VibrantWellness

Intestinal Permeability *(Leaky Gut)*

What is Intestinal Permeability?

Intestinal permeability is a feature of the **intestinal barrier** that lets the body selectively absorb essential fluids and nutrients from the digestive tract while keeping out harmful microorganisms and toxins in the gut lumen.[1] [2]

What Is the Intestinal Barrier?

The intestinal barrier acts as a guard between our body and the gut lumen. It consists of:

- **Mechanical elements**, including the epithelial layer, mucus[1]
- **Humoral elements**, including secretory IgA and antimicrobial peptides (e.g., defensins, lysozyme)[1] [3]
- **Immunological elements**, including innate immune cells and lymphocytes[1]
- **Muscular and Neurological elements**[1]

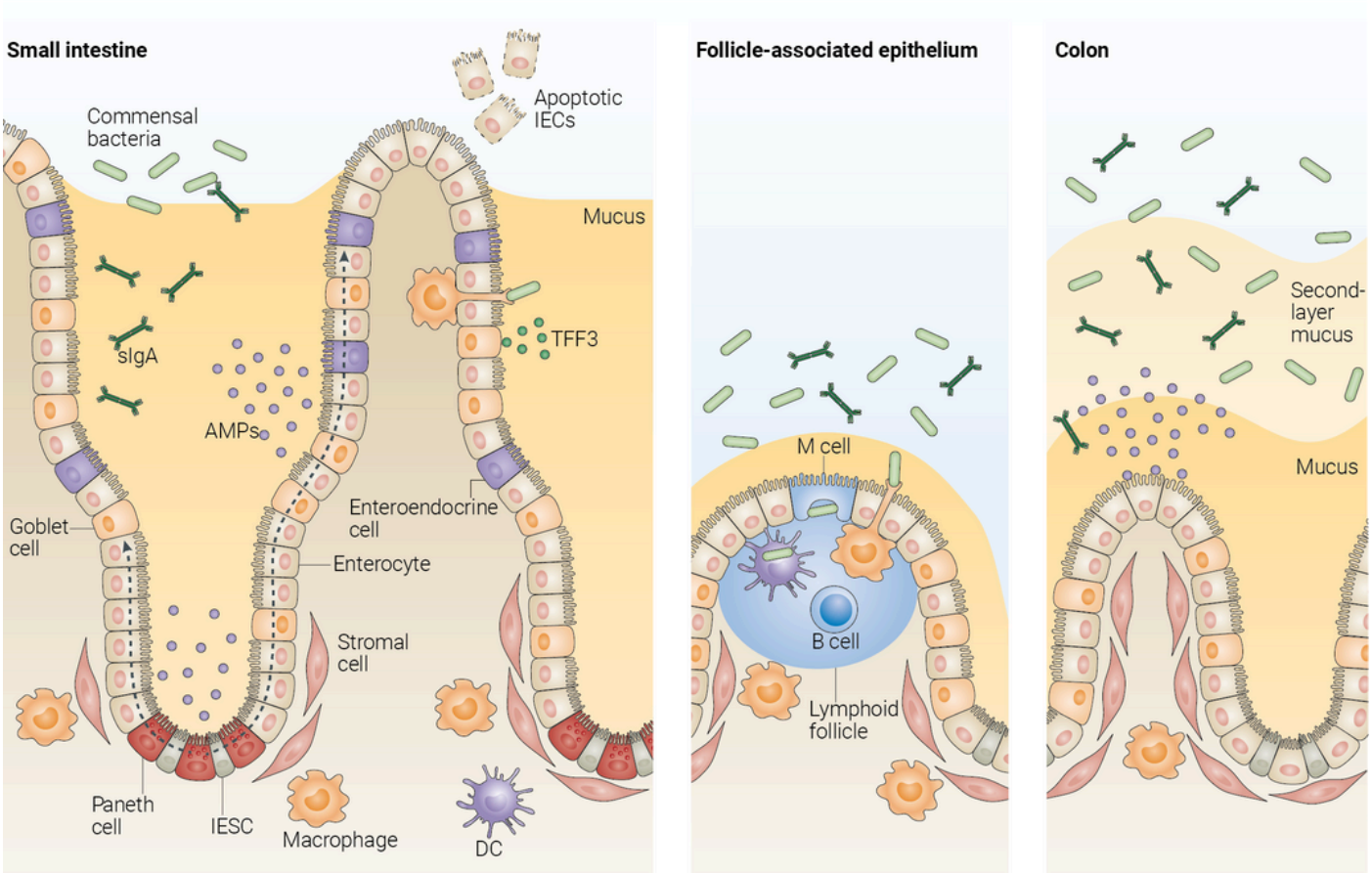


Image Credit:
Peterson, L., Artis, D. Intestinal epithelial cells: regulators of barrier function and immune homeostasis. Nat Rev Immunol 14, 141–153 (2014). https://doi.org/10.1038/nri3608

What Is Intestinal Hyperpermeability *(a.k.a. "Leaky Gut")?*

Intestinal **hyperpermeability** or "leaky gut" occurs when the intestinal integrity is compromised, causing a loss of intestinal homeostasis, functional impairment, or disease.[1]

The primary mechanism involves the **opening of intercellular tight junctions.**[4] If the intestines become too permeable, substances from the gut (external environment) can enter the bloodstream (body/internal environment), leading to inflammation.

What Factors Contribute to Intestinal Hyperpermeability?

Many factors contribute to hyperpermeability, including:

Dietary factors

- Western style diet[1]
- High fat diet[1]
- High fructose intake[1]
- Vitamin A deficiency[1]
- Vitamin D deficiency[1]
- Flavonoid deficiency[1]
- Butyrate deficiency[1]
- Alcohol consumption
- Environmental toxin exposure

Medications

- Antibiotics use[1 11 12 13]
- Nonsteroidal anti-inflammatory drugs (NSAIDS)[14]
- Proton pump inhibitors (PPIs)

Lifestyle Factors

- Chronic psychological stress[5 6]
- Smoking tobacco[7]
- Excessive exercise, particularly in hot conditions[8 9 10]

Gut conditions

- Dysbiosis[13 15]
- Small intestinal bacterial overgrowth (SIBO)
- Yeast overgrowth (*Candida albicans*)
- Parasites
- Low gastric acid production
- Low Akkermansia muciniphila levels
- Food sensitivities

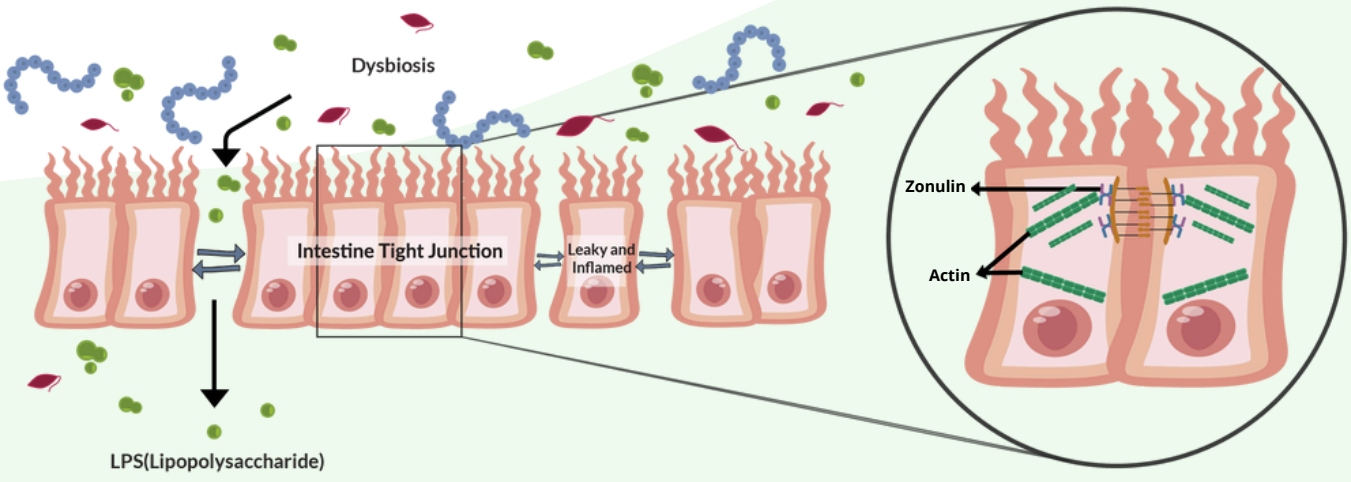
Associated Health Conditions

Both gut-specific and wider health issues have been linked to alterations in the intestinal barrier:

1. **Digestive:** Inflammatory bowel disease (IBD), irritable bowel syndrome (IBS), cancer, and food sensitivities[1 2]
2. **Systemic:** Depression, anxiety, migraine headaches, muscle pain, chronic fatigue, anxiety, mood swings, brain fog, micronutrient deficiencies, obesity, metabolic diseases[1]
3. **Autoimmune:** Celiac disease[16], rheumatoid arthritis, Type 1 diabetes[16], asthma, and Hashimoto's thyroiditis

Vibrant's Intestinal Hyperpermeability Test

The Intestinal Permeability test available through Vibrant Wellness measures zonulin levels and blood antibodies to three important biomarkers: **zonulin, actin, and LPS (lipopolysaccharide).**



Key Biomarkers Explained

Zonulin

- Zonulin, discovered in the early 1990s, regulates intestinal permeability. In other words, it acts as a “gatekeeper protein.” When zonulin is present or released, it causes the tight junctions in the gut to loosen, triggering increased gut permeability. Hence, zonulin levels serve as an indicator of gut permeability. If there are high zonulin levels in the blood or if there are antibodies against zonulin present, it suggests that the tight junctions are compromised and the intestinal barrier is damaged.[4] [16] [17]
- Bacterial imbalance and gluten consumption are the most powerful triggers of zonulin release and subsequent intestinal hyperpermeability.[4]
- Zonulin receptors are found on the blood-brain barrier. When zonulin binds to these receptors, it can open the brain's tight junctions. This establishes a link between a "leaky gut" and a "leaky brain."

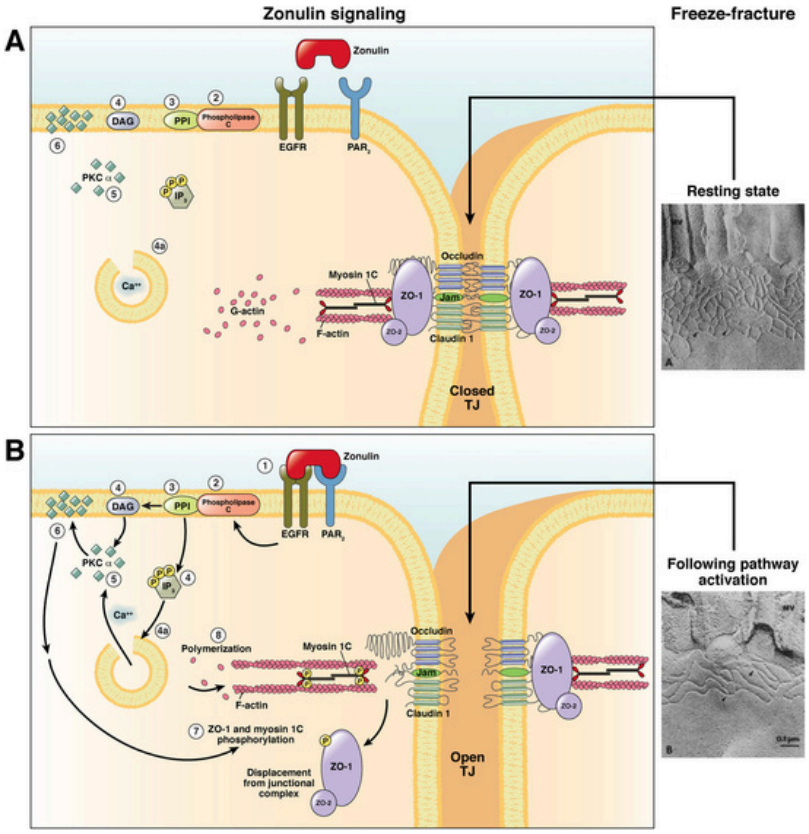


Image Credit:
Fasano A. Intestinal permeability and its regulation by zonulin: diagnostic and therapeutic implications. Clin Gastroenterol Hepatol. 2012;10(10):1096-100. https://doi.org/10.1016/j.cgh.2012.08.012

Actin

- Actin is one of the most abundant proteins in the human body. It’s most known for its role in muscle contraction (filamentous actin interacting with myosin). However, it is also essential for many cellular functions. For example, actin’s transition from monomeric (G-actin) and filamentous (F-actin) states allows cells to divide (cytokinesis), move, and change shape.[17] [18]
- When zonulin triggers the tight junctions to open, actin helps pull the cells apart.[17]
- In addition to attaching intestinal cells together, actin also serves to anchor the microvilli to the cell membrane barrier. In other words, actin is essential to the structure (cytoskeleton), and thus the health, of the cell.
- Antibodies to actin in the bloodstream can indicate compromised structural integrity of intestinal tight junctions or microvilli.[19]

LPS (Lipopolysaccharide)

- Our digestive tract is home to trillions of microorganisms, including gram-positive (+) and gram-negative (-) bacteria.
- Lipopolysaccharide (LPS) is an important component of the outer membrane of gram-negative bacteria. As gram-negative bacteria grow, they constantly shed LPS. Therefore, LPS is naturally present in the gut.[20] [21]
- When the gut becomes hyperpermeable (often referred to as "leaky"), LPS can seep into the bloodstream, leading to endotoxemia. Several factors can exacerbate this: an unusually high presence of LPS-producing bacteria in the gut, or when using antibiotics or antimicrobials, which cause these bacteria to release more LPS upon dying. Furthermore, when there's an excessive growth of gram-negative bacteria outside the digestive system, LPS plays a significant role in causing sepsis.[22]
- Endotoxemia briefly increases inflammation throughout the body. This happens because the immune system reacts to bacterial LPS as if it's facing a full-fledged bacterial invasion. If endotoxemia is chronic, it can heighten the risk of several chronic illnesses, such as cardiovascular disease, metabolic syndrome, liver diseases associated with metabolic dysfunction, chronic fatigue, obesity, depression, and autoimmune disorders.[23]

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