Medieval geographers once marked mysterious regions beyond the known world with the words "terra incognita," a phrase used to describe places unknown. In endoscopy, however, the mysteries of the small bowel are currently disappearing at the rate of 120 images a minute.

Originating in the 1980s, the premise of a tiny, ingestible capsule containing a camera preceded miniaturization technology by almost two decades, a time during intestinal diseases and disorders, and has since become the procedure of choice for evaluation of the small bowel mucosa.

"Capsule endoscopy is a giant step forward in the visualization of small bowel mucosa. It enables us to identify diseases and conditions that may not be readily identifiable using conventional endoscopy and radiology."

– Nuzhat Ahmad, MD
Associate Director, Endoscopic Services, HUP

Contained in an indigestible plastic shell, current capsule endoscopes are approximately 11 mm in diameter and 26 mm in length. The capsule’s miniature imaging system is excreted naturally. Acquired images have a 1:8 magnification, which is higher than that of conventional endoscopes.

capsule endoscopy at Penn:
Exploring the Unknown

Wireless capsule endoscopy at Penn:
Exploring the Unknown

John Chang, MD and Erick Chan, MD: Each received the American Gastroenterology Association/Foundation for Digestive Health and Nutrition (AGA/FDHN) faculty transition grant award.

 Linda Greenbaum, MD: American Liver Foundation Investigator of the Year.

Gary Wu, MD: Appointed chair of the NIH NIDDK-C study section. Elected chair of the AGA Intestinal and Immunology Section of the AGA Council.

Top Docs: as named in Philadelphia Magazines: David Metz, MD, Julius Deren, MD, Gregory Ginsberg, MD, Timothy Hoops, MD, Michael Kochman, MD.

In addition, I would like to introduce to you the following who have joined our faculty as of July 2007:

 Geoﬀ Spencer, MD: Geoﬀ was medical resident and chief resident at Penn, and has completed his GI fellowship and Master of Science in Clinical Epidemiology at Penn. His clinical expertise is in gastrointestinal reflux disease, peptic ulcer diseases and GI motility disorders, all under the Motility and Physiology Program under Drs. David Metz and David Katzka. Geoﬀ sees patients at the Hospital of the University of Pennsylvania.

John Chang, MD: John completed his medical residency and GI fellowship at Penn. He is a physician-scientist who is doing research in inﬂammatory bowel diseases, and recently published in Science. John’s clinical interests are in IBD as well, and he sees patients at the Hospital of the University of Pennsylvania.

David Jaffe, MD, and Nuzhat Ahman, MD
Hospital of the University of Pennsylvania

Medieval geographers once marked mysterious regions beyond the known world with the words “terra incognita,” a phrase used to describe places unknown. Until recently, the small bowel was one such place, its deep and tortuous folds hidden to most diagnostic methods. With the advent of capsule endoscopy, however, the mysteries of the small bowel are currently disappearing at the rate of 120 images a minute.

Originating in the 1980s, the premise of a tiny, ingestible capsule containing a camera preceded miniaturization technology by almost two decades, a time during which endoscopy and push enteroscopy came into use for small bowel investigation. Capsule endoscopy (CE) was introduced in 2001 as an adjunctive tool for the evaluation of small intestinal diseases and disorders, and has since become the procedure of choice for evaluation of the small bowel mucosa.

Wireless capsule endoscopy at Penn:
Exploring the Unknown

David L. Jaffe, MD and Nuzhat A. Ahmad, MD
Hospital of the University of Pennsylvania

“Capsule endoscopy is a giant step forward in the visualization of small bowel mucosa. It enables us to identify diseases and conditions that may not be readily identifiable using conventional endoscopy and radiology." – Nuzhat Ahman, MD
Associate Director, Endoscopic Services, HUP

Contained in a indigestible plastic shell, current capsule endoscopes are approximately 11 mm in diameter and 26 mm in length. The capsule’s miniature imaging system is comprised of a metal ox ide silicon chip camera, six light emitting diodes, two silver oxide batteries and a UHF-band radio telemetry transmitter. Patients wear an abdominal sensor array and an external data recorder unit capable of processing two images a second. The capsule is swallowed with a glass of water after the patient has fasted for 12 hours and travels through the GI system by natural peristalsis. The capsule is disposable and is excreted naturally. Acquired images have a 1:8 magnification, which is higher than that of conventional endoscopes.

Capsule Endoscopy at Penn
Gastroenterologists David Jaffe, MD, and Nuzhat Ahmad, MD, currently employ capsule endoscopy at the Penn Digestive & Liver Center as an adjunctive diagnostic modality for obscure gastrointestinal bleeding when endoscopy and colonoscopy are
When eosinophilic esophagitis (EE) was first reported in 1977, the disease was considered a manifestation of another disorder, eosinophilic gastroenteritis. The transition of EE from its early case reportable status to its position today as a recognized disease state owes much, says David Katzka, MD, to significant advances in clinical understanding of allergic and inflammatory mediators and their influence on gastrointestinal disease.

Director of the swallowing program at the Penn Digestive & Liver Center, Dr. Katzka has an acute appreciation for EE and the intricacies of its diagnosis. Not the least of these is differentiating EE from gastroesophageal reflux disease (GERD).

“Narrowing and stricture of the esophagus are common to both GERD and EE,” Dr. Katzka notes. “Distinguishing between the two is paramount, however, because acid suppression has little effect on eosinophilic inflammation when it is caused by allergy.”

EE is an inflammatory condition marked by dense eosinophilic infiltration of the esophageal lining. There are other important differences, as well. While the etiology, diagnosis and treatment of GERD clearly share a common thread, no such rubric exists for EE—and herein lies its complexity.

**Pathogenesis**
Recent studies have characterized EE as a multi-step process initiated by a priming cutaneous allergic response. This response then activates bone marrow eosinophils, which on further allergic exposure, target the esophagus.

Analyses of biopsy specimens in EE demonstrate the increased presence of a variety of activated inflammatory mediators, including T-cells, mast cells, IL-5, IL-13 (a key cytokine in the pathogenesis of allergic disorders) and tumor necrosis factor-alpha, all of which contribute to the allergic reaction. IL-5 has been found to promote eosinophil trafficking to the esophagus, and with IL-13, is expressed in blood eosinophils in patients with EE.

“Other etiologies for EE are also emerging,” says Dr. Katzka, noting that a variety of investigators have provided anecdotal evidence to support a familial pattern for EE. Recent studies from the laboratory of Dr. Marc Rothenberg, of Cincinnati Children’s Hospital Medical Center, have demonstrated the finding of an abnormal gene in almost 50 percent of children with EE. Whether these findings prove a cause related to genetic predisposition precipitated by environmental exposure, however, remains to be determined.

**Presentation**
While the majority of reports of EE are in pediatric populations, the incidence of EE is increasing in the adult population. The primary presenting symptom in these patients is dysphagia, often of long-standing, and occasionally attended by food impaction, particularly in young adults. A recent prospective three-year investigation reported that 14 percent of patients presenting with food impaction to a community-based hospital had eosinophilic esophagitis.

“The most striking finding of this study,” Dr. Katzka observes, “was an age difference of at least 25 years between patients with histologic markers for eosinophilic esophagitis, and those lacking such criteria. This suggests that an episode of food impaction in a young adult should alert gastroenterologists to the possibility of eosinophilic esophagitis.”

**Diagnosis & Treatment of Eosinophilic Esophagitis at Penn**
Diagnosis of EE is based on two principles: 1) demonstrating increased eosinophils in the esophageal mucosa, and 2) ruling out acid reflux as a cause or co-contributor. The former is done through endoscopy and biopsy and the latter through either pH testing and/or an adequate trial of high-dose proton pump inhibitor therapy for two months with repeat biopsies. Although certain demographic and clinical features may reliably predict the allergic form of EE (i.e., male gender, younger age and personal and family history of other allergic disorders) the aforesaid principles must be completed to make the diagnosis. While genetic testing is a tantalizing prospect, Dr. Katzka adds, its part in the diagnostic paradigm has yet to be determined.

Treatment for EE is based on 1) management of the underlying allergies that are putatively causing the inflammatory response in the esophagus and 2) mechanical treatment of the esophageal strictures. All patients are referred to an allergist for evaluation. Typically, treatments include topical steroids (oral Budcason or prednisone and montelukast. An elemental diet is extremely effective, but long-term use is impractical. Newer medications such as mepolizumab, an IL-5 inhibitor are currently being investigated. In adults, esophageal dilation is often required because structure formation is so common, but this is often done after medical treatment to reduce risk of perforation.