Biomarkers of GI tract diseases

- Introduction
- The gastrointestinal (GI) tract is a complex system performing multiple biological functions which are anatomically distributed
- Site for food processing and absorption
- Largest immune organ also
- At the interface with external environment constitutes barrier against ingested foreign materials like microbes, toxins
- Like with many tissues, succumbs to diseases
- Several biomarkers available
Biomarkers of GI tract diseases

- The GI tract
  - The GI tract (gastrointestinal tract)
    - The muscular alimentary canal
      - Mouth
      - Pharynx
      - Esophagus
      - Stomach
      - Small intestine
      - Large intestine
      - Anus
  - The accessory digestive organs
    - Supply secretions contributing to the breakdown of food
      - Teeth & tongue
      - Salivary glands
      - Gallbladder
      - Liver
      - Pancreas
Biomarkers of GI tract diseases

• Introduction
• Sampling methods of GI tract diseases
  • Feces analysis – many diseases
  • Biopsy - cancers
  • Imaging - ulcers
Biomarkers of GI tract diseases

- **Digestive Biomarkers**
- **Elastase 1**
  - This is a pancreatic enzyme
  - Secreted as zymogen (inactive enzyme)
  - Activated by trypsin in duodenum
  - Remains undegraded during its transit through intestine
  - So serves as very good marker for the function of pancreas
  - Especially useful marker in acute pancreatitis, and pancreatic insufficiency
Biomarkers of GI tract diseases

- **Digestive Biomarkers**
- **Hypochlorhydria – VEGF in saliva**
  - Characterized by low to no acid production in stomach
  - Leads to improper digestion and absorption
  - VEGF plays role in preventing H\(^+\) leaking back thus maintaining acidic environment
  - Less VEGF in saliva indicate disease

![Diagram of gastric hydrogen secretion](image)
Biomarkers of GI tract diseases

- Digestive Biomarkers
- Triglycerides
  - High levels of triglycerides in feces indicate problems with fat digestion
  - Could result from pancreatic insufficiency, insufficient bile
Biomarkers of GI tract diseases

• Immune Biomarkers
• Fecal IgA
  • IgA found mainly in body secretions
  • Increased sIgA is found in conditions like inflammation
  • Specific sIgA like anti-gliadin IgA indicate gluten intolerance
Biomarkers of GI tract diseases

- Absorption biomarkers
  - Long chain fatty acids, total fat, cholesterol
  - Healthy GI tract absorbs, malabsorption will result in elevation in stools
- Vegetable fibers and muscle fibers
  - Poor digestion and absorption results in appearance of muscle fibers in feces
Biomarkers of GI tract diseases

- Absorption biomarkers
- Lactose intolerance
  - Disaccharides are converted into monosaccharides
  - Lactase required for digestion of lactose
  - Lactase is limited in humans
  - Results in lactose intolerance
  - Leads to production of gas, pain, loose stools…. 
Biomarkers of GI tract diseases

- Absorption biomarkers
- Steatorrhoea
  - Presence of fat in stools
  - Because of defective fat absorption
  - Defective fat absorption also leads to defective absorption of fat dissolved vitamins
  - Vitamin D and Vitamin K deficiency especially
Biomarkers of GI tract diseases

- Other biomarkers
- Color
  - Abnormal color may be because of excess intake of pigmented food
  - Brown color because of action of intestinal bacteria to produce stercobilinogen
  - Red color because of blood could indicate many conditions like
    - Cancer
    - Ulcer
    - Inflammation
    - Injury
Biomarkers of GI tract diseases

- Other biomarkers
- Fecal occult (hidden) blood test (FBOT)
- Frequently used test is guaiac based FBOT

\[
\text{Pseudoperoxidase} \\
\text{Hemoglobin} + \text{H}_2\text{O}_2 + \text{guaiac} \rightarrow \text{oxidized guaiac} + \text{H}_2\text{O} \\
\quad \text{(colorless)} \quad \text{(Blue color)}
\]

- Annual test recommended for early detection of colon cancer
Biomarkers of GI tract diseases

- Other biomarkers
- Neutrophils
  - Neutrophils are found in feces during infection with bacteria like *salmonella, shigella, yersinia* and *E. Coli*
  - Toxin mediated or viral mediated diarrhea do not cause appearance of neutrophils
  - Can be detected by imaging and staining procedures
Biomarkers of GI tract diseases

- Other biomarkers
- HLA-DQ variants in celiac disease – (predisposing)
- Mainly a autoimmune disorder
- Sensitivity to gluten
- Effects the villi of small intestine, resulting in less absorption
- Chronic condition may turn into cancer
Biomarkers of GI tract diseases

• Other biomarkers
• HLA-DQ variants
Biomarkers of GI tract diseases

• Other biomarkers
• Crohn’s disease
• A type of inflammatory bowel disease
• Characterized by abdominal pain, fever, diarrhoea…
• Still not clear why this disease occurs
• Collective effect of genetics, environment and lifestyle choices may result in disease
Biomarkers of GI tract diseases

- Other biomarkers – cancer markers
- Mostly non-specific
- Unpredictable and changes from case to case
- CEA – Carcino embryogenic antigen
- A cell adhesion glycoprotein
- Well studied marker for colorectal cancer
- Produced by fetus, no production after birth
- Some cancers tend to activate the gene and expression level increases
- Can be tracked in blood
Biomarkers of GI tract diseases

- Other biomarkers – cancer markers
Next class

- Next class.....
- Biomarkers of renal diseases