

The Digestive System Connected to the Nervous System

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The Digestive System

Our digestive systems begin secreting when we begin thinking about or smelling food. Chewing thoroughly is enormously important to effective and well-functioning digestion. On the tongue are nerve sensors for each taste, and stimulation of those taste receptors stimulates different effects in the body, for example the taste of bitter stimulates digestive secretions.

Good mucus coating in the esophagus facilitates smooth passage of food to the stomach. The stomach is lined with a thick layer of mucus to protect itself from hydrochloric acid. It has three layers of muscle fiber that cause the churning motion that helps mix food with stomach acids. Secretion and function of the stomach, small intestine and pancreas are orchestrated by both nerve receptors and hormones. There are endocrine cells in these organs which secrete gastrin, secretin, CCK and motilin, which help all these various activities happen accurately for what's been eaten.

From the stomach, food enters the small intestine where it's mixed with bicarbonate and enzymes from the pancreas. The bicarbonate neutralizes the food mixture so its pH is more neutral. The small intestine is highly folded, designed for maximum surface area to absorb nutrients. It doesn't have the mucus coating of the stomach, and is sensitive to the actions of herbs like astringents. All the blood that leaves the small intestine flows through the hepatic portal veins to the liver. The liver is the great recycle station where the bits of what we've consumed begin to be reorganized and sent out in the bloodstream. The function and wellbeing of the large intestine depends upon fiber and a healthy ecosystem. Its roles are primarily excretion of the waste of GI tract and the liver, and the reabsorption of water and a few other substances like bile acids. Peristalsis is rhythmic muscular contractions that propel food down the gut.

The Nervous System of the Digestive Organs

As a whole, the human nervous system operates in two modes: sympathetic, commonly known as 'fight or flight' when the body perceives a threat (stress), and parasympathetic, or 'rest and digest' mode. When the sympathetic mode is switched on, heart rate and breathing accelerate, and blood is directed toward the muscles for fast action, inhibiting digestion. In parasympathetic mode, we are relaxed and gastrointestinal secretion and motility increase.

The organs of digestion are served primarily by the Vagus nerve, one of the larger nerve networks in the body. It's divided into nerves in the submucosal layer that stimulate secretions and nerves deeper within the muscles of the gut which stimulate peristalsis. These nerves of course communicate with the brain through the central nervous system, but they are also rich in interneurons, or cross-links that enable the GI system to make most of its' own decisions.

The Enteric Nervous System (ENS) is comprised of:

- Sensory neurons that detect substances (what you've eaten) inside gut
- Stretch receptors that detect tension in the gut wall indicating bulk (food)

Motor neurons that direct digestive gland activities (secretion) and smooth muscle contraction (peristalsis)

Some of the neurotransmitters at work in the ENS include acetylcholine, norepinephrine, GABA, serotonin, substance P and vasoactive intestinal peptide. We recognize some of these also as hormones, and communication chemicals important also in mood, stress and immune response.

Hormones orchestrate much of homeostasis, or the maintenance of balance in the human being. This is quite a complex feat, and it's the balance, or relationship of hormones to one another that facilitates equilibrium. Hormones from many different glands, including the kidney, heart and organs not usually associated with the endocrine system, all function in relationship to one another, for example high levels of some feed back to reduce levels of others. That's how something like stress can impact other hormonal functions, like a late menstrual period or even changes to one's cycle.

The Connections

There are two ways that the condition of the gut tissue impacts, and can be impacted by the condition of the rest of the body. One is reflexive action – because the GI tract arises from the same cells in the embryo as respiratory and urinary tissue, they are all linked. When one consumes a demulcent herb like marshmallow, the soothing effect on the throat, stomach and intestines reflexively soothes the respiratory passages and urinary tubules. The actual mucilage doesn't have to travel through the blood . . . it can't anyway . . . the molecules are large, and not broken down until they get to the large intestine, past absorption! (Learn more about this in *Principals & Practice of Phytotherapy/Mills & Bone*)

The other is the 'tissue state' model, where tension, stagnation, weakness or hypersensitivity become generalized throughout the body. In this case, normalizing the overall tissue state will address both nervous and digestive systems, along with the rest of the body. For example stimulating sluggish digestive, liver and circulatory function will also stimulate better, quicker nerve and hormonal communication. (Learn more about this in *Practice of Traditional Western Herbalism/Wood*).

Because digestion is controlled by both nervous and endocrine systems, both can impact how well our GI tract functions. It's well known that stress is positively correlated with several GI conditions, including ulcers, irritable bowel syndrome/spastic colon and inflammatory bowel diseases including ulcerative colitis. Especially chronic stress promotes the body's secretion of inflammatory mediators – communication chemicals that the ENS recognizes that can initiate or exacerbate inflammation.

The state of the digestive organs and their function can also, conversely, affect one's mood. For example, stagnation in the gut—gas, bloating, constipation – can lead to feelings of gloom and depression. Irritation to the intestines, from food allergens, junk foods or poorly digested food, can result in irritability of the emotions as well. Anger is a well-known contributor to and effect of Liver Heat in TCM.

Actions of Herbs

Carminatives are aromatic herbs containing volatile oils. These small molecules help relieve gas, tension and spasm. They help the digestive process function smoothly and with ease.

Bitters are stimulating to the secretions of stomach, pancreas, liver and small intestines, and increase our ability to digest and assimilate our food.

Demulcents are slimy, mucilaginous herbs. They are made up of branched carbohydrate molecules that easily trap water and other molecules, causing them to swell and become like soft sponges. These herbs are very soothing to the gut walls and the nerves.

Nervines are relaxing herbs that are often tonic or supportive to the nervous system.

There are many herbs possessing both carminative qualities that affect our digestive systems and nerve properties that ease stress and relax the nerves. The natural synergy in the plant makes these herbs particularly well-suited to problems involving both systems in a person.

Carminative nervines - lemon balm, chamomile, lavender, hawthorn, rosemary, valerian, peppermint, hyssop, celery seed

Carminative bitters – turmeric, angelica, elecampane, wormwood, mugwort

Bitter nervines – motherwort, blue vervain, hops, skullcap

Demulcent nervines – linden, oats

Other demulcents – marshmallow, slippery elm, plantain, flax

Use carminatives when there is gas, irritability, fluctuating stool frequency and/or consistency, bloating, cramps or flatulence.

Use bitters when there is indigestion, heartburn, poor fat digestion or constipation.

Use demulcents when any of the GI tract mucous membranes are irritated, ulcerated or inflamed – from the throat on down, and for watery stools.