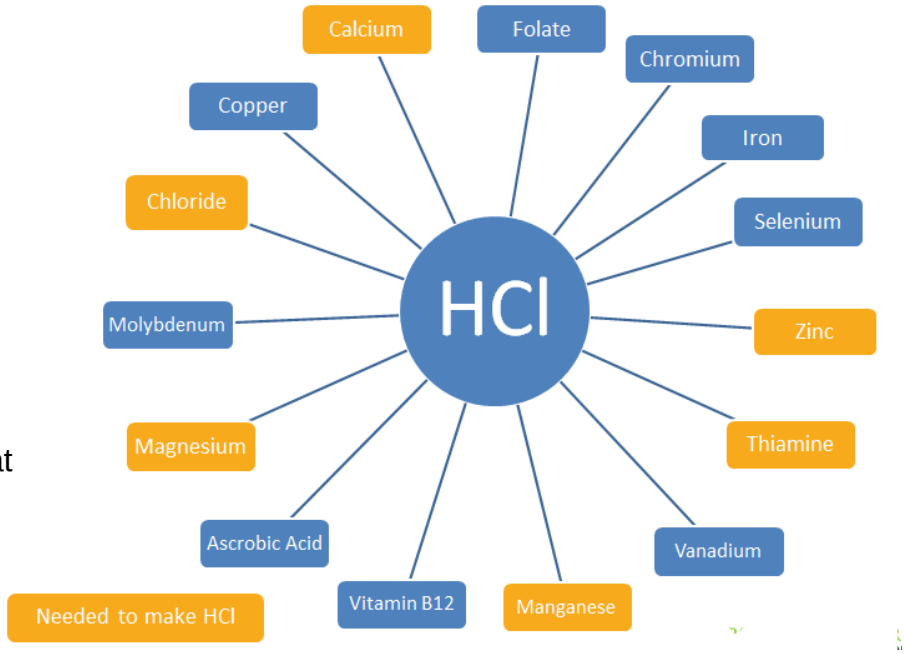
Optimizing Gut Health in Children with Down Syndrome

Oral - Chewing

- Optimize oral muscle tone
- Support nerves that innervate oral muscles and tongue
- Exercise and sensory input to improve muscle function
- Starting solid foods too early can lead to gut issues - wait for good head control and first tooth
- https://www.youtube.com/watch?v=kNjOYhalGAU

Stomach - HCl

- Needed for protein digestion and vitamin & mineral absorption
- Triggers gallbladder contraction
- Helps to cleanse upper portion of small intestines
- Requires healthy vagus nerve function
- Requires histamine
- High histamine can cause hyperchlorhydria
- Acid blockers do not properly treat root cause of 90% of reflux
- Acid blockers lead to mineral deficiencies and bone loss



Gallbladder - Bile

- Needed for fat absorption, acts like soap
- Bile synthesis is heavily dependent on optimal methylation
- Nutrients that support production of bile: phosphatidylcholine, taurine, glycine, B12, folate
- Elevated copper is sign of poor bile flow
- Bile helps to cleanse upper portion of small intestines
- Infants, children and adults with Down syndrome have an increased risk of bile sludge and gallstones

Small Intestines - Absorption/Motility

- The gut is a muscle, root cause of low muscle tone will also causes slow gut motility
- Slow gut motility leads to yeast and/or bacterial overgrowth (SIBO)
- Yeast and bacterial overgrowth create significant problems with absorption of macro and micronutrients.
- 75% of immune system is in the small intestines, communicating with bacteria inside the gut

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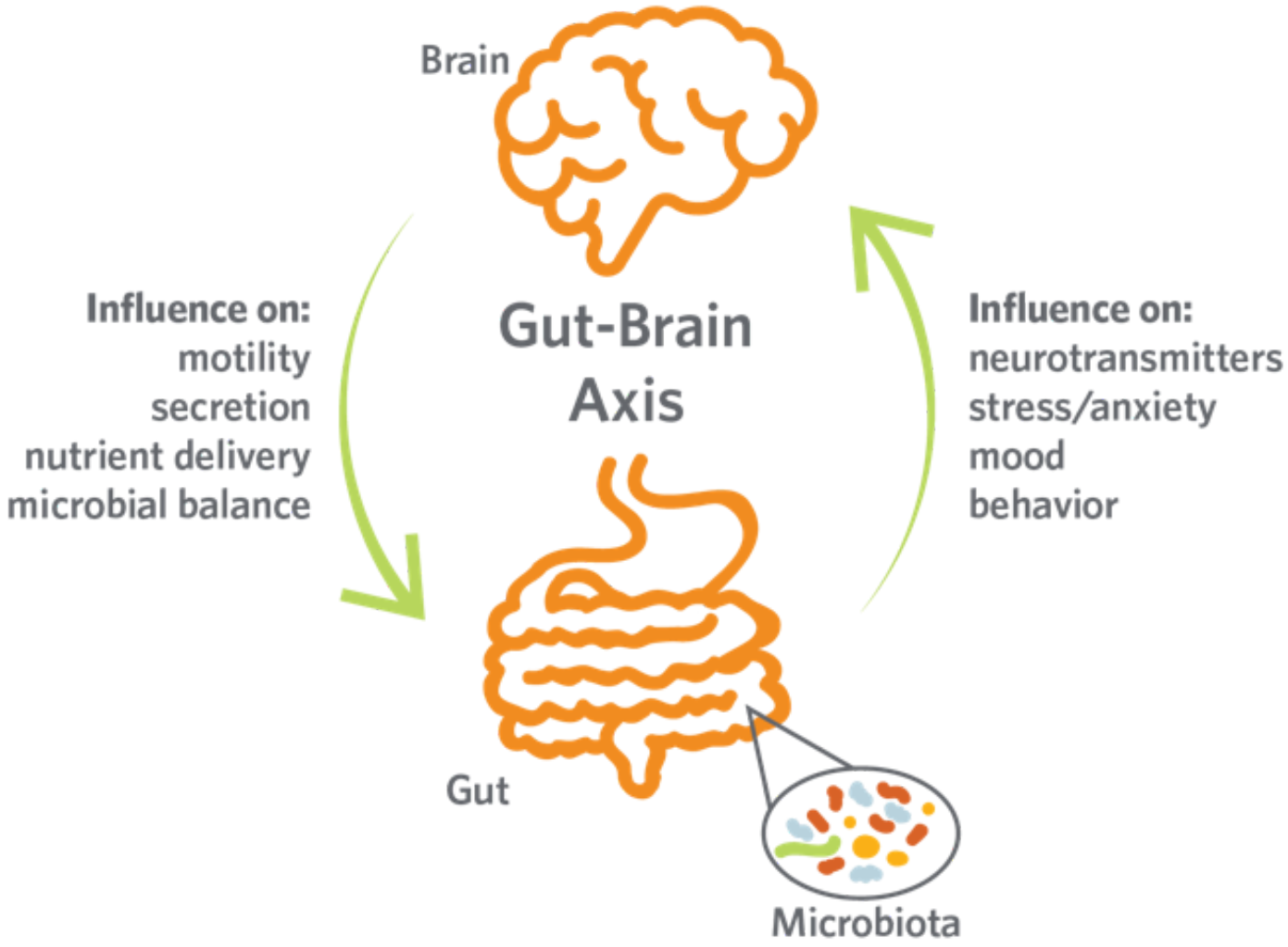
Large Intestines - Microbiome



- Gut bacteria can produce neurotransmitters - serotonin, dopamine, noradrenaline, GABA, acetylcholine and histamine.
- Gut-brain axis can influence emotion, behavior and cognition.
- Gastrointestinal microbiome can play significant role in immune system function.
- Overuse, or in some cases just one time use, of antibiotics can cause significant changes to the gut microbiome that can impact brain function leading to increased anxiety, depression, irritability, sleep disturbances and cognitive changes.
- Candida (yeast) overgrowth creates metabolites that interfere with absorption of vitamins like thiamine that can have detrimental effects on the central and peripheral nervous system.
- Inflammation in the gut disturbs tryptophan metabolism which lowers serotonin levels and results in elevations of quinolinic acid in the brain which ultimately results in neuron destruction.

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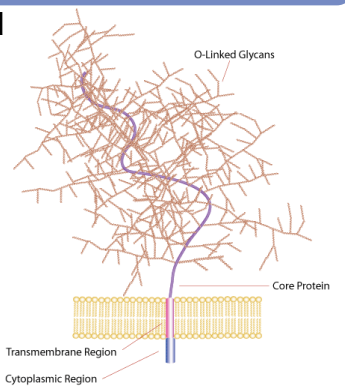
Mucin

- Glycosylated proteins that are either attached to a membrane or released
- Found in respiratory tract, digestive tract, gallbladder, reproductive tract, urinary system, eyes and ears.
- Forms a protective barrier to outside organisms (bacteria, yeast, viruses)
- Involved in bile viscosity
- Feed and protect healthy bacteria
- Sulfation is essential step in mucin formation
- Low mucin levels lead to increased gut permeability and infections
- Separates self from non-self and prevents autoimmune reactions



Cholecystokinin

- A hormone released in the gut that is also one of the most the abundant and widely distributed neuropeptides in the brain
- Involved in feeling of satiety and sleepiness within central nervous system
- Triggers release of bile from gallbladder and digestive enzymes from pancreas
- Increases colonic motility
- Ways to increase: olive oil, beans (careful if SIBO is present), protein with every meal, optimize HCl synthesis

Acetylcholine

- A neurotransmitter released by nerve cells to send signals to other cells (neuron, muscle cell, gland cells)
- One of the most important concepts to support gut health in children with Down syndrome
- Essential for optimal gut motility, gallbladder contraction and pancreatic function
- Made from choline and an acetyl group
- Requires optimal glucose metabolism (glucose → pyruvic acid → acetyl CoA)

Action Plan

- Treat constipation at root cause
- Optimize gut motility by supporting ACh synthesis (choline, vitamin B1, vitamin B2, vitamin B5)
- Watch for signs and symptoms of SIBO, yeast overgrowth, gallbladder issues
- Support mucin production with magnesium sulfate baths, aloe, n-acetyl glucosamine
- Feed but bacteria plenty of fiber so they don't feed on mucin
- Avoid antibiotics whenever possible
- Wean from acid blockers while supporting gut motility (most common root cause of reflux)

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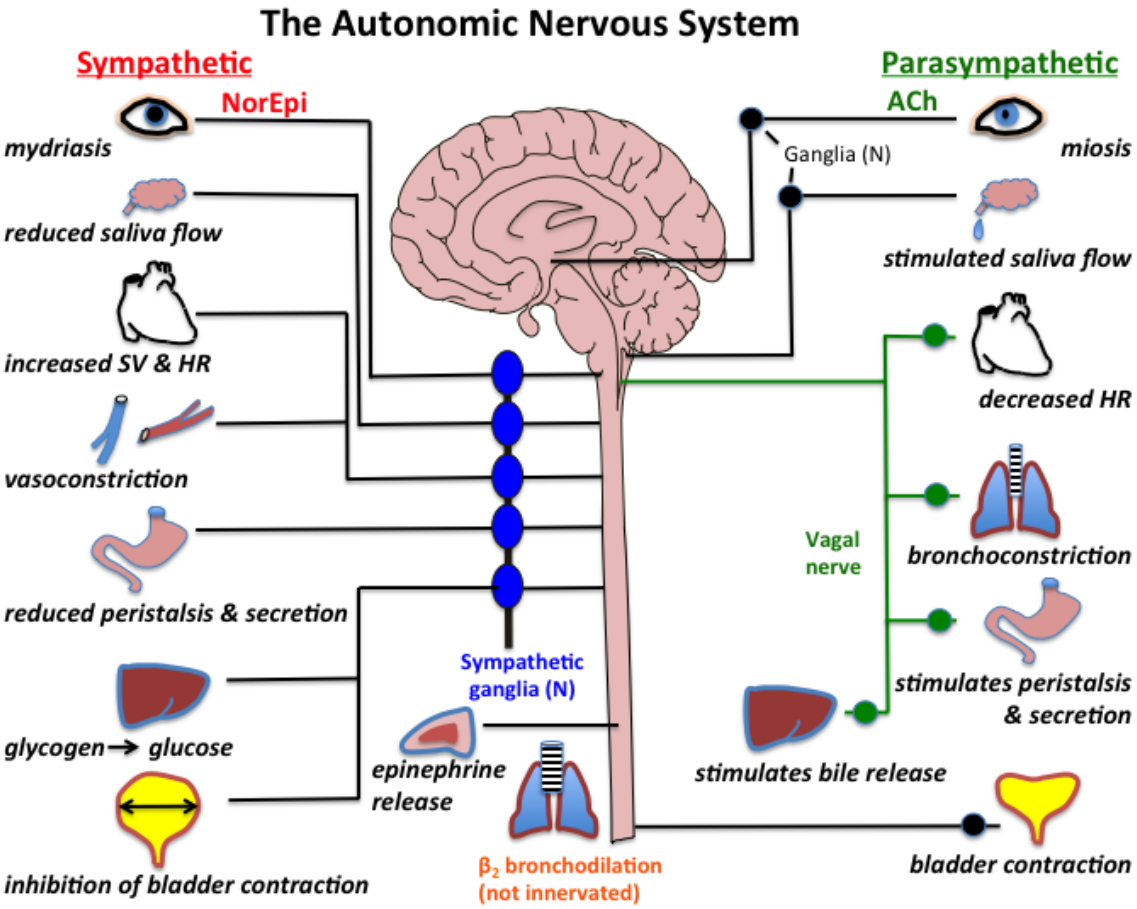

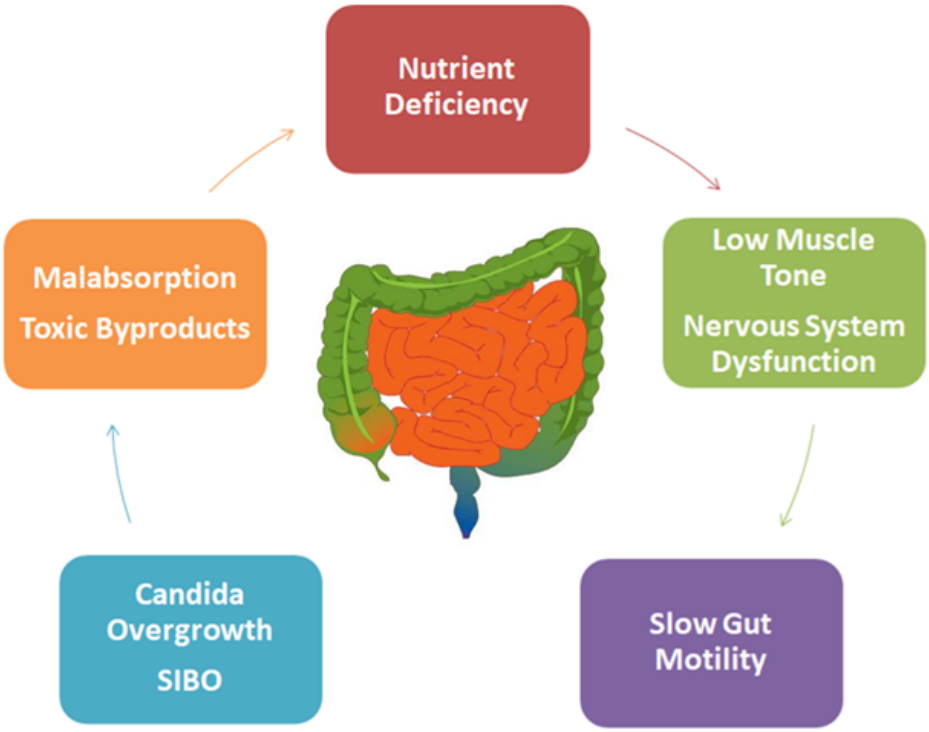

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Optimal Diet for Children with Down Syndrome

Foods to Avoid	Reason
✕ Dairy	• Higher rate of cow's milk protein intolerance • Can cause/contribute to constipation respiratory issues and ear infections
✕ Sugar	• Provides source of glucose without B vitamins necessary for metabolism • Depletes B vitamins • Impaired glucose metabolism impacts cognition and leads to increased BMI • Over-consumption contributes to yeast overgrowth
✕ White rice	• Source of glucose without B vitamins necessary for metabolism • Source of arsenic that impairs thiamine absorption • Over-consumption causes vitamin B1 deficiency
✕ Gluten	• Increased rate of non-celiac gluten sensitivity (NCGS) • Increases gut inflammation and linked to neuroinflammation in NCGS • Contributes to thyroid autoimmunity • Increases intestinal permeability
✕ Simple/white carbs	• Low in fiber • High in glucose - B vitamins are absent • Low in vitamins and minerals

Optimal Diet for Children with Down Syndrome

Foods to Encourage	Reason
☑ Fruits and Vegetables	• Source of fiber • Source of antioxidants • Source of vitamins and minerals
☑ Olive oil	• Increases cholecystokinin secretion • Source of polyphenols
☑ Coconut oil	• Mean chain triglyceride (MCT) that doesn't need bile for absorption • Shown to improve cognitive function in Alzheimer's disease
☑ Meat	• Source of choline, carnitine, creatine, cholesterol, vitamin B12 and iron
☑ Eggs	• Source of choline, vitamin B2, vitamin A and vitamin D
☑ GF Oats	• Healing to the gut (mucilaginous) • Prevents ketosis in children • Source of B vitamins • Source of fiber and resistant starch
☑ Bone broth	• Helps heal leaky gut • Source of collagen and gylcine • Limit in those with elevated histamine
☑ Organic Whole Foods	• More nutrient-dense • Avoids pesticides like glyphosate

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