Why do you think is so important to have a “brain in the gut”?

The ENS regulates the coordination of GI smooth muscle contractions. The ENS is comprised of sensory neurons in the gut that send signals to interneurons in the ENS that interprets this information to determine the automatic response necessary based on the stimuli and instruct motor neurons to react and cause responses in the effector systems (muscle, secretory epithelium, and vasculature) of the gut. The ENS also indirectly influence the gut by acting on the endocrine cells, and the cells of the immune system.

Lastly, the microbiome in the gut sends signals via the ENS, and through the vagus nerve, interact with the CNS by regulating brain chemistry and influencing the release of hormones (for example secretion of dopamine and serotonin) associated with food craving, stress response, anxiety, happiness, pleasure, depression, learning, memory function and pro social behavior.

What are the functions of the ENS in mammals?

The main function of the ENS, are:

* Control of motility of the small and large intestines

The major patterns of motility in the intestines, are: propulsive reflexes that move food for small and longer distance(peristaltic) and retropulsion associated with vomiting or gagging. The ENS is programmed to generate these outcomes. Control of motility is in the ENS, whereas the primary integration centers for control of gastric motility are in the brainstem.

* Regulation of fluid exchange and local blood flow

The enteric nervous system regulates the movement of water and electrolytes between the gut lumen and tissue fluid compartments. It does this by directing the activity of secretomotor neurons that innervate the mucosa in the small and large intestines and control its permeability to ions.

ENS controls fluxes of fluid cross the epithelial surfaces of the gastrointestinal tract .

Local blood flow to the GI tract mucosa is regulated through enteric vasodilator neurons so that the mucosal blood flow is appropriate to balance the nutritive needs of the mucosa and to accommodate the fluid exchange between the vasculature, interstitial fluid and gut lumen.

* Regulation of gastric and pancreatic secretion

Neural regulation happens through cholinergic neurons in the stomach wall, these neurons receive inputs both from the ENS and from the vagus nerve.

* Regulation of gastrointestinal endocrine cells

Nerve fibers run close to endocrine cells of the mucosa of the gastro-intestinal tract which sample the luminal environment.

* Defense reactions

Enteric neurons are involved in defense reactions of the gut including diarrhea to eliminate toxins, colonic propulsive activity to rid of pathogens and vomiting.

* Entero-enteric reflexes

Entero-enteric reflexes regulate one region in relation to others for example when nutrients enter the small intestine, secretion of digestive enzymes from the pancreas occur. There is a neuronal loop carrying signal from one region of intestine to sympathetic ganglia and back to the gut wall.

Ref.: http://www.scholarpedia.org/article/Enteric\_nervous\_system