



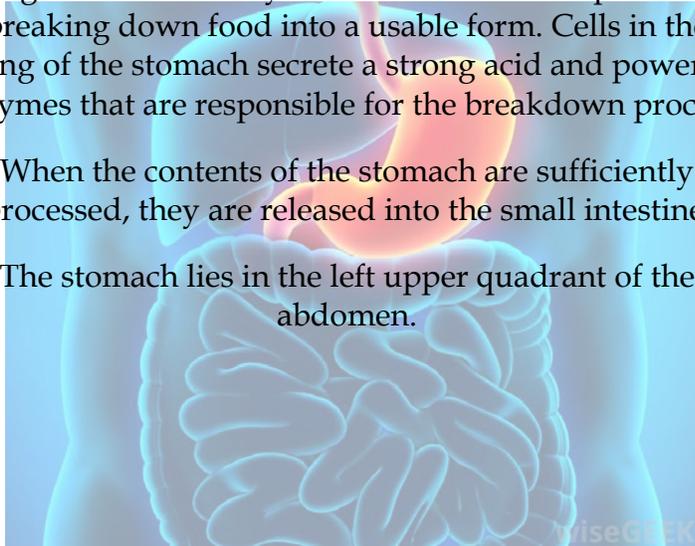
# The CEGIIR Lunch'N'Learn News

## 1. THE STOMACH: WHAT IS IT AND WHAT DOES IT DO?

The stomach is part of the digestive system. It is a hollow organ, or "container," that holds food while it is being mixed with enzymes that continue the process of breaking down food into a usable form. Cells in the lining of the stomach secrete a strong acid and powerful enzymes that are responsible for the breakdown process.

When the contents of the stomach are sufficiently processed, they are released into the small intestine.

The stomach lies in the left upper quadrant of the abdomen.



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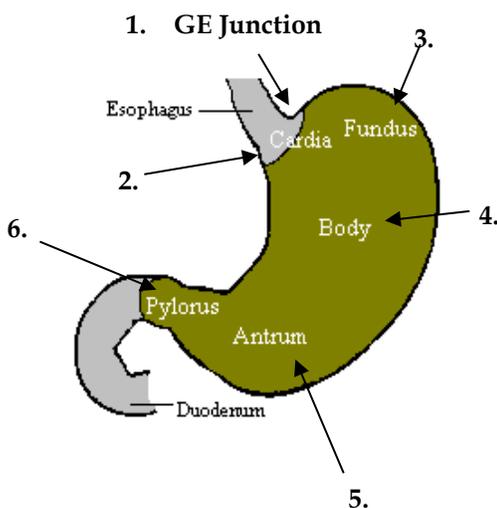


- The eighth session of the CEGIIR GI Lunch'N'Learn Series was held on August 19, 2015 at noon in Katz 7-003
- Today's newsletter brief is a Q & A summary by Dr. Sander Van Zanten from this session about "Proving the Stomach is the Most Beautiful Organ and H. Pylori the Most Interesting".

Questions? Comments?

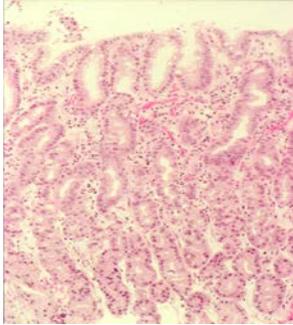
For inquiries, suggestions or feedback, please email Melissa Silva/Kayla-Marie Smith at [llcegiir@ualberta.ca](mailto:llcegiir@ualberta.ca)

## 2. ANATOMY OF THE STOMACH



- 1. Gastroesophageal (GE) junction** - an important anatomical marker for the entrance of the stomach. Diseases such as GERD, Barrett's esophagus, etc. occur here.
- 2. Cardia** - near upper portion of stomach. Includes the cardiac sphincter which acts as a valve that prevents the stomach contents from going back up into the esophagus
- 3. Fundus** - acts as temporary storage of food
- 4. Body** - main (and largest) part of stomach where food is mixed and broken down. Gastric acid and pepsinogen are produced here.
- 5. Antrum** - "directs traffic", lower part of stomach where broken down food is held until it is ready to be released into the small intestine
- 6. Pylorus** - narrow bottom part of stomach near small intestine. Includes pyloric sphincter which acts as a valve to control the emptying of stomach contents into the small intestine

### 3. HISTOLOGY & LAYERS OF THE STOMACH



Normal Body Mucosa

1. **Mucosa** (epithelium, lamina propria, muscularis mucosae)
  - a. Gastric glands – produce mucus
  - b. Gastric pits – glands open into pits
  - c. Parietal cells – upper part of gastric gland, secrete HCl & intrinsic factor
  - d. Chief cells – base of glands, secrete pepsinogen & lipase
2. **Submucosa** – dense irregular connective tissue
3. **Muscularis externa** – 3 layers: inner oblique, middle circular, outer longitudinal
4. **Serosa** – continues with peritoneum

### 4. WHAT IS HELICOBACTER PYLORI?

Gastric acid protects the stomach by killing nearly 90% of bugs. *Helicobacter Pylori* is a gram-negative bacterium that can be found in the stomach. It is a major cause for stomach inflammation, ulcers, atrophy of the stomach and increases the risk of stomach cancer.

*H. Pylori* usually does not invade cells, however when penetrating the mucous layer it can cause profound inflammation. Up to 85% of those infected with *H. Pylori* do not experience any signs or symptoms.

#### Outcomes of *H. Pylori* colonization:

- ~85% - Gastritis
- 5-15% - Duodenal/Gastric Ulcers
- <1% - Gastric Cancer



Treatment is a hot topic, and there is still a lot to be learned.

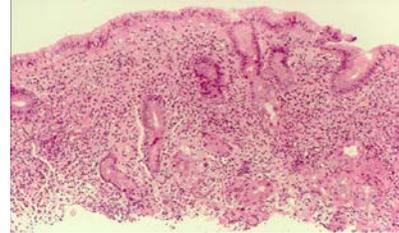
## 5. HISTOLOGY OF H. PYLORI INFECTION

H. Pylori infection causes an infiltrate of white cells in the mucosa (mainly lymphocytes & some neutrophils). Chronic infection leads to atrophy and loss of gastric architecture.

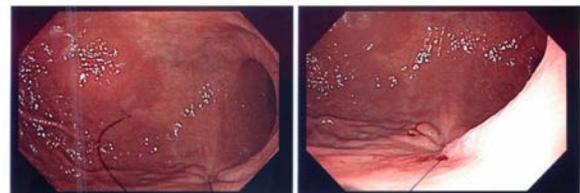
Intestinal metaplasia (potentially reversible replacement of one cell type with another) is a risk factor for the formation of gastric cancer.

Intestinal dysplasia (proliferation of cells with an abnormal type) is considered to be neoplastic and directly leads to cancer.

H. Pylori infection is the worst in the transition zone area of the stomach.

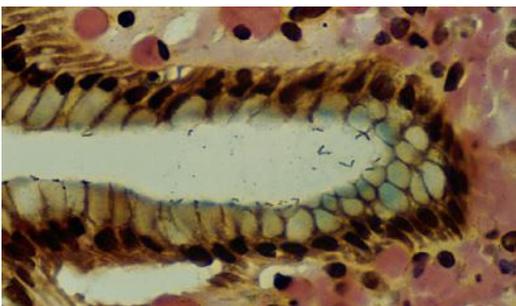


Body Gastritis with Atrophy



*Gt healed*  
*Transition zone*

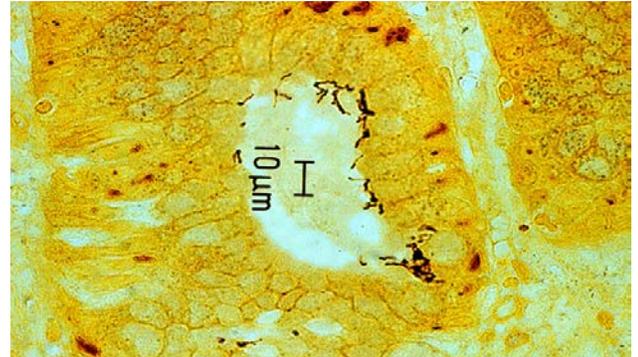
## 6. WHAT IS THE PREVALENCE OF H. PYLORI INFECTION IN CANADA?



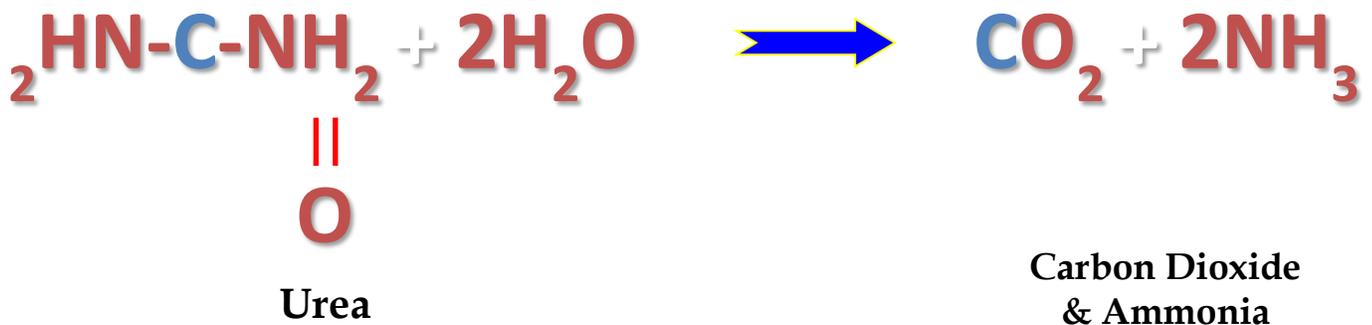
- In the 1980s risk was 6-8%, commonly in elderly
- Currently 25-30% of the Canadian population
- Prevalence is decreasing in younger population

## 7. HOW DO YOU DIAGNOSE H. PYLORI INFECTION?

1. Culture – difficult, fastidious organism to grow
2. Histology – curved organism, rapidly dx with special stains
3. Rapid urease test
4. <sup>13</sup>C or <sup>14</sup>C – urea breath test
5. Serology (e.g. ELISA)



## 8. WHAT IS THE RAPID UREASE TEST?

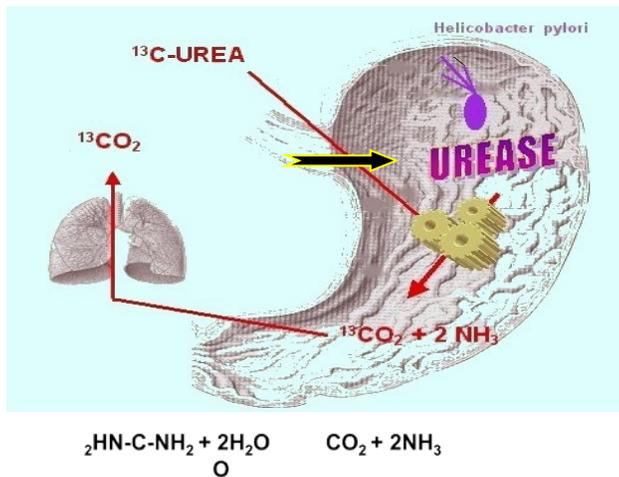


The rapid urease test is a rapid diagnostic test for the diagnosis of Helicobacter Pylori by finding the presence of an enzyme called urease. Urease is secreted by H. Pylori.

The basis of this test is to secrete the urease enzyme which catalyzes the conversion of urea to ammonia and carbon dioxide.

A gastroscopy is performed and biopsy of stomach lining cells is collected. These samples are then sent to the laboratory for testing.

## 8. WHAT IS THE UREA BREATH TEST?



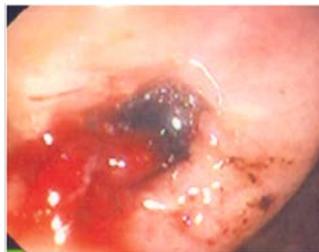
Urea is normally produced by the body as a waste byproduct of nitrogen-containing chemicals and then eliminated in the urine.

The urea breath test is based on the ability of H. Pylori to break down urea into carbon dioxide which is absorbed by the stomach and eliminated in the breath.

## 9. WHAT ARE GASTRIC ULCERS?



Asymptomatic Ulcer



Complicated Ulcer



Bleeding Ulcer

A gastric ulcer is a break in the lining of the stomach which often occurs due to erosion of the mucosal layer. Gastric ulcers are found within the stomach, commonly in the pyloric region.

They often occur as a consequence of H. Pylori infection.

If there is active bleeding, an endoscopy is performed and the ulcer is injected with epinephrine. This causes vasoconstriction and then the ulcer can be surgically ligated. Clips can also be used to band the ulcer.

H. Pylori infection often occurs first in the antrum. This can lead to ulcer formation, but rarely leads to gastric cancer.

Inflammation that involves the antrum and the body is associated with a higher risk for gastric cancer.

## 10. WHAT IS THE TREATMENT OF H. PYLORI INFECTION?

The treatment of *Helicobacter Pylori* often involves the use of a proton pump inhibitor with antibiotics.

Proton pump inhibitors reduce the production of acid as mentioned previously.

Antibiotics help make sure the treatment works.

Bismuth helps slow the growth of bacteria.

1. **Concomitant therapy** (PPI + Amoxicillin + Clarithromycin + Metronidazole); Dr. Van Zanten's choice for 1<sup>st</sup> line therapy
2. **Quadruple therapy** (PPI + Bismuth + Metronidazole & Tetracycline) – bismuth based (Pepto-Bismol) suppresses *H. Pylori*, but does not kill it. The downside of this therapy is many tablets (20-22 tabs) in more days (x 14). The success rate is 87%; however this combination is no longer used. Dr. Van Zanten's choice for 2<sup>nd</sup> line therapy.
3. **Triple Therapy** (PPI + Amoxicillin + Clarithromycin) - the combination of a PPI with clarithromycin & amoxicillin has a success rate of 84%. This was once first-line treatment, however efficacy has gone down due to resistance of clarithromycin.
4. **Sequential therapy** (PPI + Amoxicillin for 5 days followed by PPI + Clarithromycin + Metronidazole for 5 days). In an Edmonton study, this was used as first line with a success rate of 83%
5. **Levofloxacin based therapy** (PPI + Amoxicillin + Levofloxacin) – taken for 10-14 days. This treatment has found success in Italy where there was found to be a success rate of >80%.

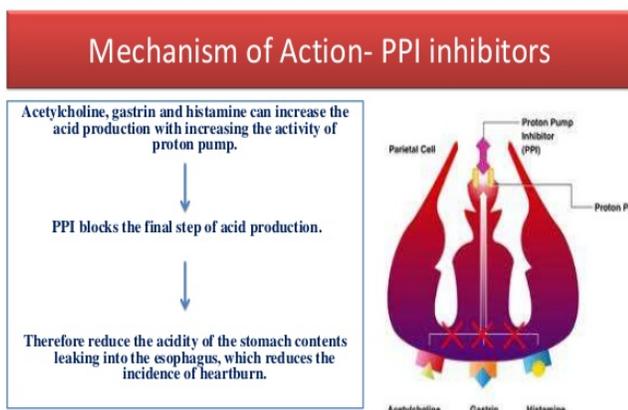


Table 2. *H pylori* Treatment Regimens

Therapy	Regimen
Triple	Clarithromycin + amoxicillin + PPI Clarithromycin + metronidazole + PPI Levofloxacin + amoxicillin + PPI Rifabutin + amoxicillin + PPI
Quadruple	Bismuth + metronidazole + tetracycline + PPI
Sequential	PPI + amoxicillin for 5 days, followed by PPI + clarithromycin + metronidazole for 5 days
Combination products	Helidac Pylera Prevpac

PPI: proton pump inhibitor.  
Source: References 8, 10, 22, 24.

## 11. PROTON PUMP INHIBITORS: MECHANISM OF ACTION



Proton pump inhibitors (PPIs) reduce the production of acid by blocking the enzyme in the wall of the stomach that produces acid. Acid is necessary for the formation of most ulcers in the esophagus, stomach, and duodenum, and the reduction of acid with PPIs prevents ulcers and allows any ulcers that exist in the esophagus, stomach, and duodenum to heal.

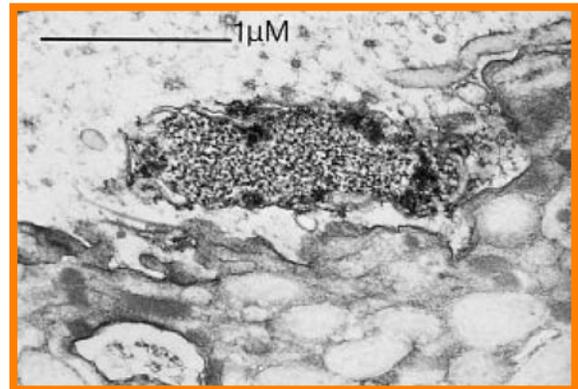
PPIs directly increase killing capacity of antibiotics by raising pH.

## 12. BISMUTH: MECHANISM OF ACTION

The exact chemical structure of bismuth is not known. Within one hour, bismuth coats the outside of *H. Pylori*. After 4 hours, it is able to penetrate the bacteria. Eventually the urease molecule is shut down.



Bismuth deposition along the cell wall and between the cell wall and the cytoplasmic membrane



Marked structural degradation with selective deposition of particulate bismuth complex in and on the surface of the organism

## 13. RESISTANCE TO H. PYLORI TREATMENT IN CANADA?

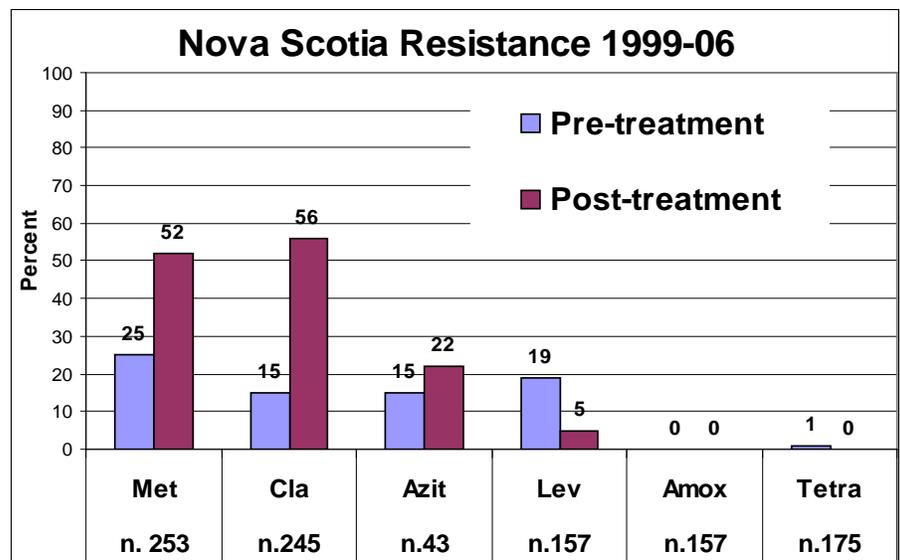
Resistance to *H. Pylori* antibiotics has increased in the past few decades.

Resistance to clarithromycin in the 1990s was low, however it has increased. Other antibiotics such as metronidazole can be used to counteract this resistance.

Amoxicillin currently has no reported resistance against *H. Pylori*.

Resistance to *H. Pylori* – the numbers:

- Metronidazole: 20-25% (stable)
- Clarithromycin: previously 2-11% → now >15-20%
- Levofloxacin: >15%
- Tetracycline: 2%
- Amoxicillin: 2%



Study on Resistance of *H. Pylori* in Halifax, NS before and after treatment from 1999-2006. There appears to have been an increase in primary clarithromycin resistance.

## 14. WHAT IS THE AKLAVIK H.PYLORI PROJECT?



Aklavik H. pylori Project

Aklavik is a small community in Northwest Territories with a population of 633 (as of 2011).

A project to measure and reduce H. Pylori levels was adapted here with guidance from a project planning committee.

This includes:

- *H. Pylori testing by urea breath testing*
- *Community surveys*
- *Endoscopy (mobile endoscopy units!)*
- *Policy development*
- *Knowledge exchange*

A higher number of participants (n=333, 58%) were found to be positive for H. Pylori. Patients were also found through endoscopy (n=197) to have esophagitis, Barrett's esophagus, gastric erosions, gastritis, gastric ulcers, etc. Higher numbers were also found to have cancer. Increased smoking leads to increased prevalence of esophagitis.

Participation to date:

- *376 participants have been recruited*
- *333 breath tests have been completed*
- *200 endoscopies performed*
- *113 treatment participants*

Community H. Pylori projects in other communities are being carried out as well such as Old Crow, YT, Tuktoyaktuk, NT and Fort McPherson, NT.

### Canadian Digestive Health Foundation



#### Did you know?

You can find up-to-date information on the stomach, peptic ulcers and H. Pylori at [www.cdhf.ca](http://www.cdhf.ca)

#### H. pylori in the News

"Eradicating H. pylori with a short course of antibiotics could reduce the risk of gastric cancer"

<http://www.medicalnewstoday.com/articles/297229.php>

#### Fast Facts

- H. pylori infection is considered a carcinogen by the World Health Organization
- There are currently no human vaccines available to [protect against H. pylori infections
- Complications of ulcers?
  1. Bleeding – in vomit or stool
  2. Obstruction – due to swelling of inflamed ulcer
  3. Perforation of the stomach lining – severe abdominal pain

## PROFILING TRAINEES SECTION

Thank you for giving us the opportunity to profile you in the CEGIIR Lunch'n'Learn Newsletter this year!

*Thank you for attending the eighth session of the CEGIIR GI Lunch'N'Learn series. We look forward to having you participate in future sessions and incorporating your feedback!*

### Next CEGIIR GI Lunch'N'Learn session:

**When?** August 26, 2015 at noon  
**Where?** Katz 7-003  
**What?** "Probiotics, Prebiotics & IBD"  
**Who?** Dr. Leo Dieleman

### Proposed future topics to be discussed this summer:

Our last session will occur on August 26, 2015. Thank you for participating and have a good summer!

### Cartoon of the Day



### Lastly...

Special thanks to Dr. Vivian Huang for founding the CEGIIR Lunch'N'Learn series, Brian Reuter, Melissa Silva, contributing scientists (you know who you are), and of course, YOU, for all your help in participating in our eighth session.

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  - **Anatomy of the stomach**
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  - **Prevalence of H. Pylori infection**
    - Image used with permission from Dr. Sander Van Zanten
  
  - **Diagnosis of H. Pylori infection**
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  - **Rapid Urease Test**
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