

# DIGESTION & ABSORPTION

## Week 15

### Essential amino acids

- Valine
- Leucine
- Isoleucine
- Threonine
- Met
- Phenylalanine
- Arginine
- Lysine
- His

**Gluconeogenesis:**  
From G6P → glucose  
Stimulated by exercise

- Saliva:**
- Water
  - Electrolytes (all of 'em)
  - Mucins
  - IgA, H<sub>2</sub>O<sub>2</sub>
  - Epidermal growth factor
  - $\alpha$ -amylase, lipase, enzymes
  - Opiophin
  - haptocorrin (B12 protector)

daily water intake = 2000mls

Secretion 7000mls

Saliva 1500

Stomach 2500

Bile 500

Pancreas 1500

Intestine 1000

Reabsorbed = 8800ml

Jejunum 5500

Ileum 2000

Colon 1300 (90%)

Stool 200

Protein digestion begins in the stomach + rapidly continues in duodenum + jejunum

Fat digestion begins in the duodenum (pancreatic lipase)

gastric secretions dissolve iron... forms complex w/ vitamin C.

Pepsinogen I

near HCl acid

Pepsin

pH optimum 1.6 - 3.2 (deactivated in duodenum)

Bile salts allow emulsification of fatty acids → micelles

Pepsins inactivated by pancreatic juice

pancreatic secretion pH = 8

influenced by 3 factors  
- recent intake  
- iron stores  
- hepcidin

ALMOST ALL IRON ABSORPTION IN DUODENUM

Small intestine  
Trypsin digests polypeptides

trypsinogen activates pancreatic digestive enzymes

VITAMINS ABSORBED

pancreatic lipase breaks down triglycerides (needs colipase)

Fatty acids broken down to form acetyl-CoA

FFA bound to albumin  
chol/TG/Phlip in lipoprotein complexes

Amino acids absorbed coupled to ion transport.

long chain FFA absorption in proximal small bowel  
JEJUNUM

Fat soluble vitamins (ADEK) insoluble in gut so need to be incorporated into micelles.

↓ if no bile or no panc enzymes

must be digested by cholesterol esterase prior to absorption

Ca<sup>2+</sup> absorption depends on 1,25 dihydroxycholecalciferol

Final protein digestion to amino acids:

- intestinal lumen
- brush border
- mucosal cell cytoplasm

50% protein from food  
25% from digestive juice  
25% from cells.

FROM LUMEN INTO CELL

disaccharides digested by enzymes of brush border  
Glucose/galactose via SGLT-1 using Na<sup>+</sup> gradient (glucose transport depends on Na<sup>+</sup>)  
Fructose via GLUT 5 fac. diffusion

FROM CELL TO ECF into blood via GLUT-2

B12 absorbed in ileum

Gastrocolic reflex  
Distension of stomach = contractions of rectum  
Amplified by gastrin

Colon resorbs 90% of water

Respiratory rate = E liberated per unit time  
RQ = ratio of CO<sub>2</sub> produced : O<sub>2</sub> consumed per unit time @ steady state

RQ CHO = 1  
Fat = 0.7  
Pro = 0.82

- 200 - 250mls faeces daily
- Solid portion of faeces is 30% bacteria
- 75% water / 25% solids
- Brown from bile pigment.



# GIT PHYSIOLOGY Week 16

NB: vagal PSNS input has a modulatory effect on ENS via M3 receptors. ↑ tension by mobilising  $Ca^{2+}$  stores.

Enteric Nervous System (100 million neurons!)  
"the little brain"

Myenteric Plexus  
"Auerbach's plexus"

Between muscular layers  
Innervates longitudinal + circular muscles  
- linked to motor control

Submucous Plexus  
"Meissner's plexus"

Between circular layer + mucosa  
Innervates glandular-epithelium, intestinal endocrine cells, submucosal blood vessels  
Control of intestinal secretion.

Neurotransmitters:

ACh, serotonin, GABA, ATP, NO, CO, peptides/polypeptides → paracrine hormones.

↑ GASTRIN -  $Ca^{2+}$   
- epinephrine

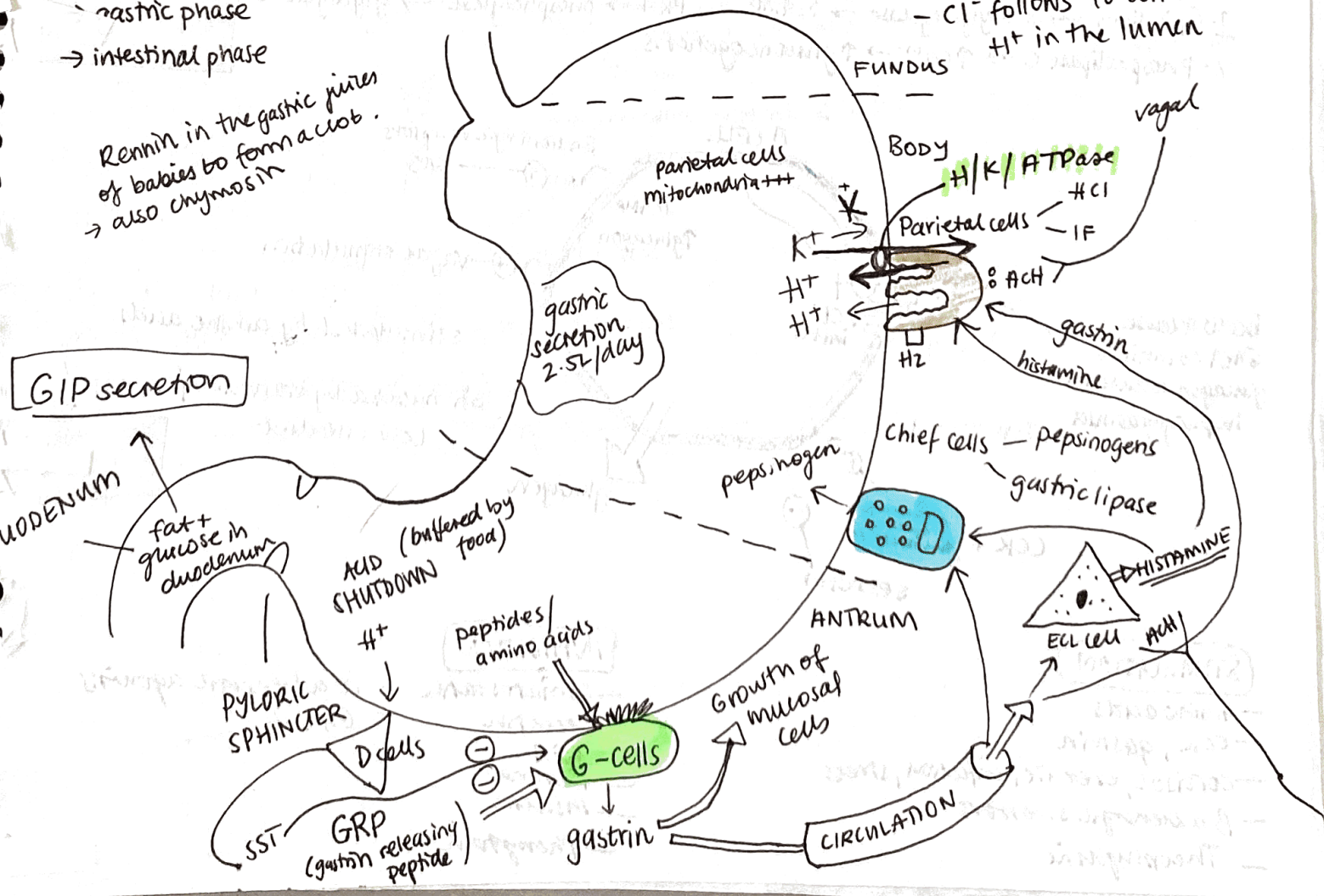
↓ GASTRIN - secretin  
- VIP - glucagon  
- calcitonin.

## GASTRIN & GASTRIC ACID SECRETION

- cephalic phase: ↑ HCl prior to food entering stomach
- gastric phase
- intestinal phase

- In the parietal cell
- Histamine + gastrin stimulate
  - Blood pH can rise after meal
  - $H^+$  pumped by  $H^+/K^+/ATPase$
  - $Cl^-$  follows to combine w  $H^+$  in the lumen

Rennin in the gastric juices of babies to form curd.  
→ also chymosin



# INSULIN & GLUCAGON SECRETION

## INSULIN

↓ insulin  
 phentolamine  
 B blockers  
 α-stimulators  
 Thiazides

↑ insulin  
 β-agonists  
 glucagon  
 theophylline

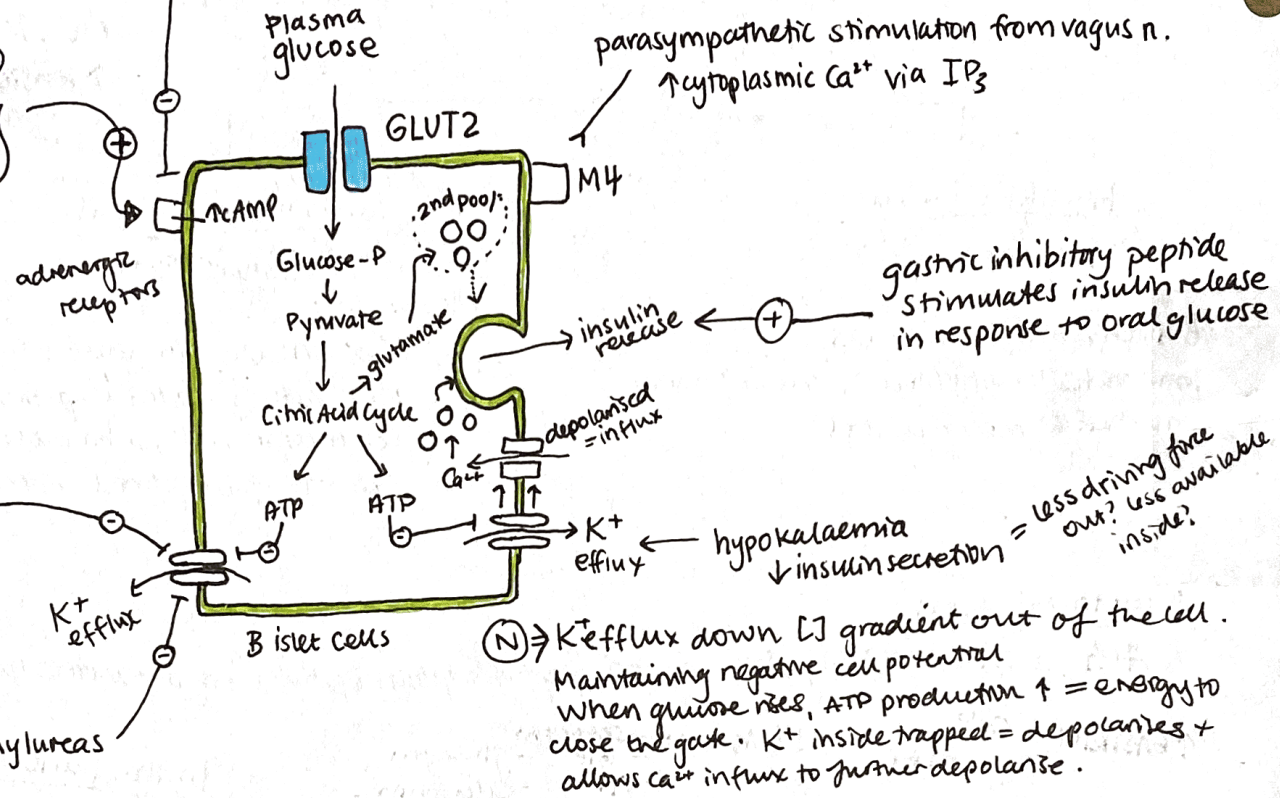
Amino acids  
 β-keto acids  
 ↓  
 ATP  
 ↓  
 metabolism

Sulfonylureas

insulin  
 noradrenaline  
 somatostatin

Insulin = tyrosine kinase pathway @ tissues

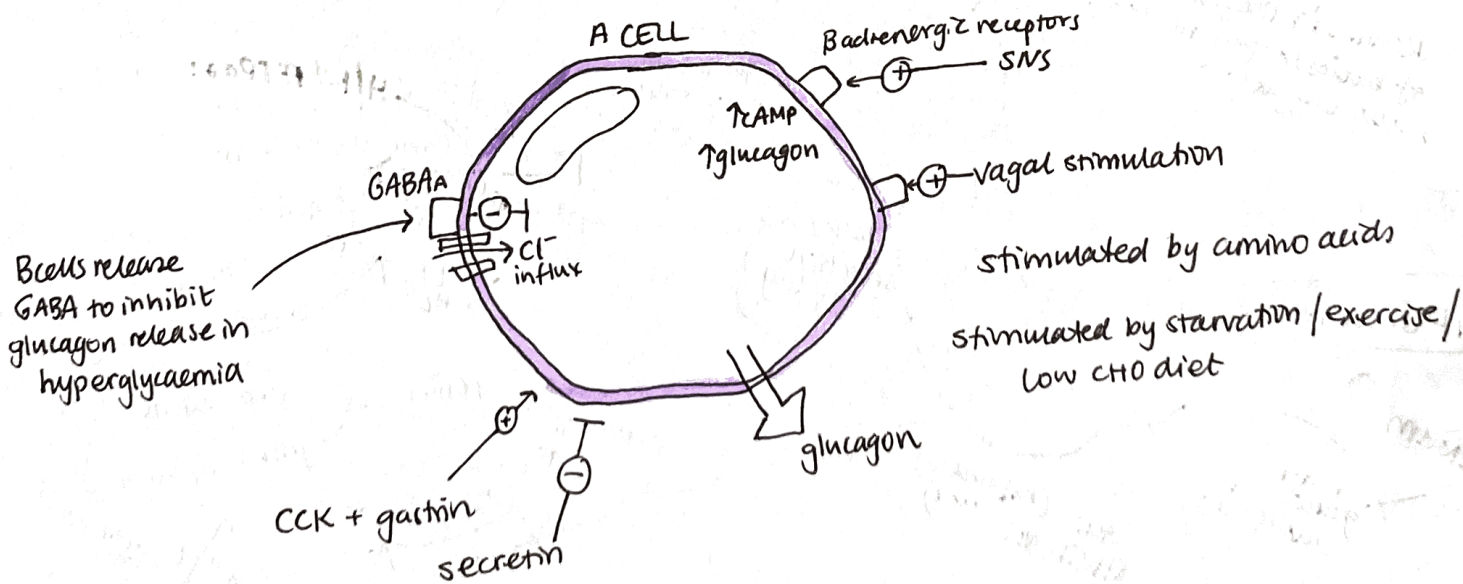
Human pancreas holds 200 units of insulin @ one time



## GLUCAGON $t_{1/2}$ 5-10 mins, metabolised by liver, produced by A cells of pancreas.

Acts on G protein coupled receptors

1.  $G_s$  in liver  $\rightarrow$  adenylyl cyclase  $\rightarrow$   $\uparrow$  cAMP  $\rightarrow$  PKA  $\rightarrow$  phosphorylase  $\rightarrow$  glycogen breakdown
2. Phospholipase C  $\rightarrow$   $\uparrow$   $Ca^{2+}$   $\rightarrow$   $\uparrow$  gluconeogenesis



### STIMULATION

- Amino acids
- CCK, gastrin
- cortisol, exercise, infection, stress
- β adrenergic stressors
- Thymine

### INHIBITION

- somatostatin
- secretin
- FFA
- ketones
- insulin
- phentolamine
- α adrenergic agonists
- GABA