Gut and Brain Connection:

A New Look

By William L Wilson, M.D.

Central Nervous System

- Conscious and unconscious mental processing
- Monitor internal & external environments
- Auto-regulatory functions
- Regulates food intake & metabolism
- Traditional view**: the brain is the master control center and works through a top down process**

Enteric Nervous System

- Controls movement through GI tract
- Regulation of fluid exchange and local blood flow
- Regulation of gastric and pancreatic secretion
- Regulation of GI endocrine cells
- Defense reactions
- Entero-enteric reflexes
- **Traditional view:** ENS controls the GI tract

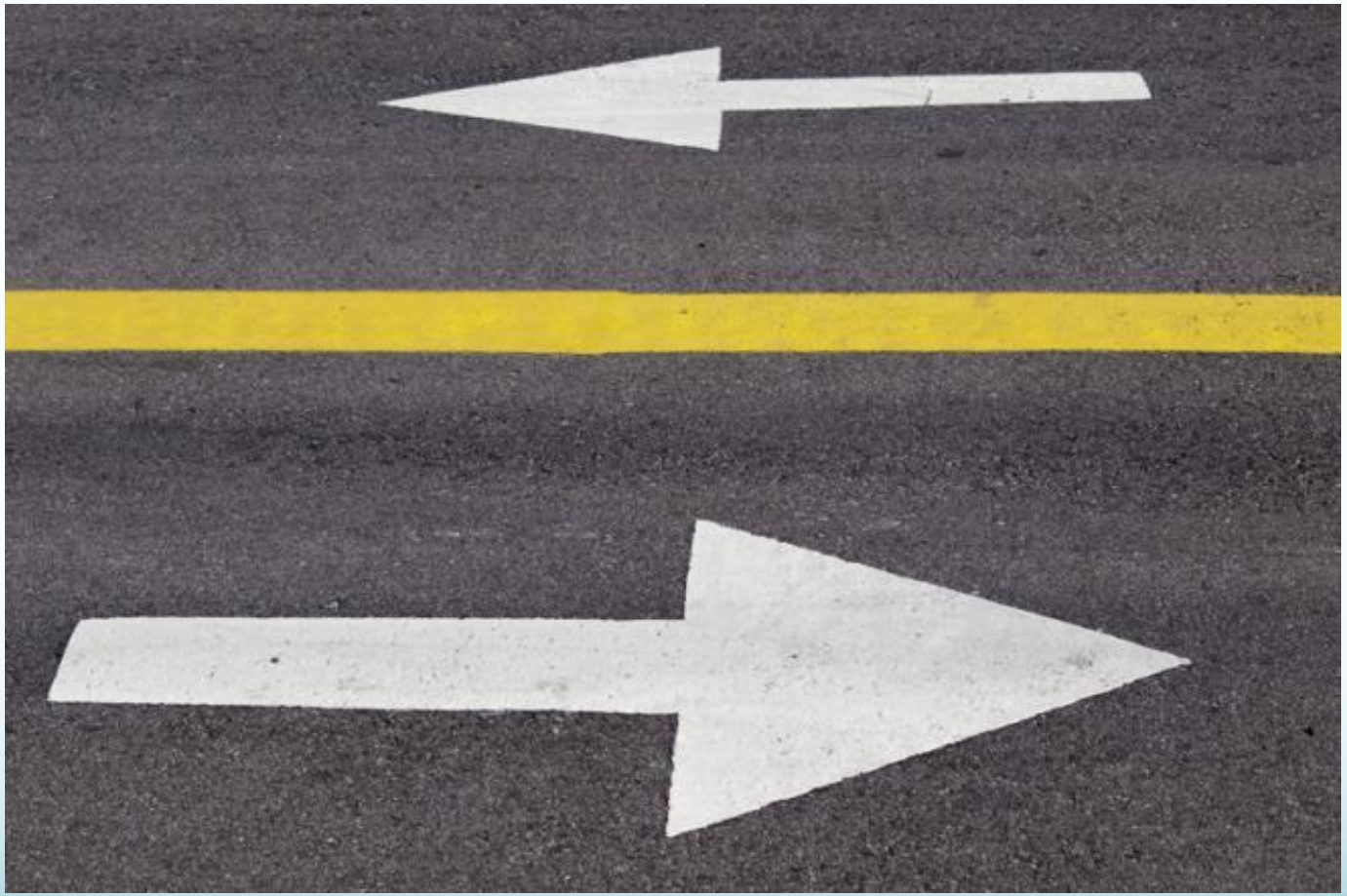
Gut Brain Connection: A Triad

- Central nervous system
- Enteric Nervous system
- Microbiome or microbiota

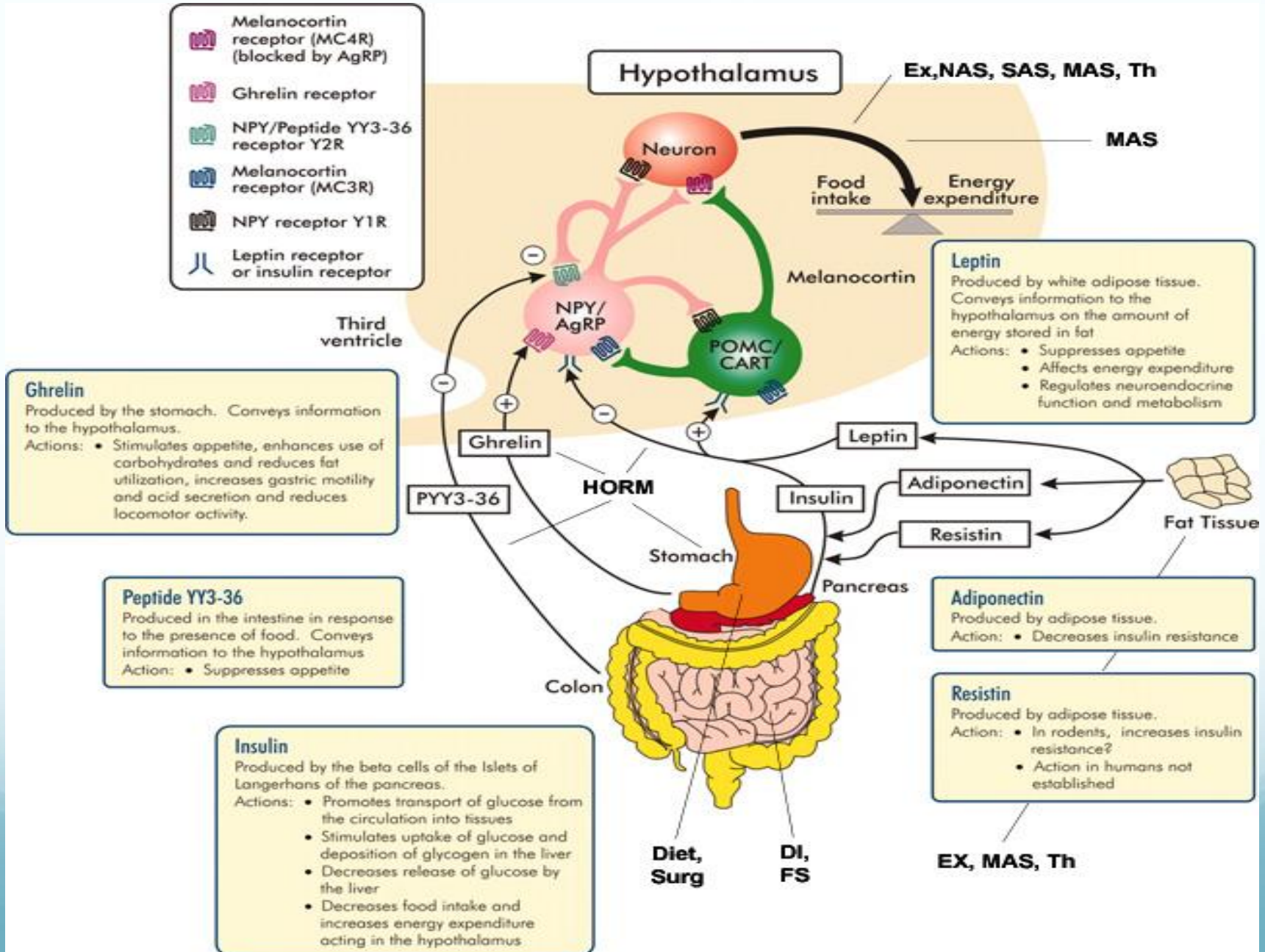
Gut Brain Connections

- Hormonal signaling
- Nervous system connections
- Microbiome CNS & ENS interactions

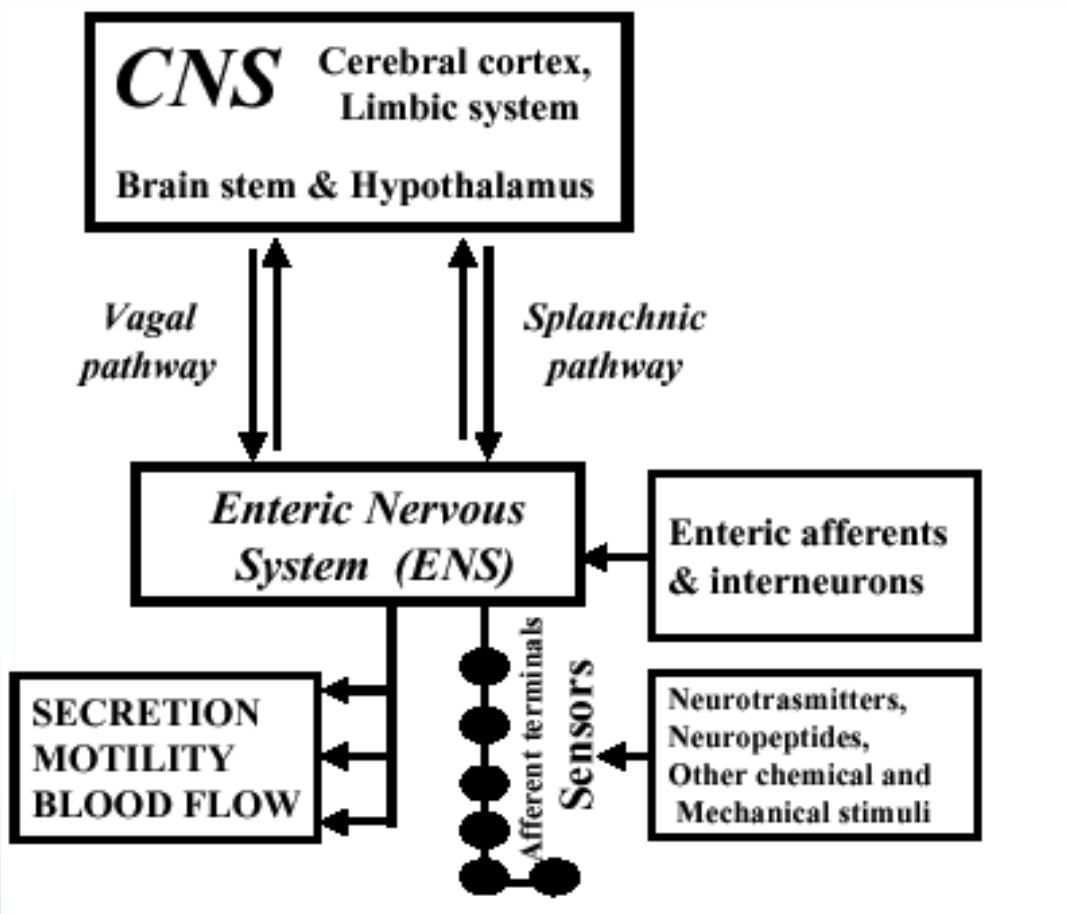
Gut Brain Communication: A Two Way Street



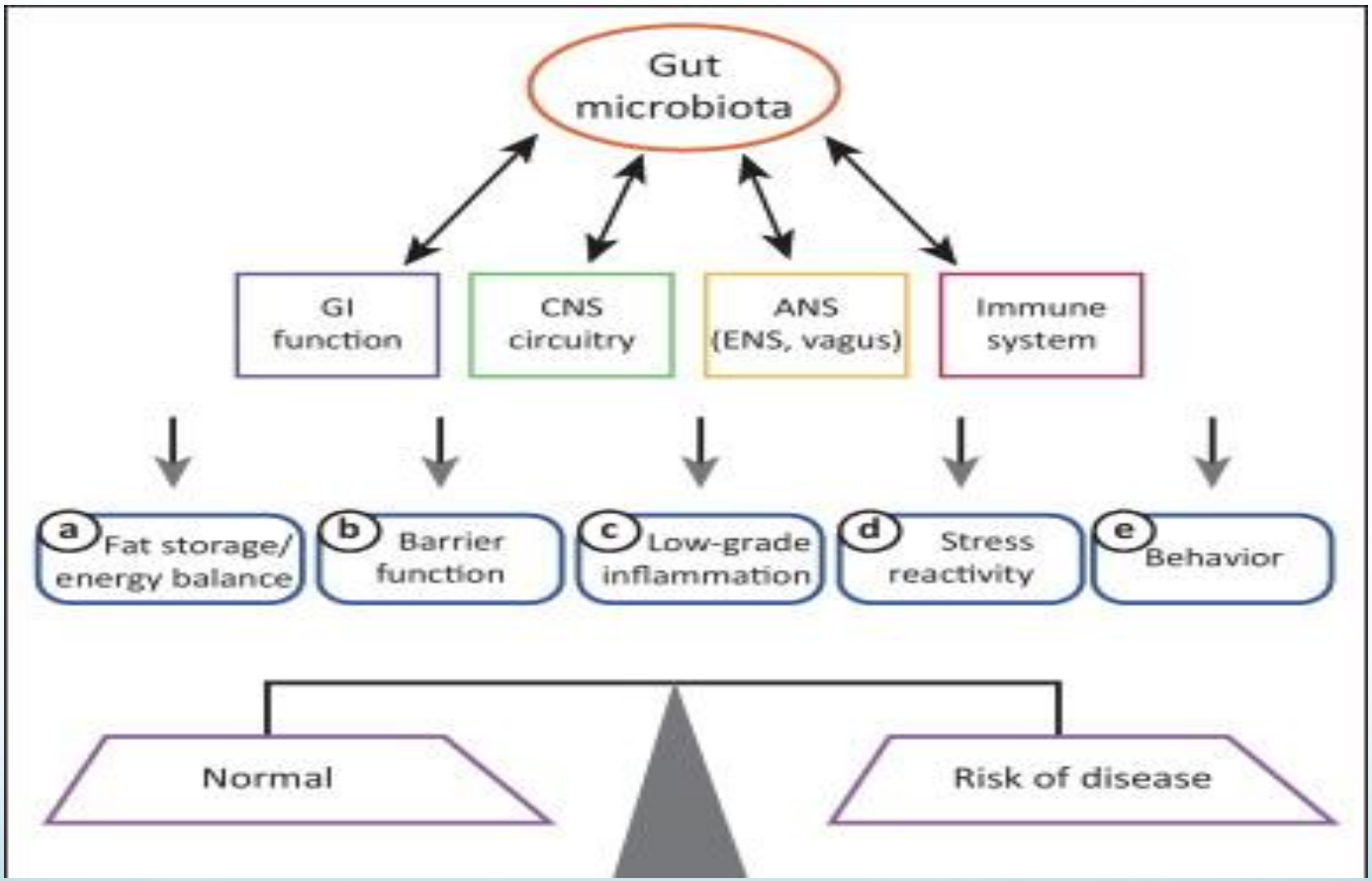
Hormonal Signaling



CNS-ENS Nerve Connections



Influence of Microbiome



Empirical Observations: Diet and Autism

- **GI symptoms** are often co-morbid in autism.
- **Dietary changes** often seem to influence autistic symptoms (gluten free, casein free diets).
- **Food allergies** are common in autism.
- **Selective eating patterns** and food aversions common in autism.
- Many with autism seem to have a **“leaky gut”**.

Popular Dietary Approaches: Weak Evidence of Efficacy

- **GAPS diet:** **Dr. Natasha Campbell-McBride. No high quality studies supporting approach to date. Lots of empirical support.**
- **Nambudripad's Allergy Elimination Techniques (NAET):** **No high quality studies supporting this approach.**
- **Gluten/Casein Free Diets:** **A few small studies suggesting benefits for some patients. Lots of empirical support.**
- **Elimination Diets:** **More individualized approach. Lacking evidence. Some empirical support.**
- **Supplement Diets:** Fatty acids, vitamins, minerals, other supplements. **Lacking high quality controlled trials.**

The Current State of Research on the Gut/Brain Connection: A Lot of Action But Not a lot of Scoring!

Gut/Brain Connection: Where's the Beef (Evidence)?

- **"Alterations of the Intestinal Barrier in Patients With Autism Spectrum Disorders and in Their First-degree Relatives"** Magistris et al; JPGN, **2010**: **A high percentage of autism patients have a "leaky gut". Those on gluten/casein free diet had less leaky gut.**

- **"Feeding Problems and Nutrient Intake in Children with Autism Spectrum Disorders: A Meta-analysis and Comprehensive Review of the Literature"** Sharp et al; JADE, **2013**: **Children with autism experienced significantly more feeding problems (selective eating) versus peers. Reduced calcium and protein intake noted.**

- **"The ScanBrit randomised, controlled, single- blind study of a gluten- and casein-free dietary intervention for children with autism spectrum disorders"** Whiteley et al; Nutritional Neuroscience, **2010**: **Gluten/Casein free diets benefits a subset of children with autism.**

- **“Glucose Levels and Risk of Dementia”** Crane et al; NEJM **2013**: **Elevated glucose levels increase risk of dementia. Autism & insulin resistance have been connected in previous studies.**

- **“Consumption of Fermented Milk Product with Probiotic Modulates Brain Activity”** Tillisch et al; **2013**: Gastroenterology: **Fermented milk product with probiotics affects cognitive functioning in healthy women. First study in humans documenting that microbiome can directly influence brain function.**

- **“Gastrointestinal Microflora Studies in Late-Onset Autism”** Finegold et al; CID: **2002**: **Late onset autism associated with abnormal gut flora with more clostridia species**.

Areas of Interest For Future Research

- Emerging evidence that processed foods can adversely affect CNS, ENS and gut integrity.
- Processed foods may be associated with diffuse brain dysfunction.
- Likely triggers: excessive fructose (sugar, HFCS), high glycemic carbohydrates (grains), excessive omega 6 fatty acids.
- New disease model: Carbohydrate Associated Reversible Brain syndrome (CARB Syndrome).

CARB Syndrome

- Characterized by up to 22 brain dysfunction symptoms that overlap with common disorders like autism.
- Associated with metabolic problems: insulin resistance, obesity.
- Extremely common disorder.
- Most people with CARB syndrome do not have autism.
- Many with autism do appear to have CARB syndrome.
- Treat the CARB syndrome (dietary measures, supplements), people with autism function much better.
- May explain subset of autism patients who respond well to dietary changes.

Take Home Message

- When it comes to diet and autism, more research is needed.
- **Empirical approach**: use low risk strategies like elimination of gluten, casein, sugar and processed foods.
- **Paleo diet**: may have benefit for many brain disorders because it eliminates pro-inflammatory foods.
- Eat a diet of high quality whole foods, avoid processed foods

Ren Wintour: Diagnosed with severe autism age two. Went on gluten/dairy free diet and eliminated foods causing allergies. He now functions almost normally**.**