

The background is a dark red color with a subtle, repeating pattern of microscopic biological structures. In the top left, there is a branching, root-like structure. In the top right, there are several rod-shaped bacteria and a larger, more complex, branching structure. In the bottom left, there are several rod-shaped bacteria and a larger, more complex, branching structure. In the bottom right, there is a large, circular structure with several long, thin, radiating lines ending in small dots, resembling a cell or a microorganism.

# CELL SEGMENTATION IN COELIAC DISEASE BIOPSIES

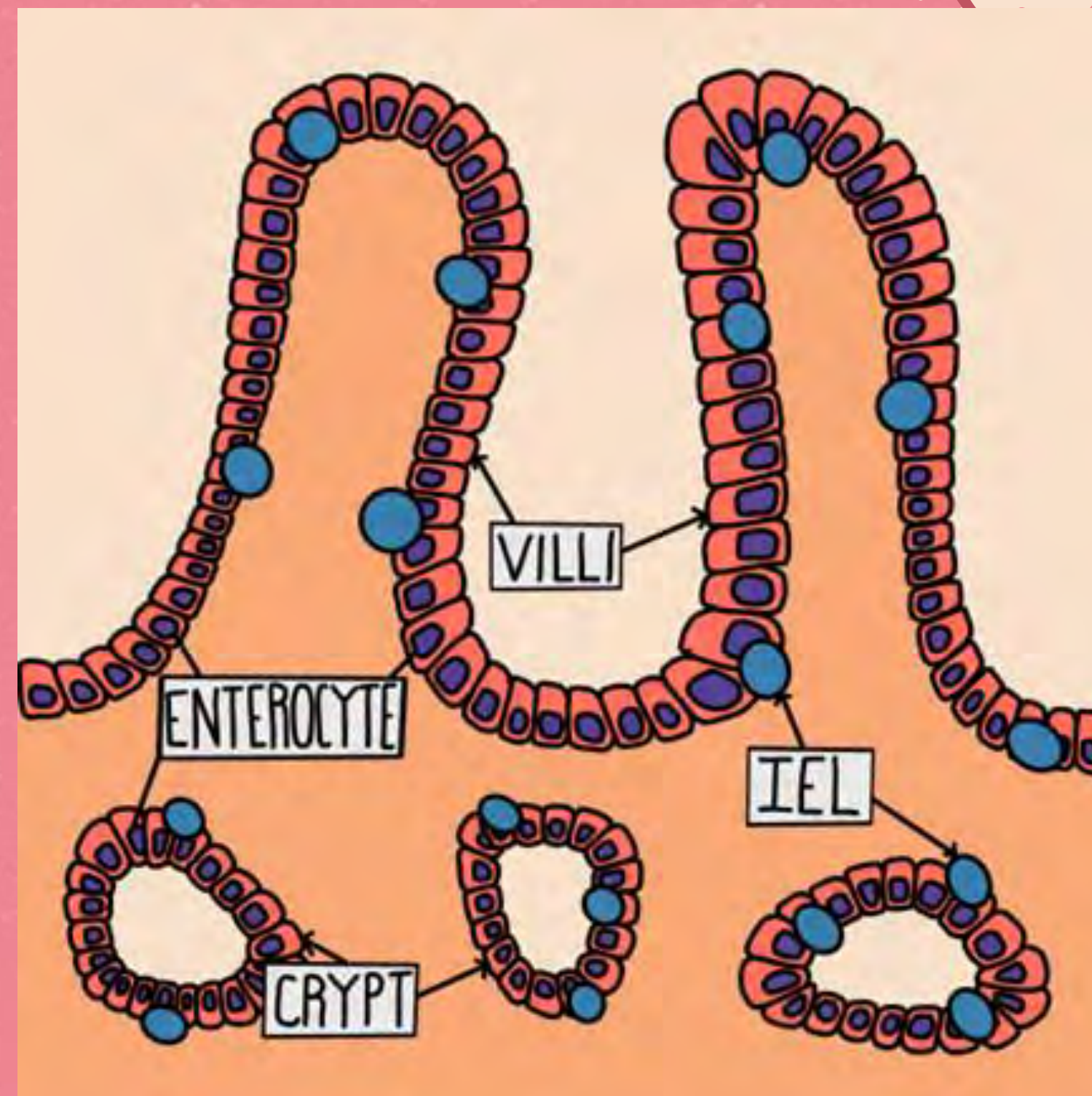
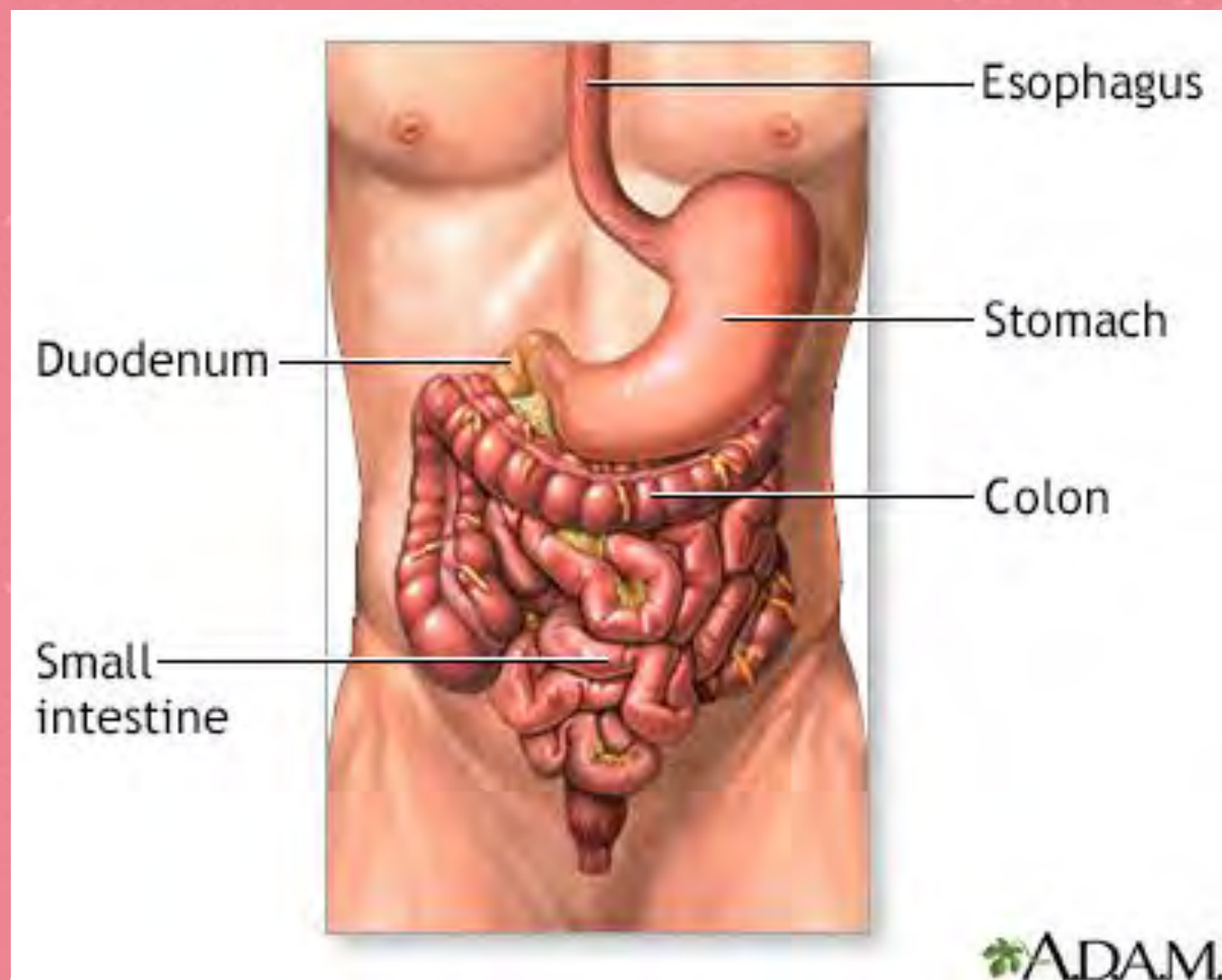
By Rebekah Bryant  
Lyzeum Ltd

# Coeliac disease

- Autoimmune disorder to gluten
- Causes inflammation/ damage to the intestine
- Effects roughly 1% of the population
- Diagnosis:
  - Blood tests
  - Duodenal biopsy

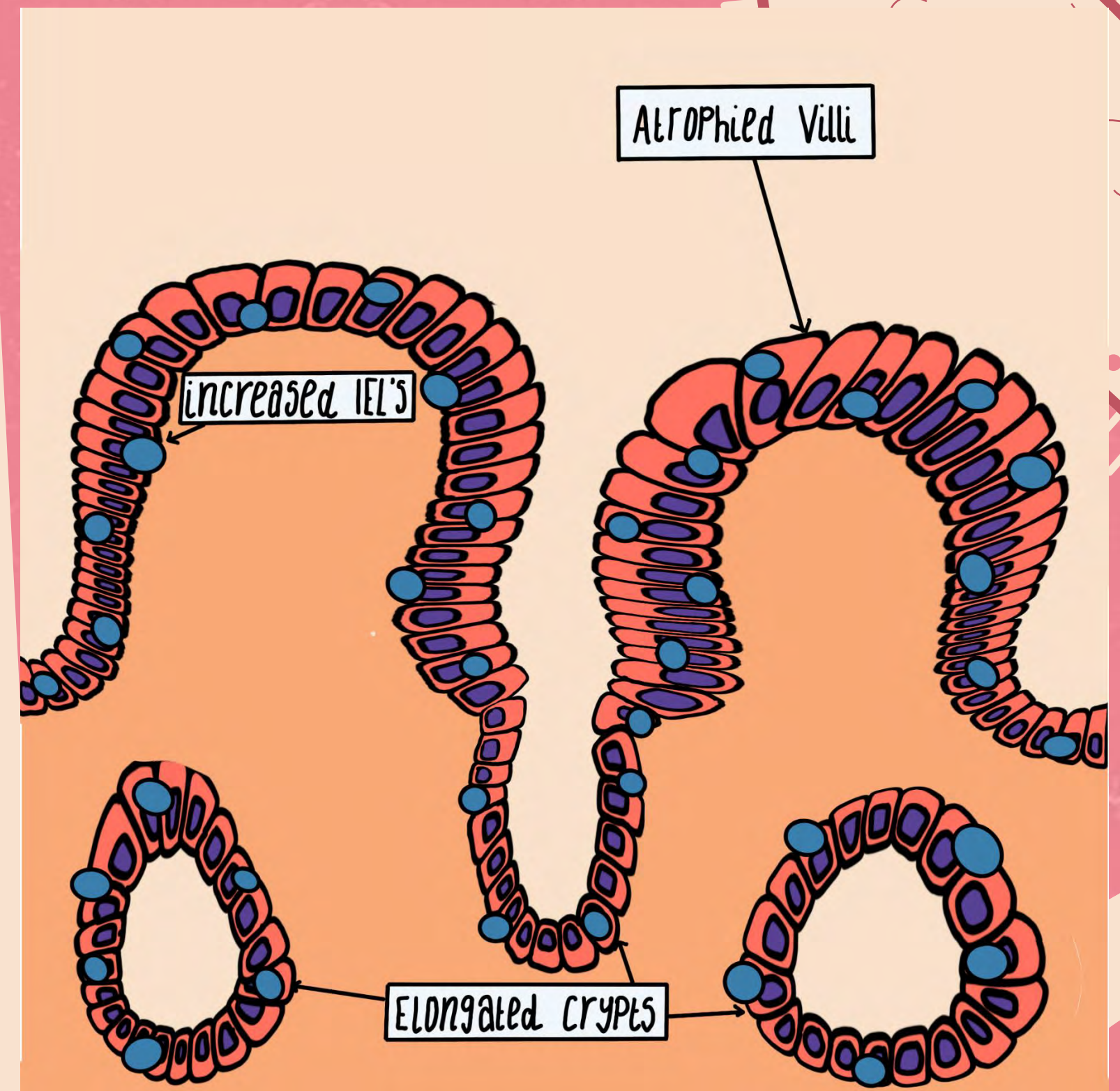


# The Duodenum



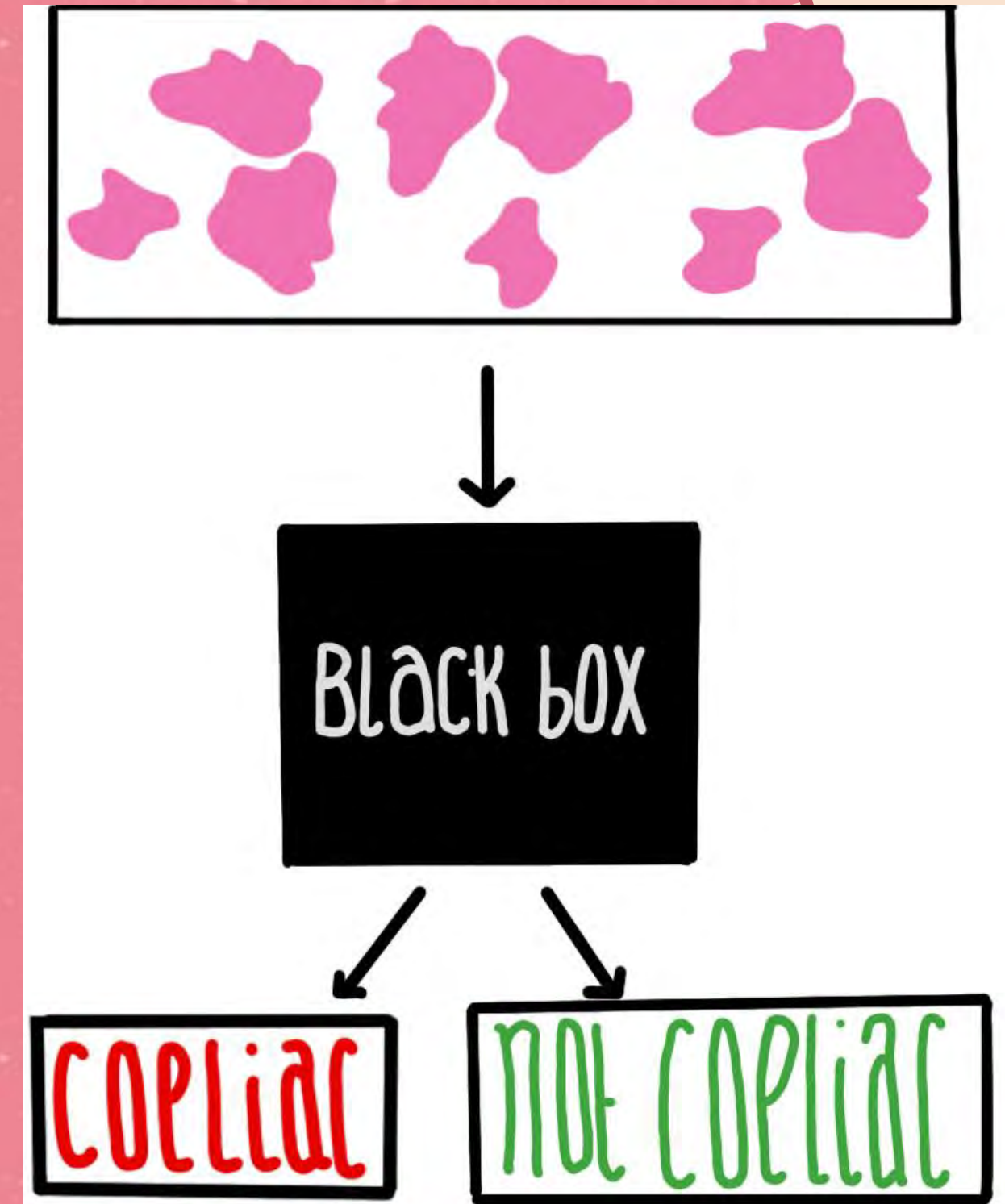
# Coeliac Disease

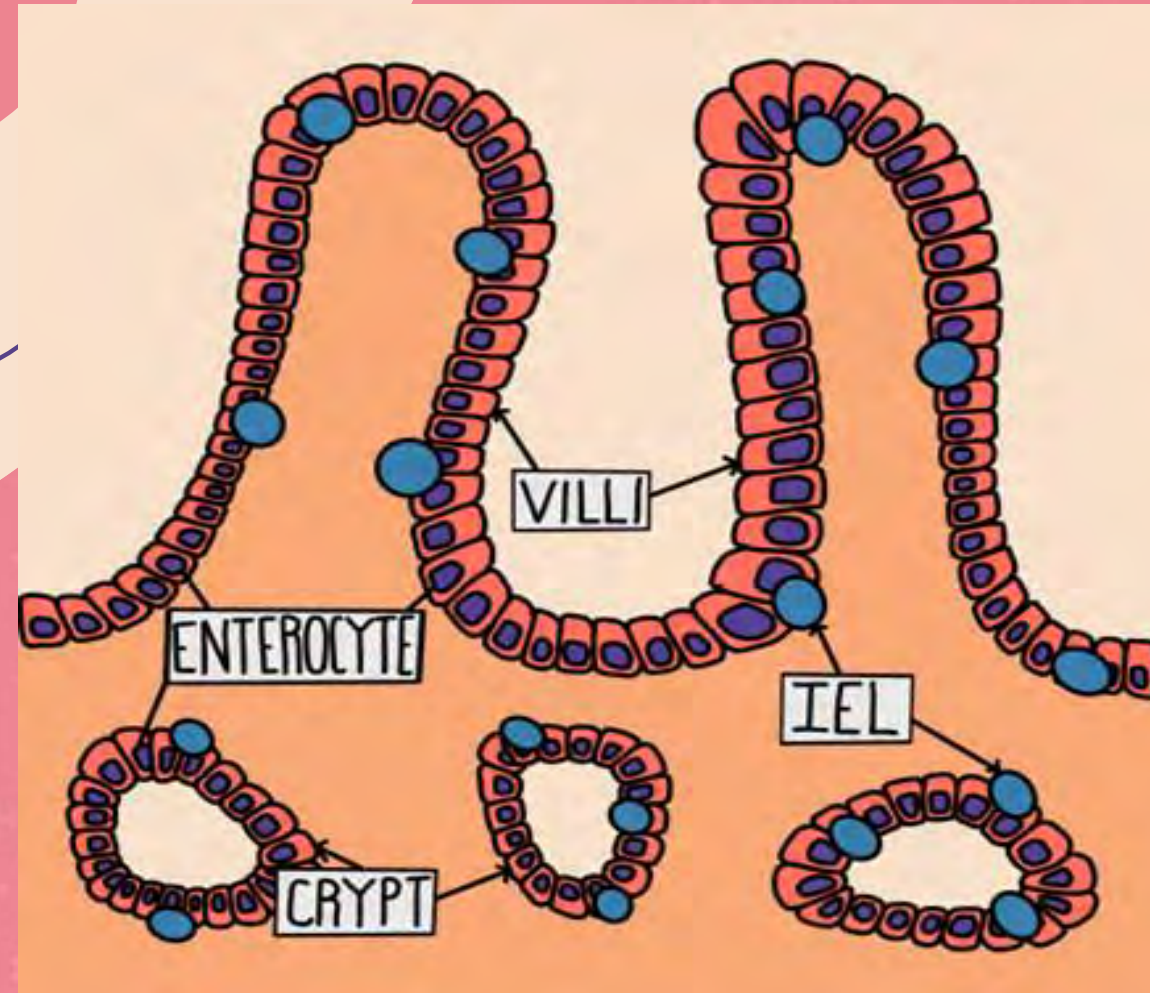
- Coeliac disease causes:
  - Villi atrophy and flattening
  - Crypt enlargement
  - Increased IEL's
  - Decreased enterocytes
- Doctors look at:
  - LENGTH of villi vs crypt
  - RATIO of IEL's to enterocytes



# Problem Identification

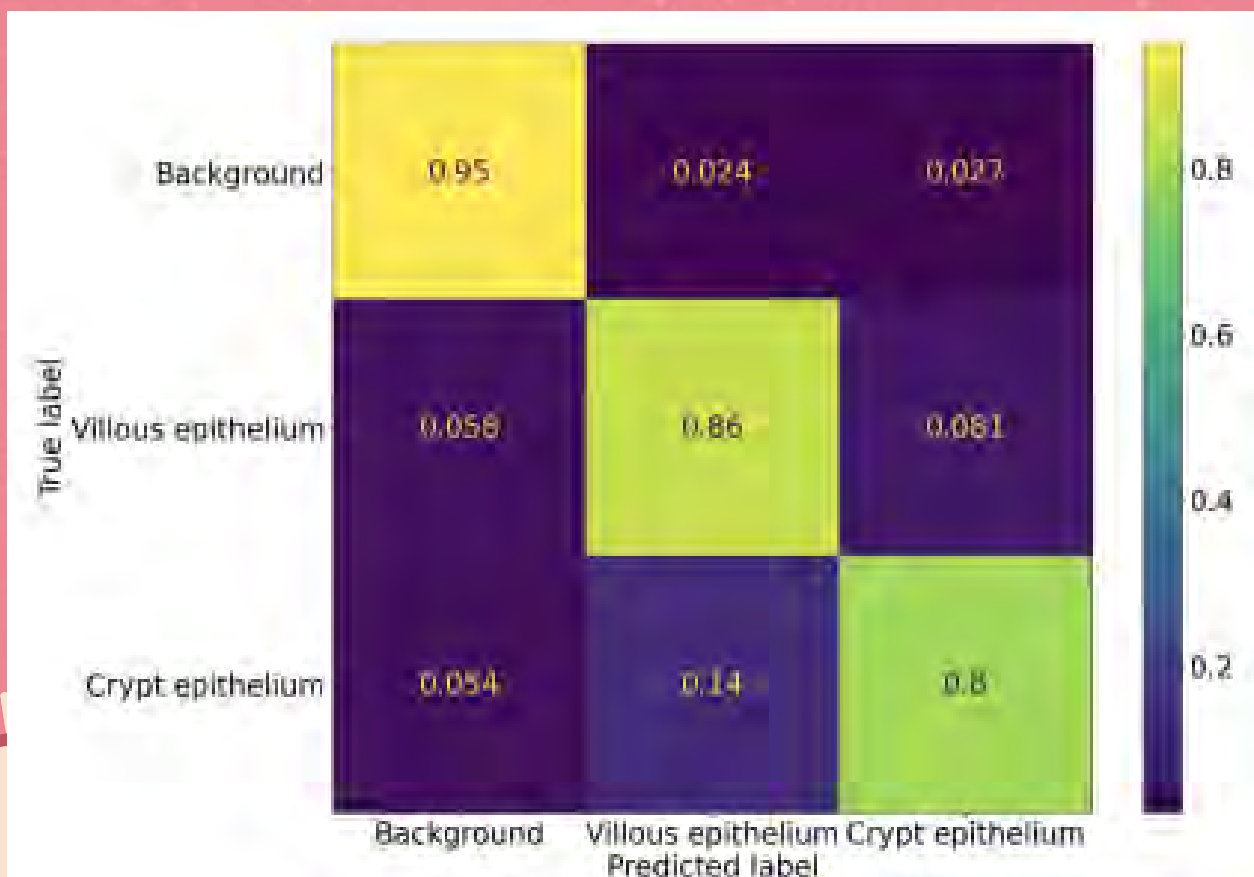
- Diagnosis Problems:
  - 20% disagreement between histopathologists
  - Labour / time intensive
- Lyzeums Model:
  - Black box classification
  - 94.1% accuracy
  - lacks clarity



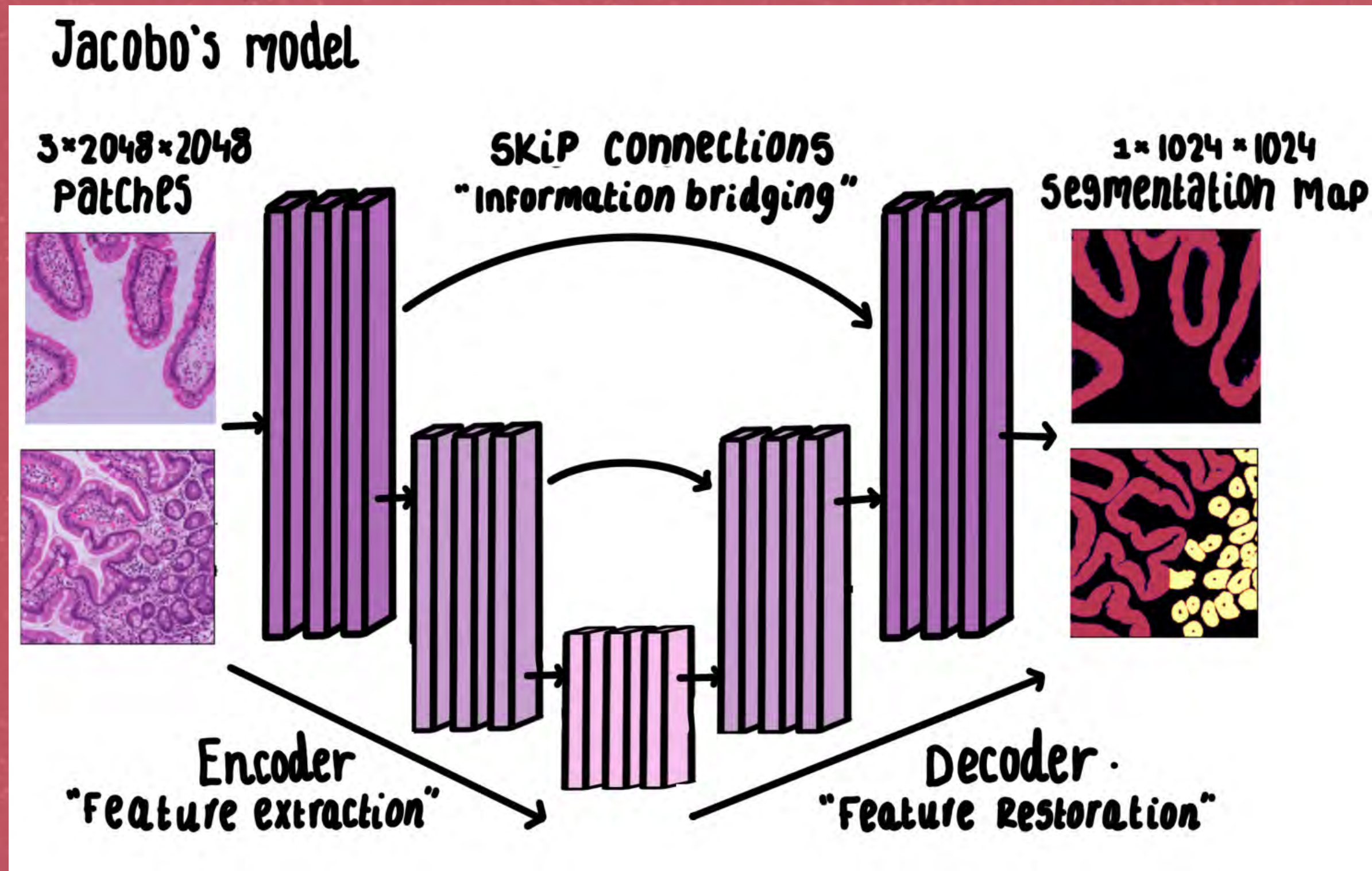


# Overview

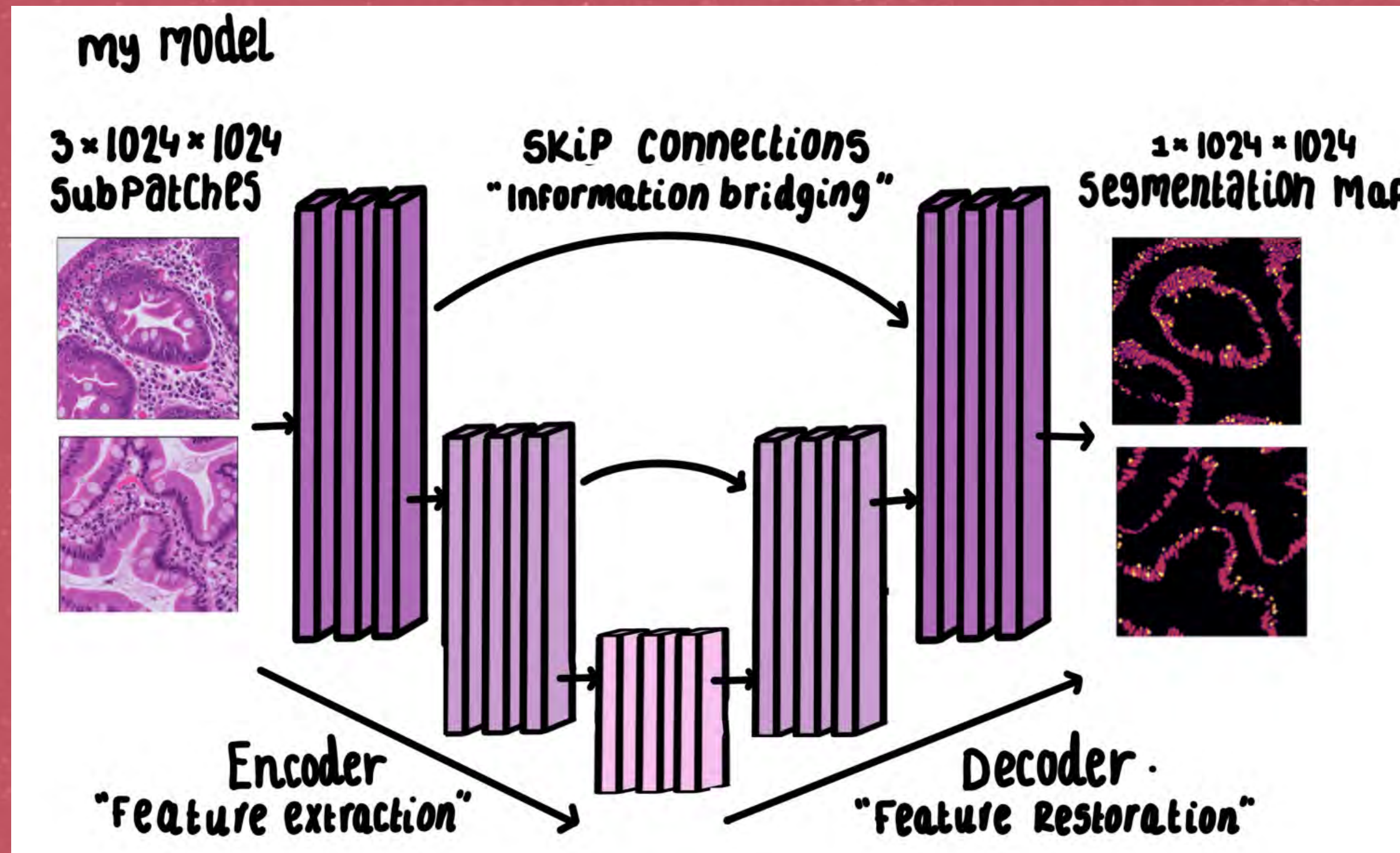
- Existing model:
  - Semantic segmentation of villi and crypt epithelium
  - Instance segmentation of villi and crypts
- My goal:
  - Semantic segmentation of IELs and enterocytes
  - Coeliac disease diagnosis through segmentation masks



# UNET - Jacobo's Model



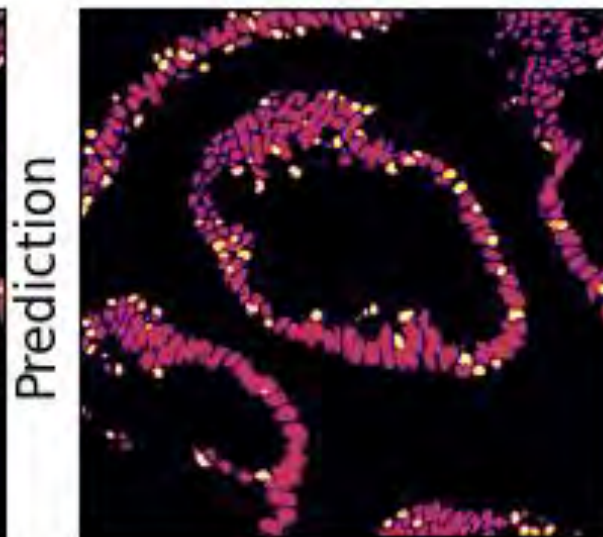
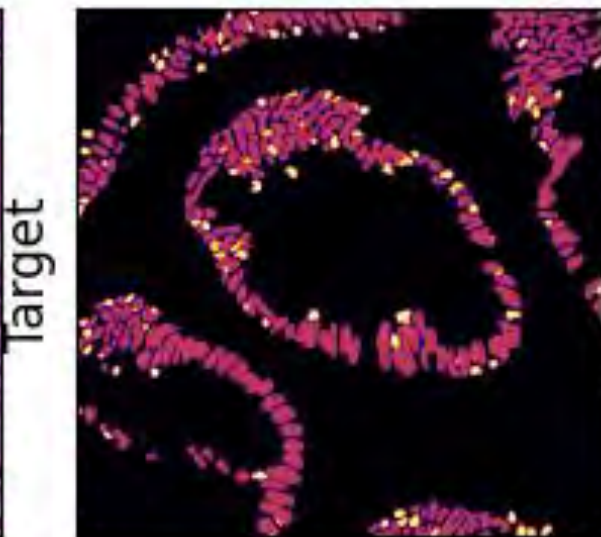
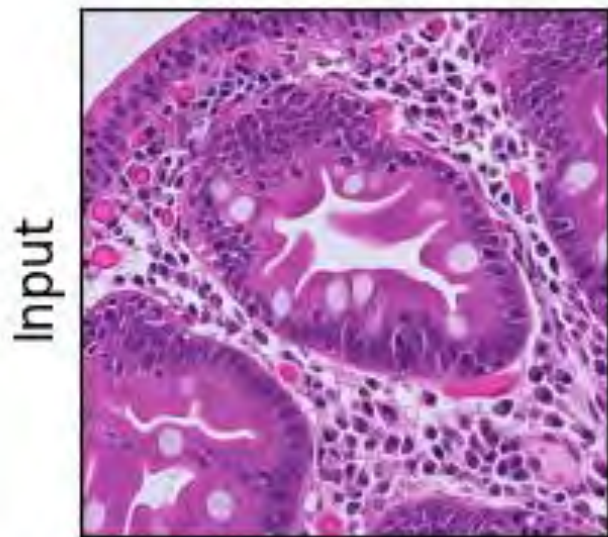
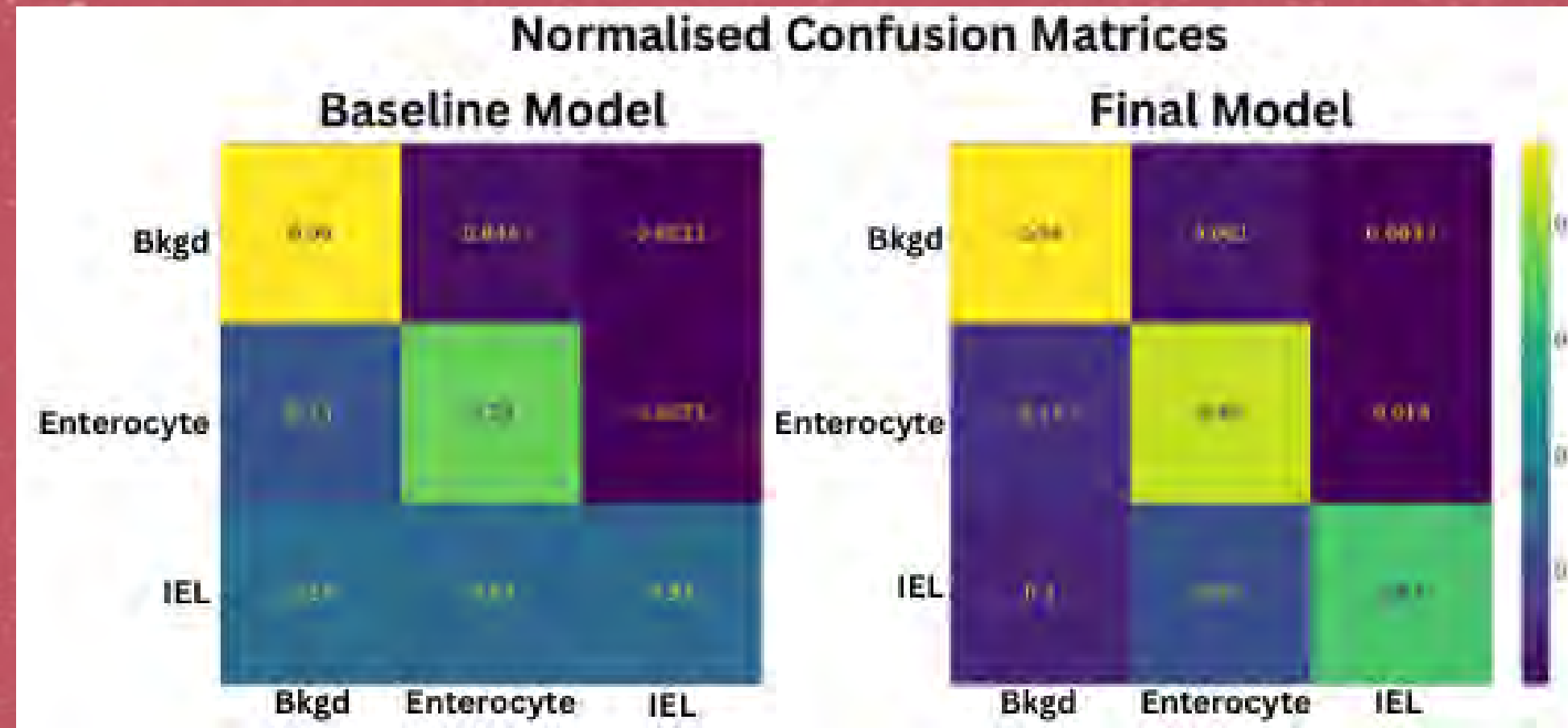
# UNET - My Model



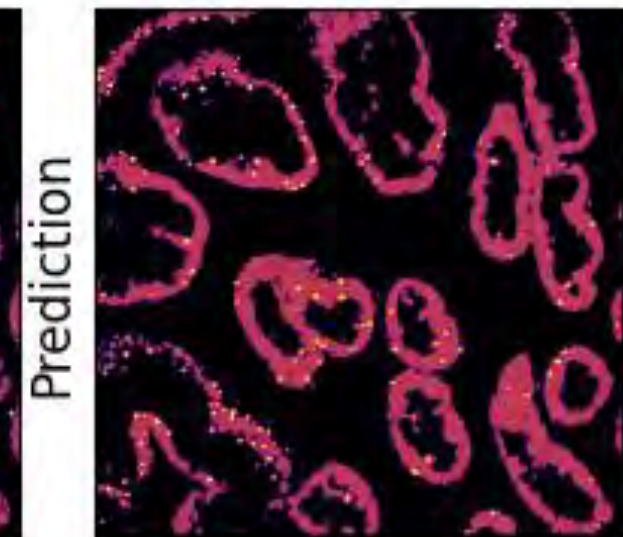
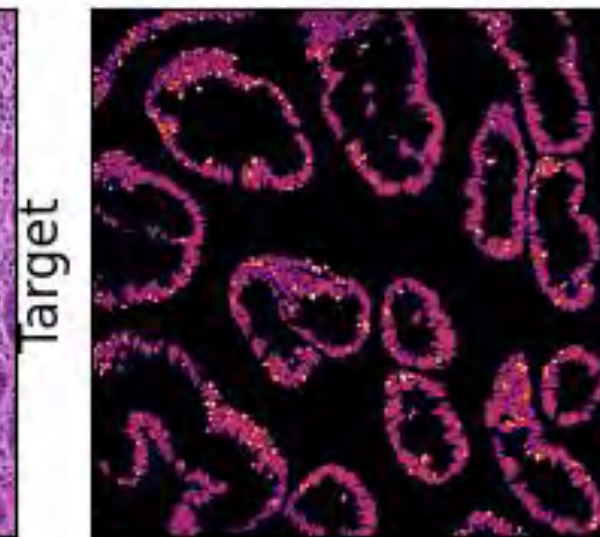
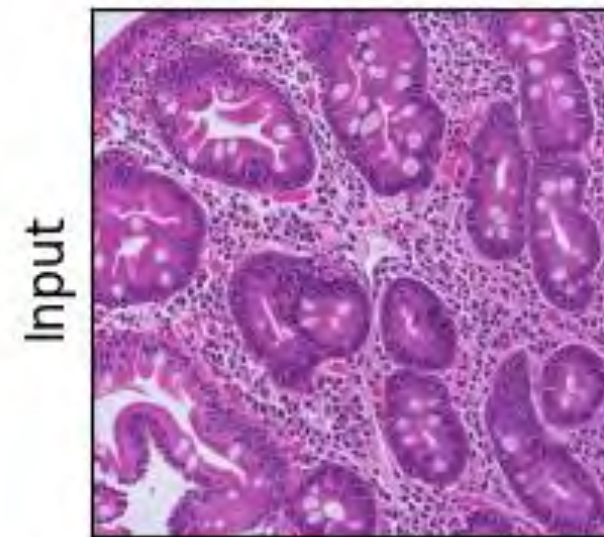


# Training - Results

## Confusion Matrix

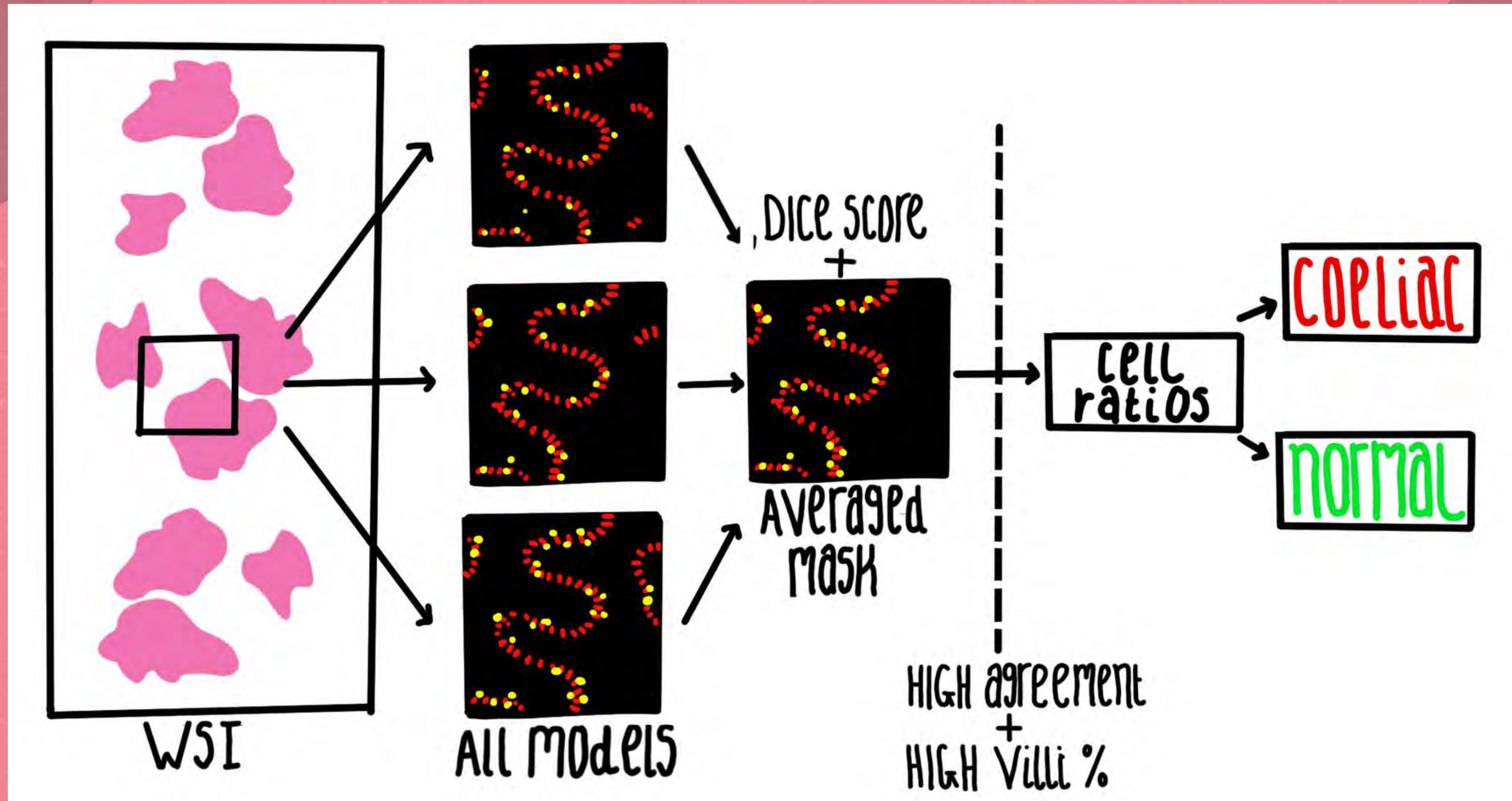


Final Model

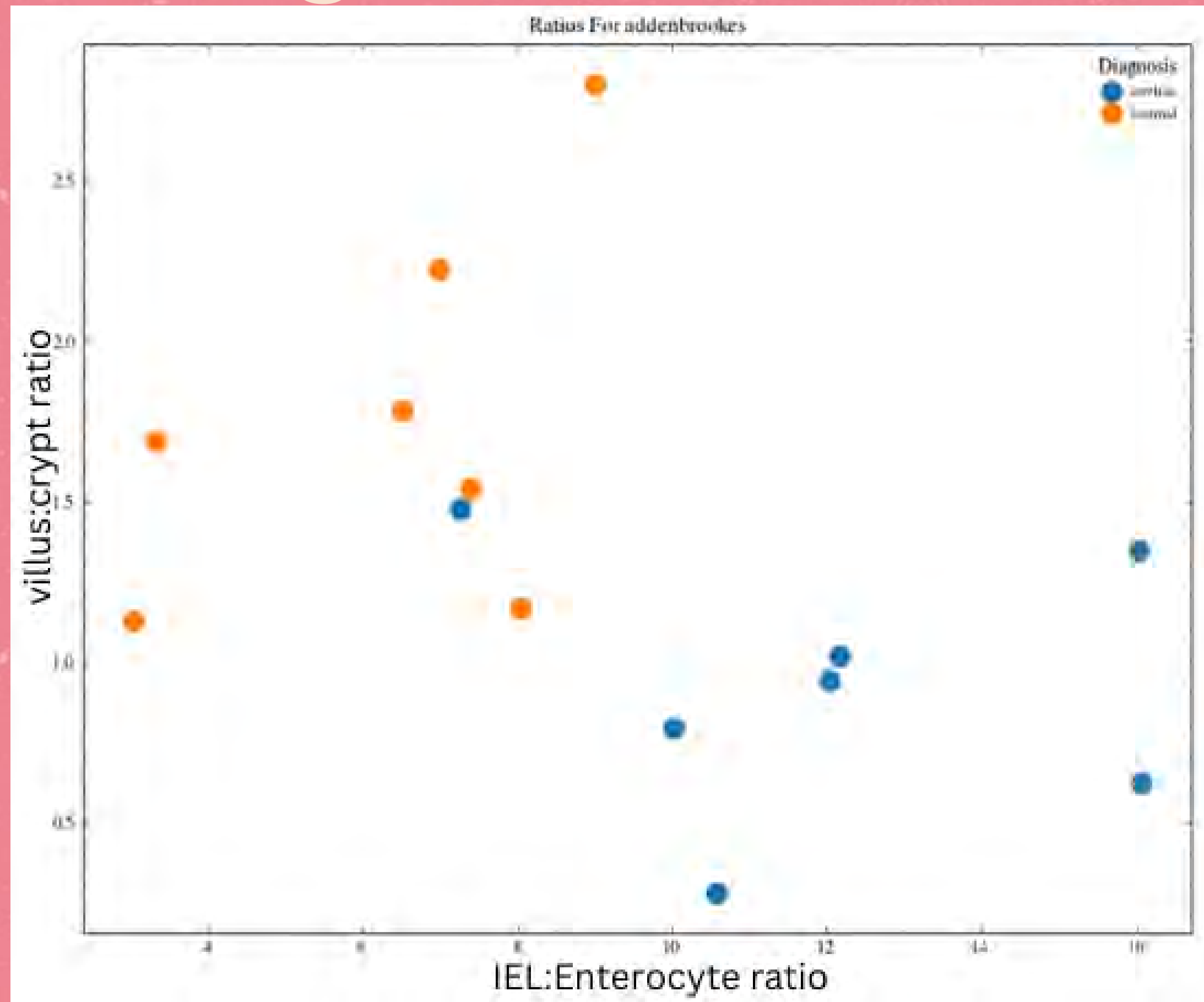


Baseline

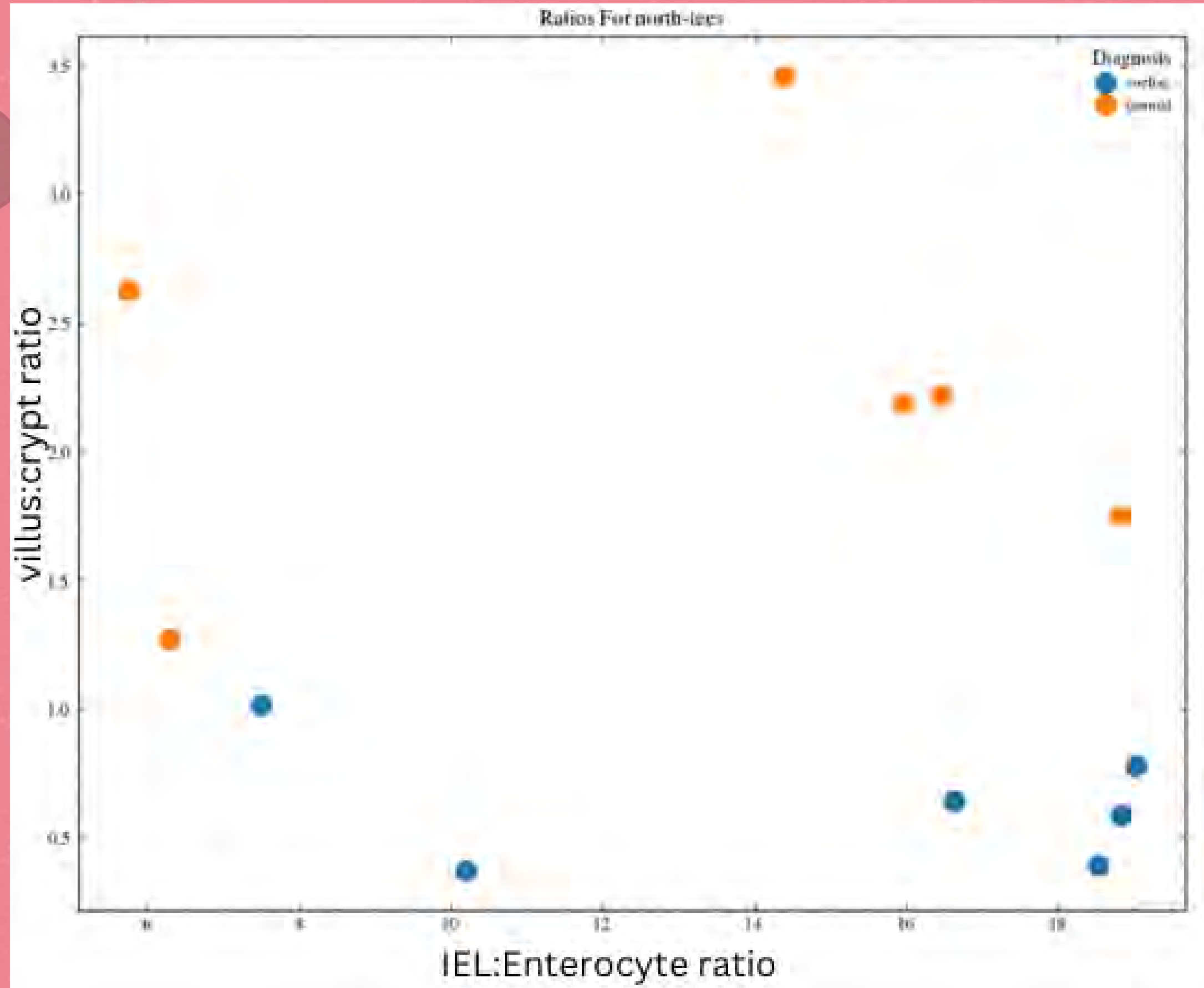
# Testing - Methodology



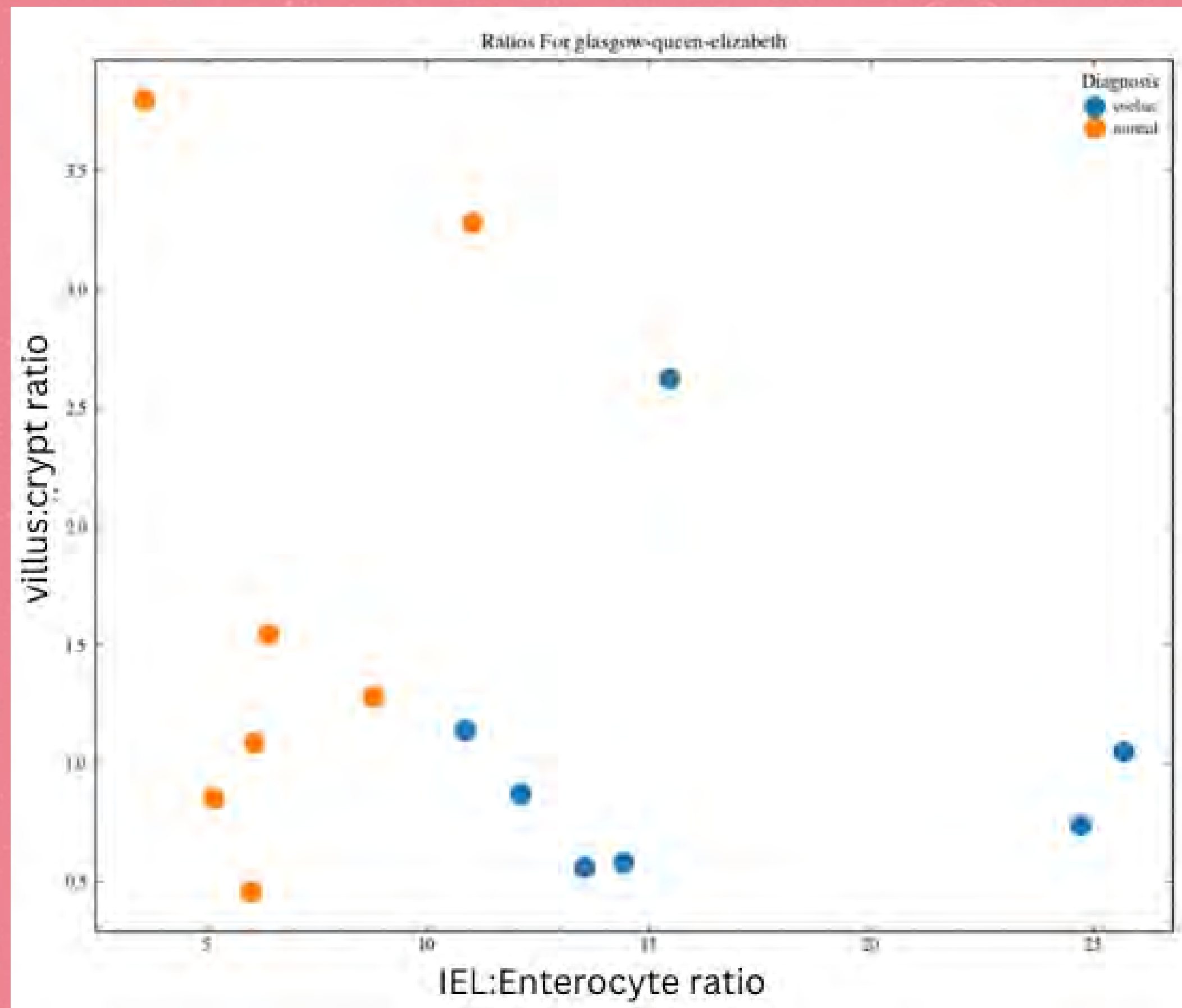
# Testing – Addenbrookes



# Testing – North tees



# Testing – Glasgow queen elizabeth

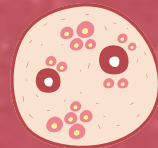


# Future Work



## Test more data

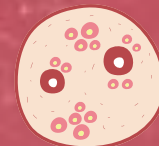
Use testing function on more data to see if other patterns immerge



## Test on other diseases

Other diseases see inflammation in the gut and increased IELs such as:

- Autoimmune Enteropathy
- Crohn's disease
- Tropical Sprue



## Transfer learning

Currently ResNet-34, a pathology-specific encoder would be better (which doesn't exist at the moment)

**Thank you!**  
**Questions?**

