Intestinal Barrier Dysfunction and Systemic Inflammation. An intact gut barrier is necessary to monitor and keep toxins, allergens, and bacteria from invading the mucosa. The gut barrier is a complex system and depends on anatomic tight junctions, immune function, antimicrobial chemicals, and digestive enzymes. Disruptions in barrier dysfunction lead to heightened immune activation in the gut, which leads to circulation of cytokines and a systemic inflammatory response (Neu, Douglas-Escobar, & Lopez, 2007). Pathogenic microbes and intestinal barrier dysfunction may cause an inflammatory response by interacting and activating lymphocytes, mast cells, and dendritic cells that mediate release of inflammatory mediators. Also, abnormal antigen exposure may lead to diseases characterized by local inflammation (such as IBD, NEC, and celiac), antigenic mimicry (such as Type 1 diabetes), imbalance Th1/Th2 (atopic disease), and systemic inflammation (e.g., systemic inflammatory response syndrome, sepsis, bad neurologic outcome).

Figure 7.2. Interplay of the Emotional Motor System (EMS) and Gastrointestinal Pathophysiology Stress, abuse, and emotional feelings influence bowel symptoms via activation of the brain’s central circuitry, called the emotional motor system (EMS), to produce autonomic and neuroendocrine responses. Bowel symptoms then cause more distress, triggering the release of mediators (cytokines, cortisol, and adrenaline) which act on the EMS, producing a feed-forward cycle of bowel symptoms and emotional distress.

Figure 7.3. Host Defenses against Small Intestinal Bacterial Overgrowth. The upper gastrointestinal tract is sparsely populated with gut coliforms. The protective mechanisms for maintaining relative gut sterility include: stomach acid; proper absorption of fermentable carbohydrates; gastric, intestinal and pancreatic enzymes; gastrointestinal motility; mucosal immunity; and an intact (competent) ileocecal valve, which serves as a barrier between the terminal ileum and colon.
**Figure 7.4.** Small Intestinal Bacterial Overgrowth. In (A) there is a normal distribution of intestinal bacteria that does not ferment poorly digestible starches, such as beans, until they reach the large intestine. In (B) there is small intestinal bacterial overgrowth, where the easily (rice) and poorly (beans) digestible carbohydrates are fermented in the small intestine by the bacteria, due to their overpopulation. Reprinted with permission from *JAMA*, 292(7):852–858. Copyright © 2004, American Medical Association. All rights reserved.

**Figure 7.5.** Fermentation and Gas Dynamics. Undigested starches are fermented by gut coliforms into hydrogen, methane, and other gases. These gases equilibrate and are absorbed into the blood stream, diffuse through pulmonary capillaries, and are excreted in the breath. This allows for the detection, by breath testing, of intestinal gases as by-products of fermentation of indigestible starches.
**Figure 7.6.** Role of Alternative Strategies in the Treatment of SIBO-IBS. Dysbiosis of the gut can initiate and drive a proinflammatory process that results in systemic neuroendocrine stress factors to be elaborated. Impairments in the emotional motor system of the brain drive the distorted mind–body processes via altered gut motility, hormones, and sympathetic nervous system overdrive.

**Figure 7.7.** Factors Involved in the Pathogenesis of Interstitial Cystitis. The translocation of gastrointestinal bacterial byproducts across a leaky-defective barrier can trigger a mast-cell–centered immune inflammatory response throughout the common mucosal immune system, including the bladder. Localized production of inflammatory mediators (histamine, tryptase, cytokines, prostaglandins) sensitizes the pain response.
Figure 7.8. Clinical Outcome in SIBO-positive and SIBO-negative Patients Treated with Rifaximin.

Figure 7.9. SIBO as the Root Cause of Functional Digestive Conditions with Systemic Manifestations.
REFERENCES


