

---

# The Enteric Nervous System 30 Years Later Advance

---

Innervation of the Gastrointestinal Tract  
The Enteric Nervous System and Its Targets  
The Enteric Nervous System in Health and Disease  
A Textbook of Neuroanatomy  
The Enteric Nervous System II  
Development of the Enteric Nervous System  
Autophagy of the Nervous System  
Fish Physiology: The Multifunctional Gut of Fish  
The Enteric Nervous System  
Hirschsprung's Disease and Allied Disorders  
Enteric Nervous System Organization and Function  
Enteric Nervous System  
Microbial Endocrinology: The Microbiota-Gut-Brain Axis in Health and Disease  
Tunig Activity Enteric Nervous System  
The Gut-Brain Axis  
Functional Dyspepsia  
Sustained Slow Postsynaptic Excitation in the Enteric Nervous System  
Neuro-Immuno-Gastroenterology  
Molecular and Cellular Analysis of the Enteric Nervous System in Vivo

Colonic Motility  
Structure of Enteric Neurons  
The Enteric Nervous System of the Mouse  
Anatomy and Physiology of the Enteric Nervous System  
The Enteric Nervous System  
Enteric Nervous System  
Relationships Among the Brain, the Digestive System, and Eating Behavior  
The Enteric Nervous System  
Neural Control of Gastrointestinal Function  
The Enteric Nervous System in Vitro  
The Brain  
Anatomy and Physiology  
Neuroanatomy and Neuroscience at a Glance  
The Central Nervous System  
Pathophysiology of the Enteric Nervous System  
Special Issue: Enteric Nervous System  
Pathophysiology of the Enteric Nervous System  
The Second Brain  
Enteric Glia  
The Enteric Nervous System  
The Second Brain

*The Enteric Nervous System 30 Years Later Advance*

*Downloaded from [ftp.bonide.com](http://ftp.bonide.com) by guest*

---

**WASHINGTON  
AIYANA**

---

Innervation of the

Gastrointestinal Tract  
Springer Science & Business Media

This book is based on the proceedings of the Enteric Nervous System conference in Adelaide, Australia, as

part of the International Federation for Neurogastroenterology and Motility. The book focuses on methodologic strategies and unresolved issues in the field and explores where the future is heading and what technological advances have been made to address current and future questions. The Enteric Nervous System II continues in the tradition of a popular earlier volume which covered the previous meeting. Many of the same authors are contributing to this new volume, presenting state-of-the-art updates on the many developments in the field since the earlier meeting. The coverage include a

wide range of topics, from structure and function of the enteric nervous system through gut motility and visceral pain. The author team includes long-established authorities who significantly contributed to the advances in ENS research over the past two decades and the new generation that will continue to contribute to advancing our understanding of the field. .

The Enteric Nervous System and Its Targets  
Springer

The Multifunctional Gut of Fish provides a comprehensive synthesis and an integrative overview of the range of gut functions and their implications for organismal physiology.

The highly diversified anatomy and functions of the gut, including nutrient uptake, immune barrier function, salt and water homeostasis and respiration, as well as neuroendocrine actions and control are covered in detail by leading authors. In addition, this volume explores the pronounced implications of gut function for whole animal integrative physiology and compensatory demands for non-gastrointestinal organs. As the first comprehensive reference to discuss the diverse morphological and functional adaptations of the gut, this volume provides an excellent resource for comparative

physiologists, aquaculturists and biomedical researchers employing fish as model organisms for mammalian physiology. Includes chapters dedicated to anatomical and functional features of the gastro-intestinal tract of fish as well as integrative aspects of gut organ function. Includes in depth coverage of recently recognized implications of feeding on salt homeostasis and acid-base balance. Provides syntheses of implications of gut function for homeostasis. Essential text for those interested in the wide diversity of functions performed by the gut. The Enteric Nervous System in Health and Disease Harper. The authors of the

most cited neuroscience publication, The Rat Brain in Stereotaxic Coordinates, have written this introductory textbook for neuroscience students. The text is clear and concise, and offers an excellent introduction to the essential concepts of neuroscience. Based on contemporary neuroscience research rather than old-style medical school neuroanatomy. Thorough treatment of motor and sensory systems. A detailed chapter on human cerebral cortex. The neuroscience of consciousness, memory, emotion, brain injury, and mental illness. A comprehensive chapter on brain development. A summary of the

techniques of brain research. A detailed glossary of neuroscience terms. Illustrated with over 130 color photographs and diagrams. This book will inspire and inform students of neuroscience. It is designed for beginning students in the health sciences, including psychology, nursing, biology, and medicine. Clearly and concisely written for easy comprehension by beginning students. Based on contemporary neuroscience research rather than the concepts of old-style medical school neuroanatomy. Thorough treatment of motor and sensory systems. A detailed chapter on human cerebral cortex. Discussion of the

neuroscience of conscience, memory, cognitive function, brain injury, and mental illness A comprehensive chapter on brain development A summary of the techniques of brain research A detailed glossary of neuroscience terms Illustrated with over 100 color photographs and diagrams [A Textbook of Neuroanatomy](#) Springer

The long tube that makes up the gastrointestinal tract is composed of a variety of tissue types and is the largest internal organ of the body. Its main function is to digest food and absorb the released nutrients. Furthermore, it is subdivided into functionally distinct regions that each

mediate one of a variety of actions upon the food consumed, including ingestion, propulsion, secretion, digestion, absorption and expulsion. Autonomic neuronal circuitry is intimately involved in controlling many of these multiple functions of the gut, making it an appealing subject for the study of neuroscientists. This book reviews the state of current knowledge on the innervation of the gut by the enteric nervous system, and its interface with the extrinsic innervation, from a number of different perspectives, with the aim of providing a comprehensive and accessible account of the subject.

**The Enteric Nervous System II**  
HarperCollins

Moreover, our incomplete understanding of the pathobiology of these disorders highlights a need for research directed to expansion of current knowledge of the neurobiology of the ENS at all levels of organization from the cellular biology of individual neurons to the biophysics of integrated networks to whole organ behavior. Investigation of the normal and disordered ENS and its interactions with the central nervous system is a branch of neurogastroenterology. Neurogastroenterology is a scientific and clinical subspecialty of gastroenterology that deals with the neural mechanisms that influence function of the digestive tract and that underlie projection

of conscious sensations to the gut.

*Development of the Enteric Nervous System* CRC Press

The field of microbial endocrinology is expressly devoted to understanding the mechanisms by which the microbiota (bacteria within the microbiome) interact with the host (“us”). This interaction is a two-way street and the driving force that governs these interactions are the neuroendocrine products of both the host and the microbiota. Chapters include neuroendocrine hormone-induced changes in gene expression and microbial endocrinology and probiotics. This is the first in a series of books dedicated to

understanding how bi-directional communication between host and bacteria represents the cutting edge of translational medical research, and hopefully identifies new ways to understand the mechanisms that determine health and disease.

**Autophagy of the Nervous System** John Wiley & Sons

This is the third edition of a comprehensive study of the neuronal disorders of the lower gastrointestinal tract in children. Important new studies and progress in research on bowel motility and motility disorders are covered in detail as well as new aspects concerning the embryology, functional anatomy of the enteric nervous system. In

particular new insights have been received from the studies in the genetics of Hirschsprung's disease. Special emphasis is laid on new surgical techniques, especially on the laparoscopic approach in combination with Soave's or Duhamel's technique.

*Fish Physiology: The Multifunctional Gut of Fish* National Academies Press

This book first presents an overview on the chemical coding of the morphological neuron types described by Stach in the pig intestine. In doing so, we have pointed out the difference between the definitions of type I neurons given by Dogiel and Stach. Secondly, it provides a basis for the morpho-chemical classification



of human enteric neurons as revealed by their immunoreactivity for neurofilaments and several neuroactive substances or related markers.

*The Enteric Nervous System* World Scientific  
The Gut-Brain Axis: Dietary, Probiotic, and Prebiotic Interventions on the Microbiota, Second Edition presents the most advances on how the gut microbiome influences central nervous system and brain function introduced in the first edition. The book also describes how environmental influences which affect the microbiota, including, diet, exercise, and early-life, impact on the gut-brain axis. The second edition contains new chapters on

metabolomics and the gut-brain-axis; dietary factors in the maintenance of a healthy brain ; the role of gut microbes in neurodegenerative disorders; the link between exercise and the gut-brain-axis; and infant Nutrition, the microbiome and neurodevelopment. In addition, the second edition presents coverage of mechanisms underlying neurological disease; approaches to investigate the role of the microbiome in brain and behavior, and 'next generation' probiotics and prebiotics. The Gut-Brain Axis: Dietary, Probiotic, and Prebiotic Interventions on the Microbiota, Second Edition continues to be the “go-to resource for further exploration of

the microbiota. Includes new chapters focused on metabolomics and the gut-brain axis; dietary polyphenols to maintain healthier brain measures and cognitive function; the role of gut microbes in Parkinson's Disease; the microbiota-gut-brain axis in psychosis; exploration of exercise and the gut-brain axis; and coverage of pediatric nutrition. Updated chapters reflect on the most recent advances on the role of the microbiome and gut-brain axis in early-life, aging, cognition, metabolism, neurodevelopmental disorders, as well as on the enteric nervous system. Addresses the role of diet and the gut-brain axis across several chapters with unique author insights

and perspectives. Examines common mechanisms and pathways by which the microbiota may influence brain and behavior. Discusses strategies to explore the contribution of the microbiome to the gut-brain axis; methods to enhance therapeutic strategies targeted toward the microbiota; and presents a case study demonstrating a rational screening approach to increase translational success. Hirschsprung's Disease and Allied Disorders. Academic Press. The research and outcomes presented in this book gather evidence concerning both the pathogenesis and treatment of functional dyspepsia. It provides the latest information on this common non-organic

disease, indicating its characteristic pathogenesis based on the brain-gut interaction and micro-environment and evidence gleaned from clinical treatment. Since the pathogenesis is associated with psychology, neurology, endocrinology and bacteriology in addition to gastroenterological physiology, it is often intractable and finding a suitable treatment rationale is challenging. Furthermore, the pathogenesis varies around the world and the efficacy of treatment using standard drugs varies among different populations worldwide; accordingly, this book highlights evidence gained in clinical trials in Japan. Functional Dyspepsia is a

milestone produced by respected experts. Addressing unique topics and new findings of treatment including challenging and/or future rationales, it offers an invaluable resource for general clinicians, gastroenterologists, and basic researchers alike. Enteric Nervous System Organization and Function Elsevier A textbook of neuroscience for undergraduate medical students providing a concise yet critical treatment of structure - function relationships as a basis for clinical thinking. It aims at conveying an understanding of how the nervous system performs its tasks by using data from molecular biology to clinical neurology.

Enteric Nervous

System John Wiley & Sons

"Persuasive, impassioned. . . hopeful news [for those] suffering from functional bowel disease." — New York Times Book Review Dr. Michael Gershon's groundbreaking book fills the gap between what you need to know—and what your doctor has time to tell you. Dr. Michael Gershon has devoted his career to understanding the human bowel (the stomach, esophagus, small intestine, and colon). His thirty years of research have led to an extraordinary rediscovery: nerve cells in the gut that act as a brain. This "second brain" can control our gut all by itself. Our two

brains—the one in our head and the one in our bowel—must cooperate. If they do not, then there is chaos in the gut and misery in the head—everything from "butterflies" to cramps, from diarrhea to constipation. Dr. Gershon's work has led to radical new understandings about a wide range of gastrointestinal problems including gastroenteritis, nervous stomach, and irritable bowel syndrome. The Second Brain represents a quantum leap in medical knowledge and is already benefiting patients whose symptoms were previously dismissed as neurotic or "it's all in your head."

*Microbial Endocrinology: The*

*Microbiota-Gut-Brain Axis in Health and Disease* Springer

What is autophagy? Why would neurons digest parts of themselves through autophagy? How can autophagy save the lives of cells under some conditions, but act as an accomplice to cell death in others? By what mechanisms are autophagy-related processes dysregulated in neurological diseases, and are there therapeutic strategies to correct or compensate for their dysfunction? This book provides an expert view of major concepts in autophagy research with a focus on autophagy in neurons. Experimental evidence for evolutionarily conserved and specialized regulatory

mechanisms for autophagy in the mammalian nervous system will be presented, including recent data on braking mechanisms. Areas of intersection with cell death, the ubiquitin-proteasome system, chaperone-mediated autophagy, and the endocytic pathway will be reviewed, along with emerging areas of mitochondrial autophagy (mitophagy) and the autophagic regulation of neuritic/synaptic processes. Advances in delineating mechanisms by which autophagy is involved in the pathophysiology of neurological disorders, including Alzheimer's, Parkinson's, Huntington's, amyotrophic lateral sclerosis,

ischemia/hypoxia and lysosomal storage diseases, will be discussed along with current drug development strategies targeting autophagy.

*Tunig Activity Enteric Nervous System* Biota Publishing

Three distinct types of contractions perform colonic motility functions. Rhythmic phasic contractions (RPCs) cause slow net distal propulsion with extensive mixing/turning over. Infrequently occurring giant migrating contractions (GMCs) produce mass movements. Tonic contractions aid RPCs in their motor function. The spatiotemporal patterns of these contractions differ markedly. The amplitude and distance

of propagation of a GMC are several-fold larger than those of an RPC. The enteric neurons and smooth muscle cells are the core regulators of all three types of contractions. The regulation of contractions by these mechanisms is modifiable by extrinsic factors: CNS, autonomic neurons, hormones, inflammatory mediators, and stress mediators. Only the GMCs produce descending inhibition, which accommodates the large bolus being propelled without increasing muscle tone. The strong compression of the colon wall generates afferent signals that are below nociceptive threshold in healthy subjects. However,

these signals become nociceptive; if the amplitudes of GMCs increase, afferent nerves become hypersensitive, or descending inhibition is impaired. The GMCs also provide the force for rapid propulsion of feces and descending inhibition to relax the internal anal sphincter during defecation. The dysregulation of GMCs is a major factor in colonic motility disorders: irritable bowel syndrome (IBS), inflammatory bowel disease (IBD), and diverticular disease (DD). Frequent mass movements by GMCs cause diarrhea in diarrhea predominant IBS, IBD, and DD, while a decrease in the frequency of GMCs causes constipation. The GMCs generate the afferent signals for

intermittent short-lived episodes of abdominal cramping in these disorders. Epigenetic dysregulation due to adverse events in early life is one of the major factors in generating the symptoms of IBS in adulthood.

#### The Gut-Brain Axis Springer

Nearly 30 years ago, a number of scientists working on the Enteric Nervous System (ENS) gathered at Flinders University, in Adelaide, Australia to discuss the advances and future of their research. It was a friendly and stimulating meeting, attended by most of the major players, in what was to become the discipline of 'Neurogastroenterology'. In 2014, the main Australasian Neuroscience Society meeting was held in

Adelaide, Australia, providing the perfect opportunity to recreate a follow-up ENS meeting. As such, the 'ENS II 2014 meeting' aimed to identify how far the field of enteric neuroscience had developed, where the future was heading, and what technological advances had been made to address current and future unresolved questions. 30 speakers from around the world were invited to give talks and revisit the original expectations, the advances made since, and the future directions of ENS research. These discussions included three generations of investigators from 7 different countries. This publication represents the majority of proceedings from

the 'The Enteric Nervous System II 2014' conference, which was held on February 1st - 2nd 2014 at the National Wine Centre of Australia, Adelaide. This meeting was an Official satellite meeting of the 34th Annual Meeting of Australasian Neuroscience Society, which was also held in Adelaide. The 20 contributions contained within this submission are from international researchers in the field of the ENS, who reviewed the advances made since the first meeting in the early 1980s and summarizes the present and future perspectives of neuro-gastroenterology. Some colleagues could not attend but did send greetings and their messages are included



in these proceedings.

### **Functional**

### **Dyspepsia** OUP USA

The enteric nervous system (ENS) is a complex neural network embedded in the gut wall that orchestrates the reflex behaviors of the intestine. The ENS is often referred to as the “little brain” in the gut because the ENS is more similar in size, complexity and autonomy to the central nervous system (CNS) than other components of the autonomic nervous system. Like the brain, the ENS is composed of neurons that are surrounded by glial cells. Enteric glia are a unique type of peripheral glia that are similar to astrocytes of the CNS. Yet enteric glial cells also differ from astrocytes in

many important ways.

The roles of enteric glial cell populations in the gut are beginning to come to light and recent evidence implicates enteric glia in almost every aspect of gastrointestinal physiology and pathophysiology. However, elucidating the exact mechanisms by which enteric glia influence gastrointestinal physiology and identifying how those roles are altered during gastrointestinal pathophysiology remain areas of intense research. The purpose of this e-book is to provide an introduction to enteric glial cells and to act as a resource for ongoing studies on this fascinating population of glia. Table of Contents: Introduction /

A Historical Perspective  
on Enteric Glia / Enteric  
Glia: The Astroglia of  
the Gut / Molecular  
Composition of Enteric  
Glia / Development of  
Enteric Glia /  
Functional Roles of  
Enteric Glia / Enteric  
Glia and Disease  
Processes in the Gut /  
Concluding Remarks /  
References / Author  
Biography

*Sustained Slow*

*Postsynaptic Excitation  
in the Enteric Nervous  
System* Biota

Publishing

The gastrointestinal tract is a long, muscular tube responsible for the digestion of food, assimilation of nutrients and elimination of waste. This is achieved by secretion of digestive enzymes and absorption from the intestinal lumen, with

different regions playing specific roles in the processing of specific nutrients.

These regions come into play sequentially as ingested material is moved along the length of the GI tract by contractions of the muscle layers. In some regions like the oesophagus transit is rapid and measured in seconds while in others like the colon transit is measured in hours and even days,

commensurate with the relative slow fermentation that takes place in the large bowel. An hierarchy of controls, neural and endocrine, serve to regulate the various cellular targets that exist in the gut wall. These include muscle cells for contraction and epithelial cells for secretion and

absorption. However, there are complex interactions between these digestive mechanisms and other mechanisms that regulate blood flow, immune function, endocrine secretion and food intake. These ensure a fine balance between the ostensibly conflicting tasks of digestion and absorption and protection from potentially harmful ingested materials. They match assimilation of nutrients with hunger and satiety and they ensure that regions of the GI tract that are meters apart work together in a coordinated fashion to match these diverse functions to the digestive needs of the individual. This ebook will provide an

overview of the neural mechanisms that control gastrointestinal function. Table of Contents: Neural Control of Gastrointestinal Function / Cells and Tissues / Enteric Nervous System / From Gut to CNS: Extrinsic Sensory Innervation / Sympathetic Innervation of the Gut / Parasympathetic Innervation of the Gut / Integration of Function / References

**Neuro-Immuno-Gastroenterology**

Biota Publishing  
British Medical Association Book Award Winner - Student Textbook of the Year 2018  
Everything you need to know about Neuroanatomy and Neuroscience ... at a Glance! Neuroanatomy and Neuroscience at a

Glance is a highly illustrated, quick reference guide to the anatomy, biochemistry, physiology and pharmacology of the human nervous system. Each chapter features a summary of the anatomical structure and function of a specific component of the central nervous system, a section on applied neurobiology outlining how to approach a patient with neurological or psychiatric problems aligned to the chapter topic, standard diagnostic procedures for most common scenarios, as well as an overview of treatment and management options. This fully updated and expanded new edition includes: Dozens of full-page, colour illustrations and

neurological scans  
Expanded coverage of techniques to study the nervous system  
More practical information on the neurological exam  
New content on neuropharmacology and drug therapies  
Bullet points and bold terms throughout assist with revision and review of the topic  
Neuroanatomy and Neuroscience at a Glance is the ideal companion for students embarking on a neuroanatomy or neuroscience course, and is an excellent reference tool for those in clinical training. An updated companion website with new clinical cases, multiple choice self-assessment questions, revision slides, and downloadable illustrations and flashcards is available

at [www.ataglanceseries.com/neuroscience](http://www.ataglanceseries.com/neuroscience)  
Molecular and Cellular Analysis of the Enteric Nervous System in Vivo John Wiley & Sons  
Newly revised and updated, *A Textbook of Neuroanatomy, Second Edition* is a concise text designed to help students easily master the anatomy and basic physiology of the nervous system. Accessible and clear, the book highlights interrelationships between systems, structures, and the rest of the body as the chapters move through the various regions of the brain. Building on the solid foundation of the first edition, *A Textbook of Neuroanatomy* now includes two new chapters on the brainstem and

reflexes, as well as dozens of new micrographs illustrating key structures. Throughout the book the clinical relevance of the material is emphasized through clinical cases, questions, and follow-up discussions in each chapter, motivating students to learn the information. A companion website is also available, featuring study aids and artwork from the book as PowerPoint slides. *A Textbook of Neuroanatomy, Second Edition* is an invaluable resource for students of general, clinical and behavioral neuroscience and neuroanatomy. *Colonic Motility* Academic Press  
Over the last few years there have been huge advances made in our

understanding of the interactions between the brain and the gut – the enteric nervous system. This book is particularly relevant in the understanding, diagnosis and management of irritable bowel syndrome – the most common functional disorder of the bowel. IBS has been diagnosed in 10-20% of

adults in the US, and symptoms of IBS are responsible for more than 3 million visits to the physician in the US. This book is aimed at specialist gastroenterologists but also should be of interest for trainees and fellows in gastroenterology, as well as PCPs and GPs with an interest in this subject.