**Understand the clinical signs of EPI in dogs/cats**

- Dogs
  - **Polyphagia**
    - May be anorexic in the end-stage of EPI
  - **Weight loss**
  - **Small bowel diarrhea**
  - Coprophagia and flatulence
  - Vomiting
  - +/- PU/PD
- Cats
  - +/-PU/PD **Weight loss**
  - 
  - Vomiting

**Explain and compare the etiology & pathophysiology of EPI in dogs vs. cats**

- Three roles of the exocrine pancreas
  - Digestive enzymes (release caused by CCK and Ach/vagal stimulation)
    - Proteases
    - Lipases
    - Amylases
  - Bicarbonate (released caused by secretin)
    - Neutralizes gastric acids
    - Can cause dysbiosis
  - Intrinsic factor for B12 absorption (ileum)
    - Dogs have some production of IF in the gastric mucosa, cats do not
- Pancreatic physiology
  - Digestive enzymes are stored in the pancreatic acinus as inactive enzymes (zymogens). This is a protective mechanism so that the pancreas doesn't auto-digest
    - Autodigesion can occur with pancreatitis
  - Trypsinogen gets activated in the duodenum by enterokinase turning it into trypsin
  - Trypsin is a protease and activates other zymogens into enzymes in the duodenum
  - TLI measures trypsin, trypsinogen, and trypsin-trypsinogen complexes using rabbit Ab's which is why it is called "trypsin-like immunoreactivity"
    - Measuring immunoreactivity in the serum
    - Highly specific and highly sensitive

**Describe the diagnostic approach to dogs/cats with EPI**

- CBC
  - Usually unremarkable
  - +/- NNN anemia of inflammation
- Serum Chemistry Panel
  - Can mimic PLE (biochemical diagnosis)
  - Panhypoproteinemia
  - Hypocholesterolemia
  - Low $Ca^{2+}$ and $Mg^{2+}$
    - Due to malabsorption of nutrients, especially fats
    - Vitamin D deficiency
    - Diarrhea
  - Other electrolyte derangements due to diarrhea
    - $Na^{+}$
    - $Cl^{-}$
  - Mild reactive hepatopathy
  - Amylase/lipase are NOT helpful
- Serum vitamin B12 levels
  - Almost always deficient due to low IF (especially cats)
  - Maldigestion
  - Malabsorption in ileum
  - Dysbiosis
- UA
  - Usually unremarkable
- Fecal float
  - Often negative but still indicated to rule out comorbidities
- Imaging
  - Typically unrewarding
  - +/- thin pancreas on ultrasound
- Spec cPL
  - Less sensitive than TLI
- Gold Standard Diagnostic: Serum trypsin-like immunoreactivity (TLI)
  - Low TLI is indicative of EPI because the pancreas is unable to produce the enzymes
  - Dogs: < 5.5 mcg/L is diagnostic for EPI
  - Cats: < 8.0 mcg/L is diagnostic for EPI
  - 12 hour fasting sample
  - Elevated TLI in pancreatitis, severe renal disease, malnourishment

**EPI in Dogs vs Cats**

| | | |
|---|---|---|
| **Age** | Young adult<br>Median 3-4 years | Adult<br>Median 7.7 years |
| **Sex** | F > M | M > F |
| **Breeds** | GSD >> CKCS, RC Collie, Chow, Westie | Any |
| **Clinical Signs** | PP, Weight loss, and SB diarrhea<br>+/- steatorrhea, flatulence, vomiting | Weight loss, diarrhea, PP, anorexia, lethargy, vomiting |
| **Pathogenesis** | **1. Hereditary PAA in certain breeds**<br>2. Immune mediated<br>3. Secondary to chronic pancreatitis | **1. Generally secondary to chronic pancreatitis**<br>2. Also PAA? |
| **Diabetes Mellitus?** | No | Possible 10% |
| **Histopathology** | Subclinical: mild lymphocytic inflammation, partial PAA<br>Clinical: severe PAA | Lymphocytic inflammation, fibrosis, PAA (pancreatic acinar atrophy) |
| **Diagnosis** | Obvious<br>Uncommon | Often subtle<br>Very uncommon |

**Describe the treatment and management of EPI (and reasons for treatment failure)**

- Pancreatic enzyme supplementation: life-long treatment with each meal
  - Use brand name product – typically from raw pig pancreata
  - Most products are powder, Avoid plant-based
  - Powder and meal do not need to be pre-incubated

- Diet
  - Highly-digestible diet
  - Avoid high fiber diet
  - No need to fat restrict
- Vitamin B12 supplementation
  - SQ: 250-1000 mcg weekly x6 weeks, then q3 weeks
  - PO 250-1000 mcg daily
  - Most are hypocobalaminemic *especially cats!
- Address dysbiosis
    - If no response to the above treatment
    - Dysbiosis common from increased intestinal substrate, lack of pancreatic juice/bicarbonate, alterations in GI motility, alterations in villi brush border

        - Treat with pre/probiotics
        - If still no response, consider Tylosin 20mg/kg po q24 h x 2-4 weeks
- Fat soluble vitamin supplementation
    - Rarely needed but may be useful in some patients due to poor absorption of fat-soluble vitamins (ADEK)
- Acid suppressants
    - Generally not indicated
- Immunosuppression is NOT indicated
    - By the time the dz is diagnosed, a majority of the pancreatic function has been lost and the immunosuppression would do more harm than good

**Causes for treatment Failure**

- Lack of owner compliance
- Use of plant-based enzymes
- Inappropriate enzyme dose
- Not on a highly-digestible diet
- Hypocobalaminemia is not addressed
- Dysbiosis not addressed
- Use of tablets instead of powder
- Most need highly digestible diet, most need B12, some need Tylan for dysbiosis