain Barrier

## Function:

BBB typically functions to prevent toxic substances from entering the brain while allowing substances like oxygen, hormones, and nutrients to pass through.



# What Compromises, Inhibits, & Challenges Healthy Development

## Environmental Toxins

- Heavy Metals: Lead, Aluminum, Cadmium, Mercury, Arsenic
- Pesticides
- Pollution
- Plastics
- Chemicals

## Pathogens

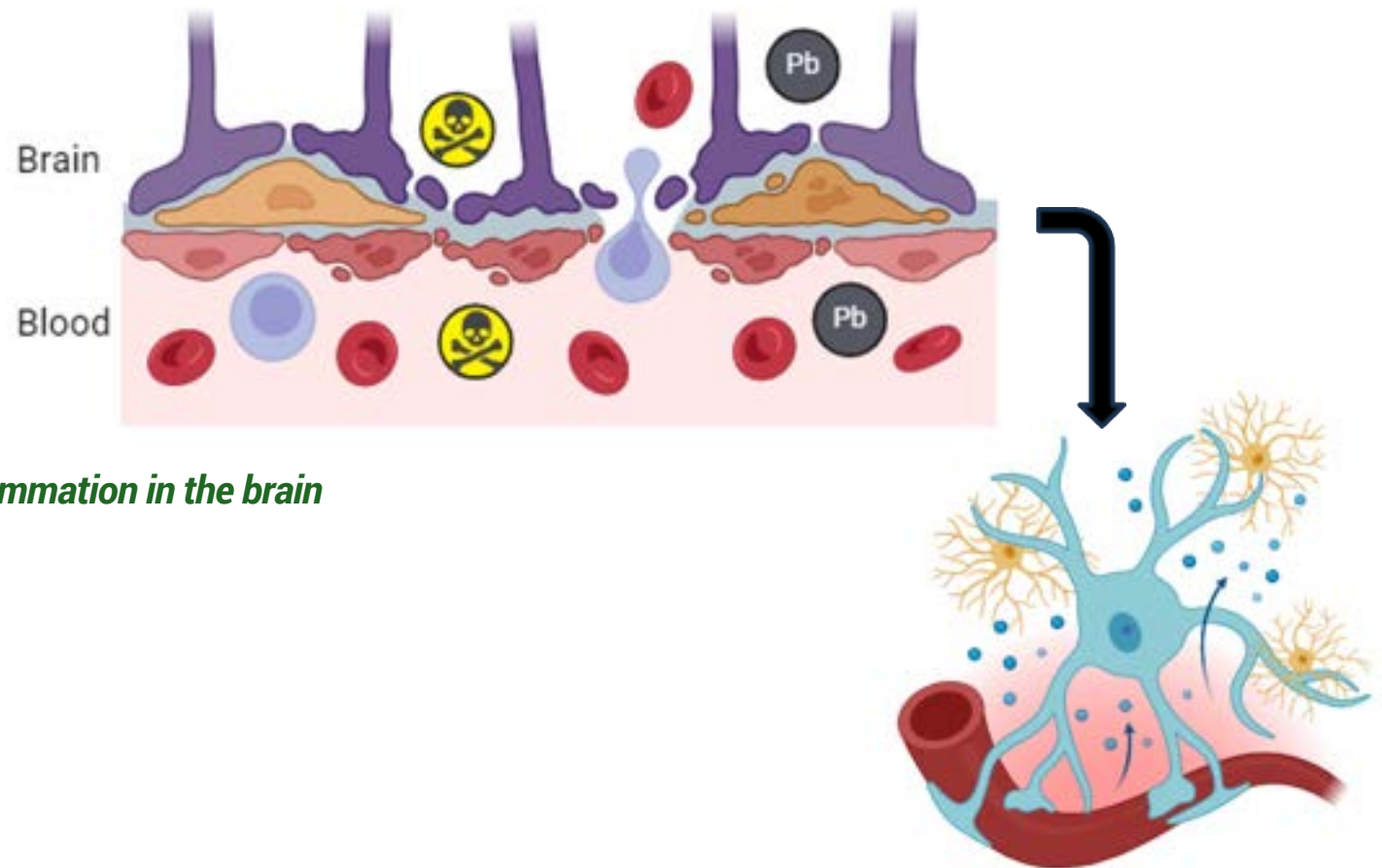
- Viruses, Bacteria, Mold

*These all can potentially damage the BBB and lead to inflammation in the brain*

## Suboptimal Nutrition

- Lack of essential nutrients
- Omega 3 Fatty Acids/ DHA
- Antioxidants (Vitamin A, E, C)
- Minerals (magnesium, zinc, selenium)

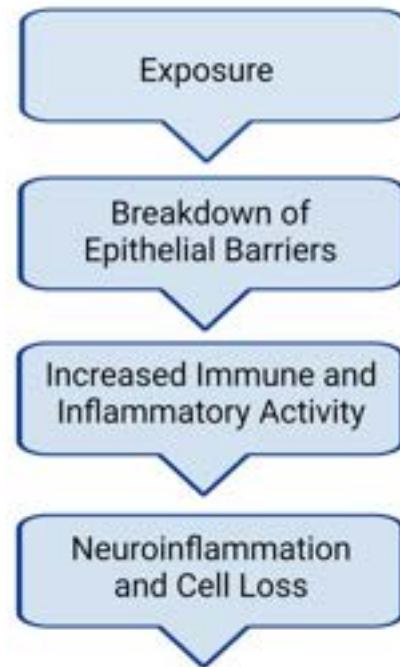
## BBB Leakage and Brain Inflammation



# The Blood Brain Barrier: Leaky Brain

## “Leaky Brain”:

A condition where the blood-brain barrier allows substances that would normally be restricted from entering the brain to pass through more easily and create inflammation (Acute vs Chronic Inflammation).



***A 2024 study revealed that long-term brain fog from Covid infection involved “leaky” blood vessels and “leaky” BBB with increased inflammation.***

Greene, C., Connolly, R., Brennan, D. et al. Blood–brain barrier disruption and sustained systemic inflammation in individuals with long COVID-associated cognitive impairment. *Nat Neurosci* 27, 421–432 (2024).

# Environmental Impacts on the Body and Brain

## Air Pollution

Researchers conclusively linked air pollution exposure before birth with **lower IQ scores in childhood**. The children of the mothers **exposed to the most pollution before birth scored on average four to five IQ points lower than children with less exposure**.

Perera FP, Li Z, Whyatt R, et al. Prenatal airborne polycyclic aromatic hydrocarbon exposure and child IQ at age 5 years. *Pediatrics*.2009;124(2):e195-e202. doi:10.1542/peds.2008-3506

## Pesticides

Researchers observed a **decrease of 2.2 IQ points** in 7-year-old children. The children's **mothers lived within 1 km of agriculturally used neurotoxic pesticides during their pregnancy**.

Gunier RB, Bradman A, Harley KG, Kogut K, Eskenazi B. Prenatal residential proximity to agricultural pesticide use and IQ in 7-year-old children. *Environmental Health Perspectives*. 2017;125(5). doi:10.1289/ehp504

## Plastics

Researchers observed that the chemical **bisphenol F** found in **plastics** may be interrupting neurological development. They found that exposure to this chemical during the fetal stage may be connected to a **lower IQ at 7 years of age**.

Engdahl E, Svensson K, Lin P-ID, et al. DNA methylation at Grin2b partially mediates the association between prenatal bisphenol F exposure and cognitive functions in 7-year-old children in the selmastudy. *Environment International*. 2021;156:106617. doi:10.1016/j.envint.2021.106617

**Heavy metals can cross the blood-brain barrier and accumulate in the brain leading to neurotoxicity, learning disabilities, decreased IQ, and behavioral problems.**

## Aluminum

Research indicates that brains of individuals affected by autism spectrum disorder have a significantly higher aluminum content than that of normal brains.

A normal brain has aluminum content of below 1 ug/g dry wt.  
A study looking at 5 donor brains with autism saw aluminum content ranging from 1.20 ug/g to 4.77 ug/g dry wt.

## Lead

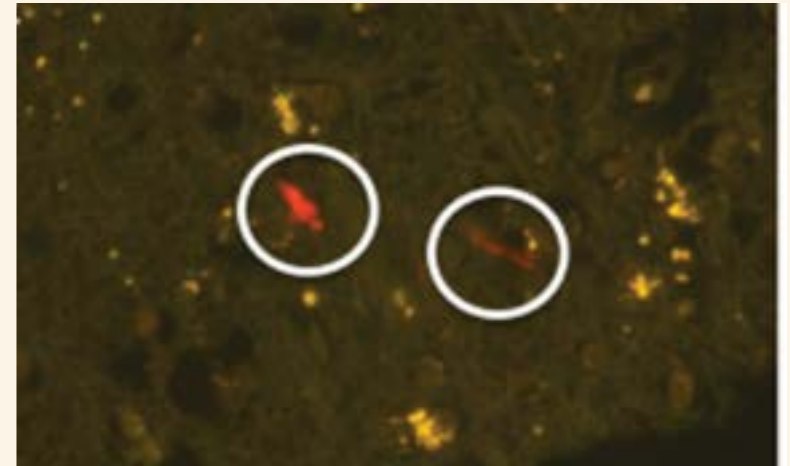
Research has shown that for every 5 mcg increase in blood lead, there was a decrease in 1.5 IQ points.

## Mercury

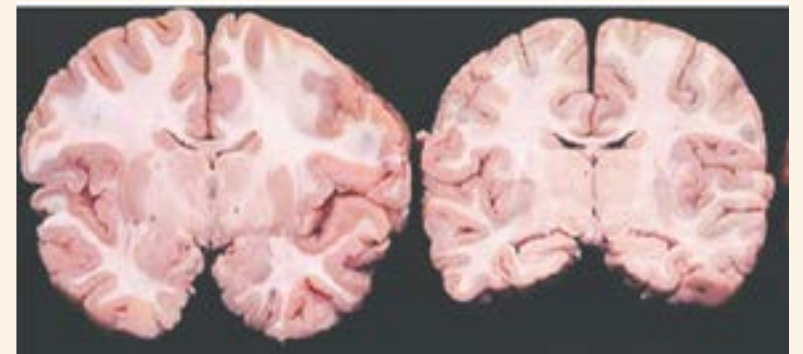
In a Texas study involving school-age children living near coal fired power plants, investigators found that for every 1,000 pounds of mercury release there is a 3.7% increase in autism.

Palmer RF, Blanchard S, Wood R. Proximity to point sources of environmental mercury release as a predictor of autism prevalence. *Health & Place*. 2009;15(1):18-24. doi:10.1016/j.healthplace.2008.02.001

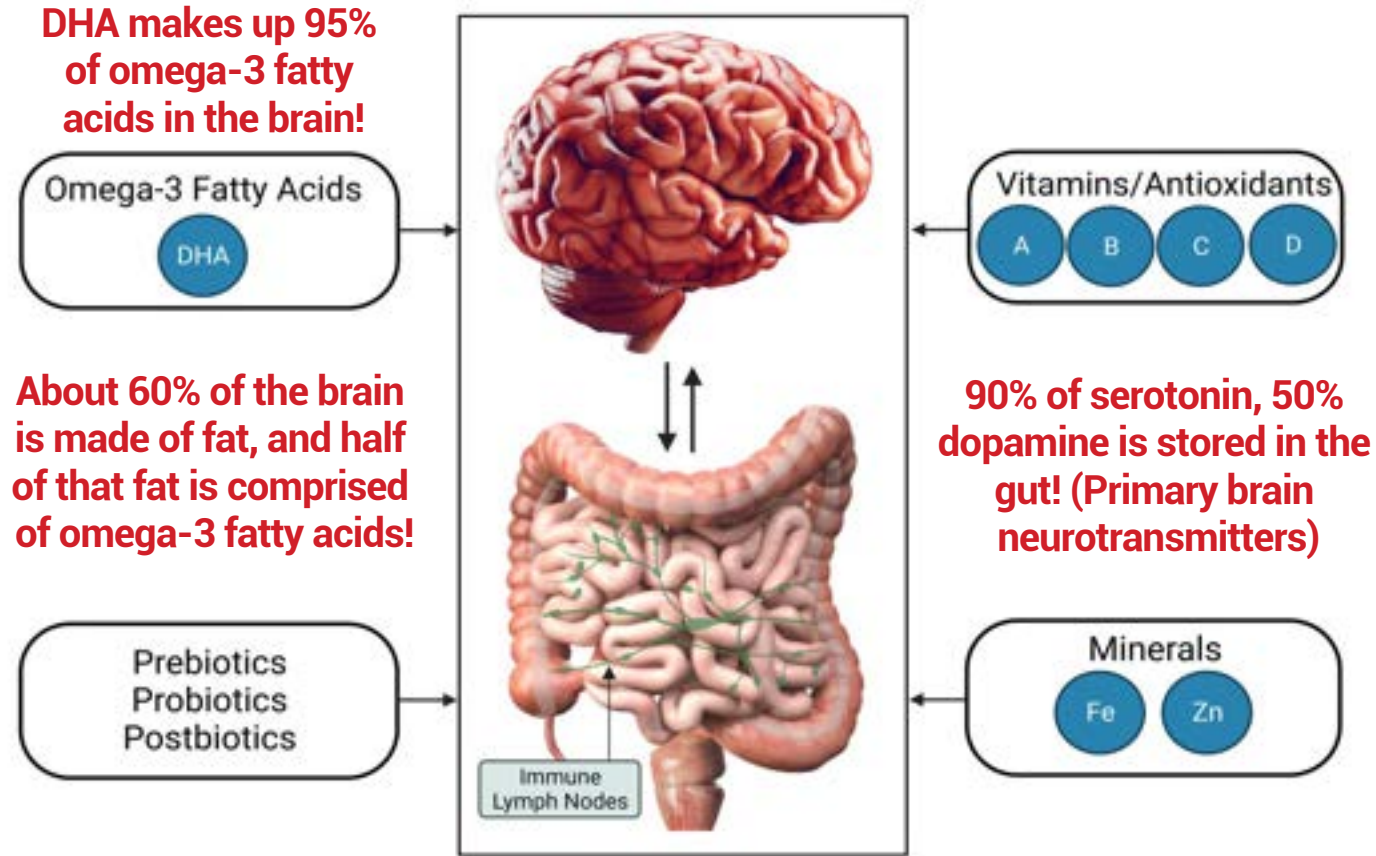
**Aluminum was identified as orange fluorescence in grey and white matter of the brain**



Mirza A, King A, Troakes C, Exley C. The Identification of Aluminum in Human Brain Tissue Using Lumogallion and Fluorescence Microscopy. *J Alzheimers Dis*. 2016;54(4):1333-1338. Figure 3.



# What Neutralizes, Protects, & Enhances



Reference: 21-23, 26, 53-58

***“Maternal supplementation with very-long-chain n-3 fatty acids during pregnancy and lactation augments children's IQ at 4 years of age.”***

Helland IB et al. Pediatrics. 2003 Jan;111(1):e39-44 Institute for Nutrition Research, University of Oslo, Oslo, Norway.

***“The children supplemented with multivitamins performed “significantly better than the placebo in reading speed, learning capacity, and arithmetic examinations”***

Wei Sheng Yan Jiu. 2003 Sep; 32(5): 455-8. Institute of Health Foods, Zhejiang Academy of Medical Science, Hangzhou 310013, China.

## Genetics vs Epigenetics

- **Where you live**
- **How you live**
- **What you eat**
- **What you do**
- **What you are exposed to in the environment**
- **How your body, mind, and genes respond to your environment**
  
- Epigenetic effects due to deficient nutrition, diet, lack of essential nutrients;  
*Vitamins, Minerals, Essential fatty acids, Amino acids.*
  
- Epigenetic effects due to xenobiotic exposure and accumulation;  
*Lead, Mercury, Aluminum (metals) Phthalates (plastics) Bisphenol-A (plastics)  
PBDEs (fire retardants) Pesticides (foods)*



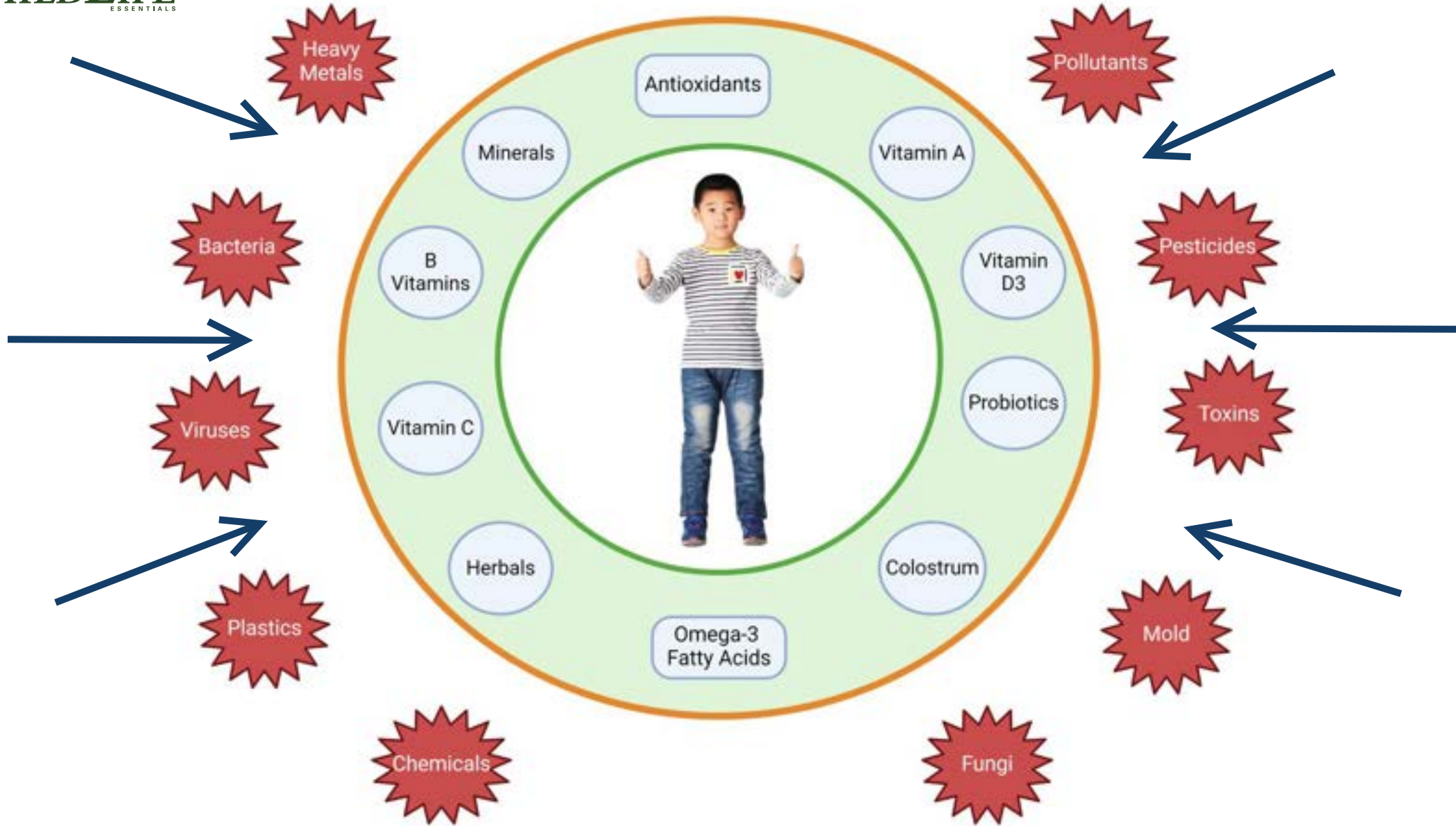
## Human Health & Longevity

**Both genetic background and lifestyle factors influence human longevity. A family study on about 475 million individuals have found the heritability of longevity genes at around 7%.**

Passarino G, De Rango F, Montesanto A. Human longevity: Genetics or lifestyle? It takes two to Tango. *Immunity & Ageing*. 2016;13(1). doi:10.1186/s12979-016-0066-z

**Epigenetic modifications, modulated by both genetic background and lifestyle, can influence the rate and quality of aging. In a study comparing 202 families, researchers have shown that 25% of the variation in human longevity can be due to genetic factors.**

Montesanto A, Latorre V, Giordano M, Martino C, Domma F, Passarino G. The genetic component of human longevity: Analysis of the survival advantage of parents and siblings of Italian Nonagenarians. *European Journal of Human Genetics*. 2011;19(8):882-886. doi:10.1038/ejhg.2011.40



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6. Eczema stats. National Eczema Association. September 5, 2023. <https://nationaleczema.org/research/eczema-facts/>.
7. Facts and statistics. FoodAllergy.org. <https://www.foodallergy.org/resources/facts-and-statistics>.
8. Sender R, Fuchs S, Milo R. Revised estimates for the number of human and bacteria cells in the body. *PLOS Biology*. 2016;14(8). doi:10.1371/journal.pbio.1002533
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