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UNIVERSITY OF LIVERPOOL

Year 1 MBChB –
Gastrointestinal system

Overview of Digestion

Prof. Barry Campbell

Infection Biology & Microbiomes, IVES

bjcampbl@liv.ac.uk
http://pcwww.liv.ac.uk/~bjcampbl/Digestion.htm

School of Medicine @UoLmedicine

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Learning Outcomes:

- LO1 - Describe the function of the regions of gut tube (i.e. from mouth to anus) and its associated secretory organs
- LO2 - Define neural, endocrine and paracrine control of the gut
- LO3 - Differentiate between involuntary and voluntary muscle control and the context to gastrointestinal (GI) tract motility (e.g. swallowing, peristalsis, defecation)
- LO4 - Differentiate between the autonomic and enteric innervation of the GI tract
- LO5 - Illustrate function versus dysfunction in the GI tract using clinical examples

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DIGESTION

"The progressive breakdown of food into a form suitable for absorption and the associated transport processes"

Digestion therefore also includes: -

- ***The processes of secretion***
- ***The processes of absorption***
- ***Movement of the gut contents***
- ***growth & differentiation***
- ***The mechanisms protecting the gut from damage or attack, and***
- ***the mechanisms controlling and integrating all of the above***

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LO1

SCHEMATIC REPRESENTATION OF MAIN REGIONS OF THE GASTROINTESTINAL TRACT

REGION:		FUNCTION:
Oesophagus		- *Transit*
Stomach		- *storage, H^+/peptic digestion & intrinsic factor*
Small intestine	duodenum	- *fat, protein, carbohydrate digestion & absorption, Ca^{2+}/Fe^{2+}*
	jejunum	- *water and electrolyte transport*
	ileum	- *bile salt & vit B12 transport*
Large intestine	Colon	- *Storage*
		- *water and electrolyte transport*
	rectum & anus	- *defaecation*

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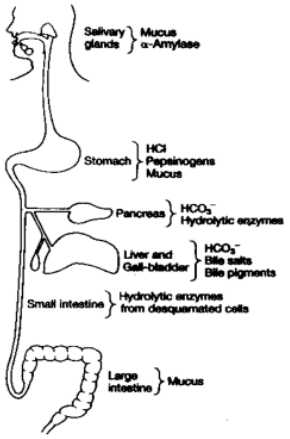
LO1

SECRETIONS OF THE GUT



Salivary glands - synthesis/secretion: amylase, mucus. Water, electrolytes

Exocrine pancreas - synthesis/secretion: proteases,lipase,amylase. HCO_3^-, water

Liver - bile salt synthesis, bile secretion.

Gall bladder - storage and concentration of bile

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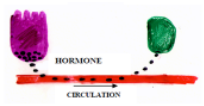
LO2

Physiological control systems in the gut

- **Endocrine** - Gut hormones



- **Paracrine** - Local regulators

- **Neural**

Intrinsic - Myenteric & submucosal nerve plexuses

Extrinsic - Afferent & efferent nerves vagal & splanchnic trunks (autonomic nervous system)

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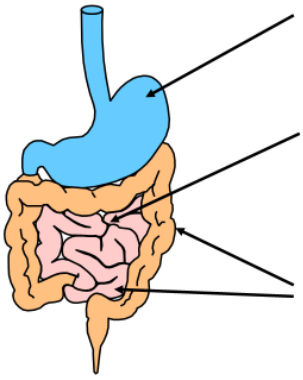
LO2

Major hormones of the gut



STOMACH
- Gastrin
- Somatostatin

UPPER SMALL INTESTINE
- Cholecystokinin (CCK)
- Secretin
- Gastric inhibitory peptide (GIP)*
- Motilin
- Vasoactive intestinal polypeptide (VIP)

ILEUM AND COLON
- Glucagon-like peptide 1 (GLP-1)
- Peptide YY (PYY)
- Neurotensin

*Also known as glucose-dependent insulinotropic peptide (GIP)

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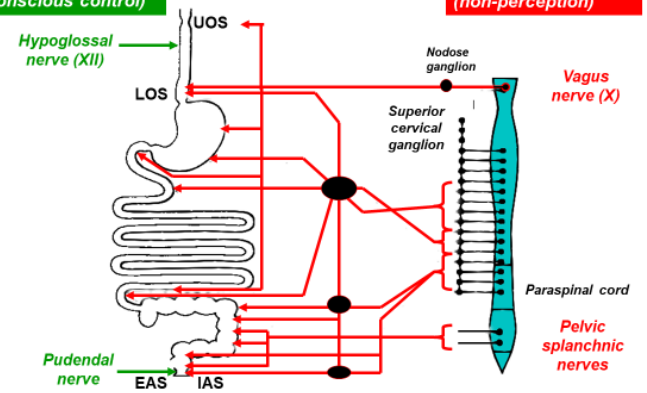
LO3

Overview of extrinsic innervation:

Voluntary *(Conscious control)*

Autonomic *(non-perception)*



UOS, Upper oesophageal sphincter; LOS, lower oesophageal sphincter; IAS, internal anal sphincter; EAS, external anal sphincter

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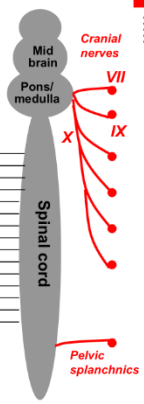
LO4

The autonomic nervous system

Sympathetic system: Noradrenaline

EFFECTS	ACTION
β (+) secretion of saliva	salivary glands
α (+) vasoconstriction β2 (-) vasodilation	gut blood vessels
β1/2 (-) decrease motility α (+) contraction	gut wall, sphincters
adrenaline (+) secretion	Adrenal medulla

α and β adrenoceptors



Parasympathetic system: Acetylcholine (Ach)

ACTION	EFFECTS
Salivary glands	(+) secretion of saliva
Gut wall	(+) increased motility and tone
Gut sphincters	(-) reflex relaxation
Gut secretions	(+) e.g acid, enzymes & electrolytes
Pancreas	(+) exocrine & endocrine secretion
Gallbladder	(+) contraction
Colon/Rectum	(+) defaecation

Muscarinic receptors
CNS - M_1, M_2, M_3, M_4 and M_5
GI tract - M_1, M_2, M_3 and M_5

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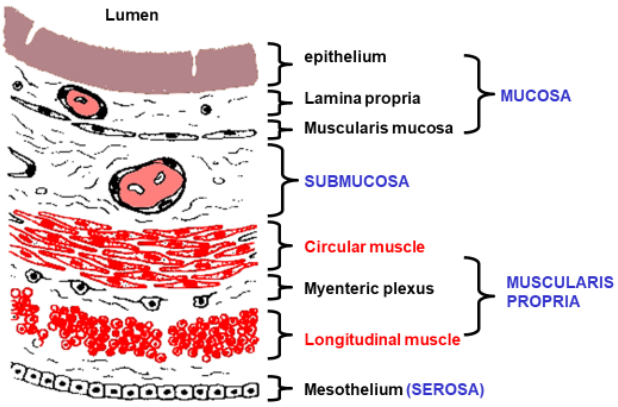
LO1

Organisation of the gut wall



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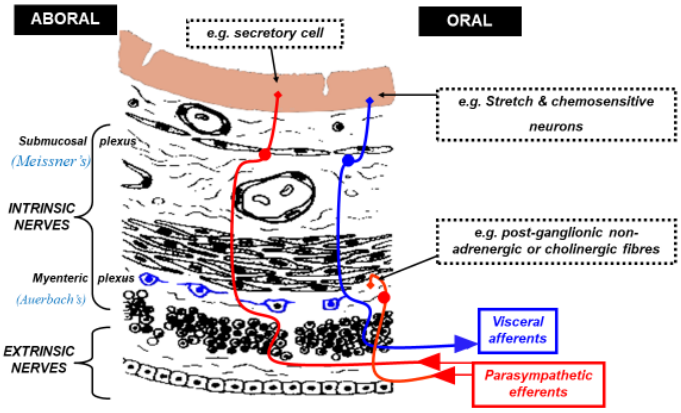
LO4

Intrinsic and extrinsic nerves of the digestive tract



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LO5

Function & Dysfunction in the GI tract

Physiology	Pathology
• Growth/development	➢ cancer
• secretion	➢ peptic ulcer, cystic fibrosis
• absorption	➢ malabsorption
• motility & signalling to CNS	➢ oesophagitis, gastroparesis, non-ulcer dyspepsia and irritable bowel
• surveillance (immuno/metabolic)	➢ ulcerative colitis, Crohn's disease, Coeliac disease
• co-ordination (neurons/hormones)	➢ aganglionic colon (Hirschsprung's)

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LO5

GI system case-based learning (CBL)

1. A problem that's difficult to swallow — *Achalasia*

- voluntary and involuntary components, motility patterns and problemsof swallowing and delivery of an ingested meal to the stomach

2. No more fish and chips! — *Gallstone pancreatitis*

- Composition of bile, gallbladder and liver functions, pancreato-biliary flow and enterohepatic circulation of bile/bile components

3. Gap year to India — *Traveller's diarrhoea*

- normal electrolyte levels/fluid balance, understanding key mechanisms of intestinal secretion,gut fluid balance, small intestinal water uptake and mechanisms of diarrhoea

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Thank you for your attention.

- bjcampbl@liverpool.ac.uk
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