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Author: John Williams, M.D., Ph.D., 2009

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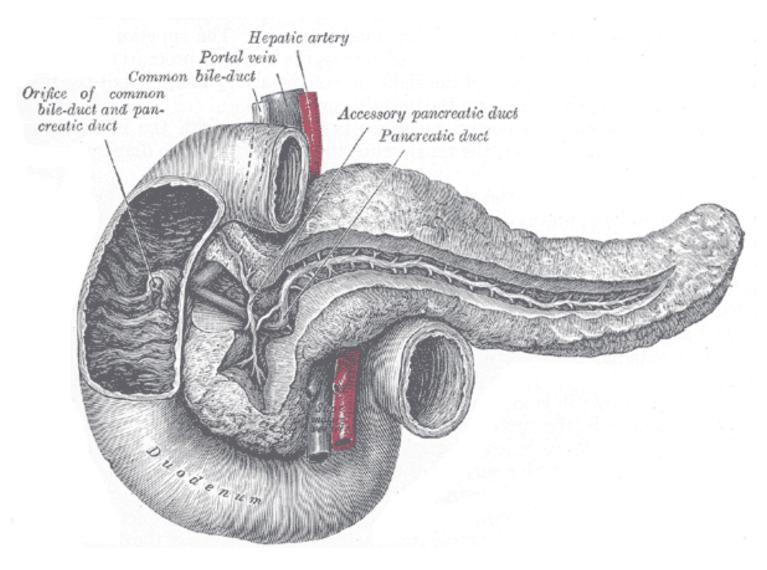
# M1 - GI Sequence

# **Pancreas**

John Williams, M.D., Ph.D.



## **PANCREAS**



Gray's Anatomy, wikimedia commons

The pancreas is made up of three functional components:

Endocrine – Islets 2%

Exocrine – Acinar 80%

Digestive Enzymes

Exocrine - Ducts 8%

Bicarbonate Rich Fluid

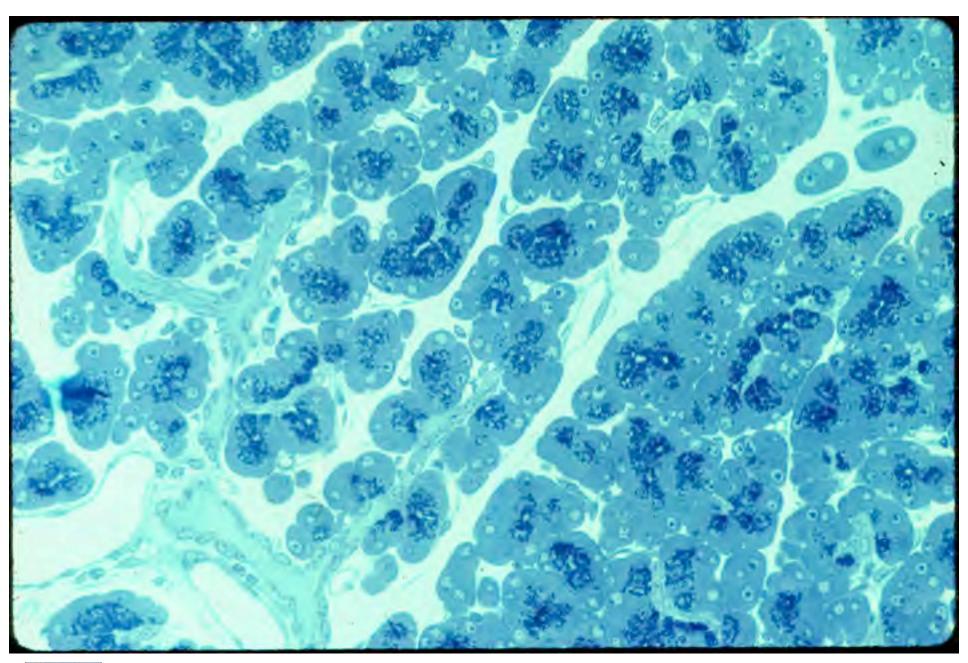
**Innervation** 

Vagal – Acini Ach main transmitter

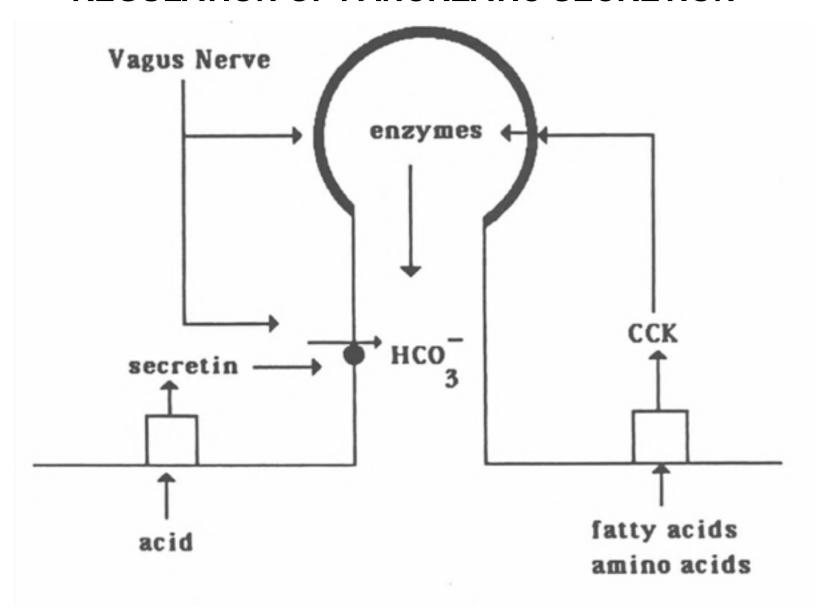
**Ducts** 

**Islets** 

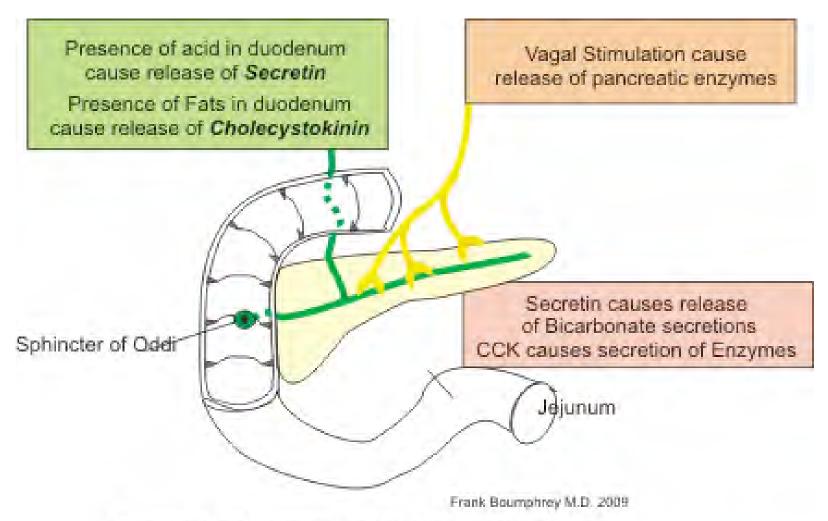
Sympathetic – Islets NE main transmitter Blood Vessels



#### **REGULATION OF PANCREATIC SECRETION**

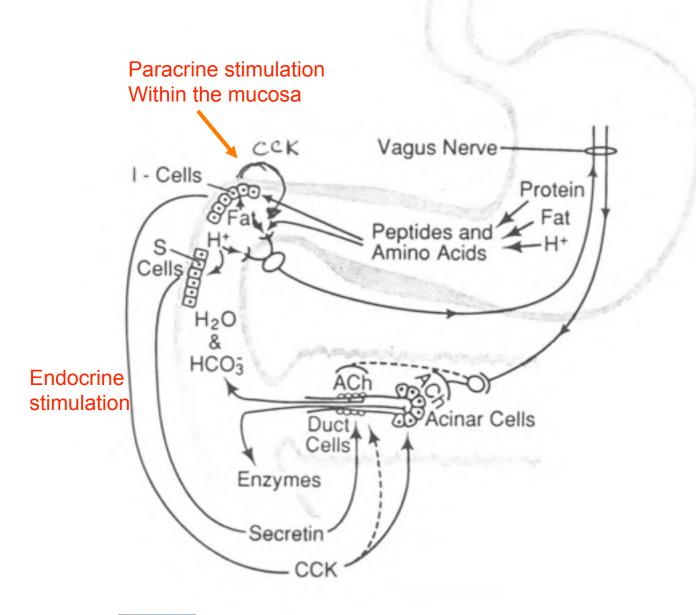


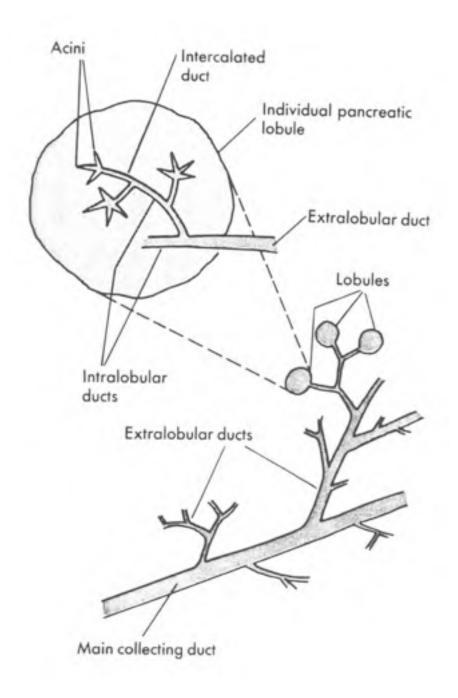
#### Stimulation of Pancreatic Secretion during the Intestinal Phase



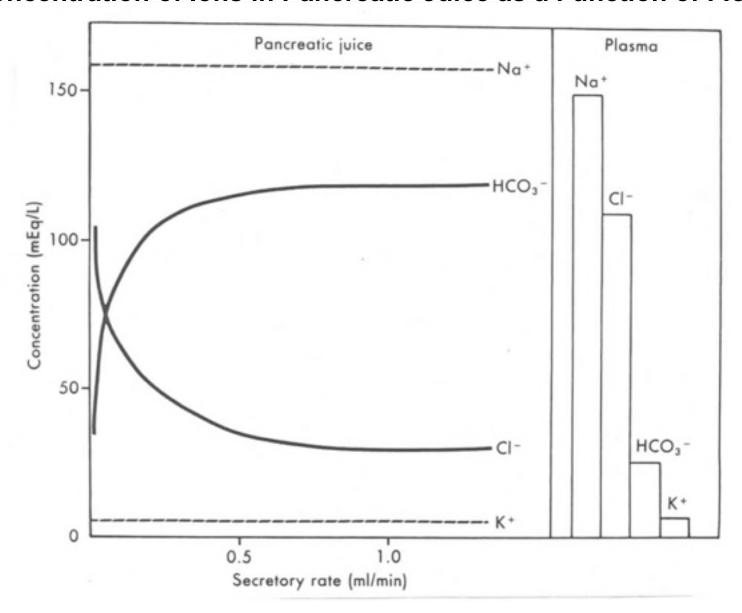
Control of Pancreatic Secretions

#### Stimulation of Pancreatic Secretion during the Intestinal Phase

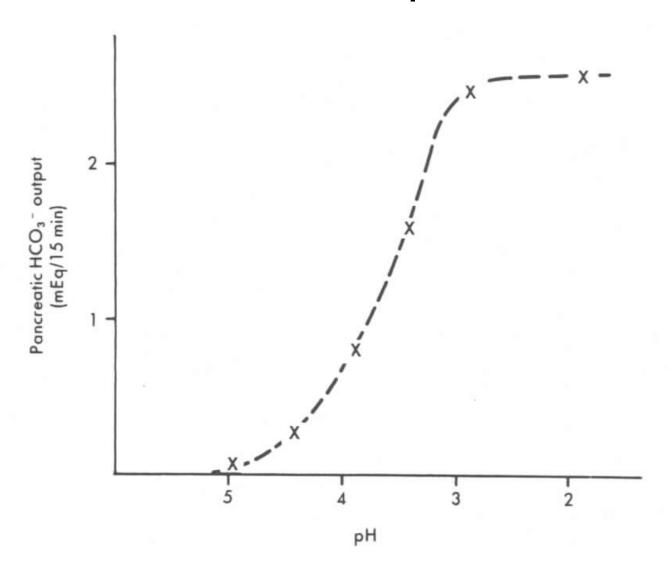




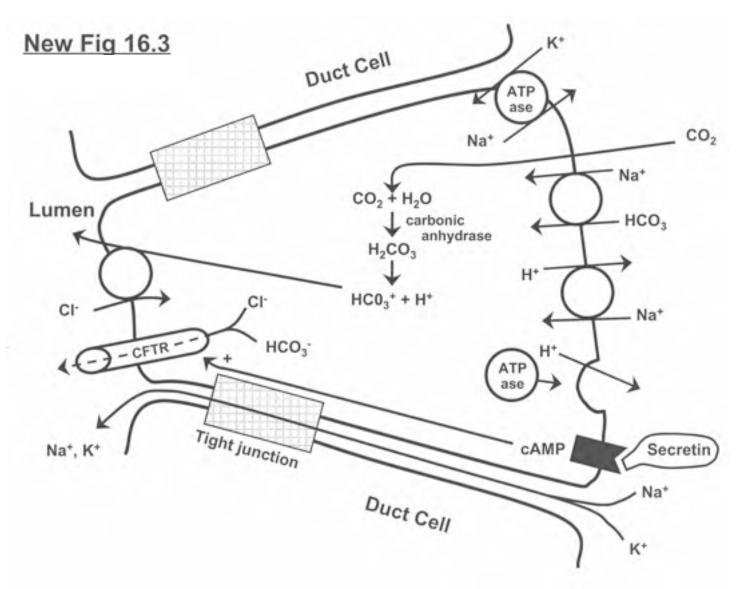
#### Concentration of lons in Pancreatic Juice as a Function of Flow



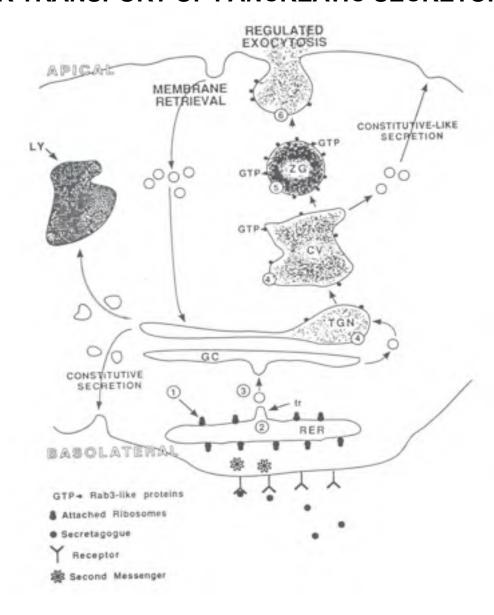
# Pancreatic Bicarbonate output increases in response to low Duodenal pH



#### **Mechanism of Pancreatic Bicarbonate Secretion**

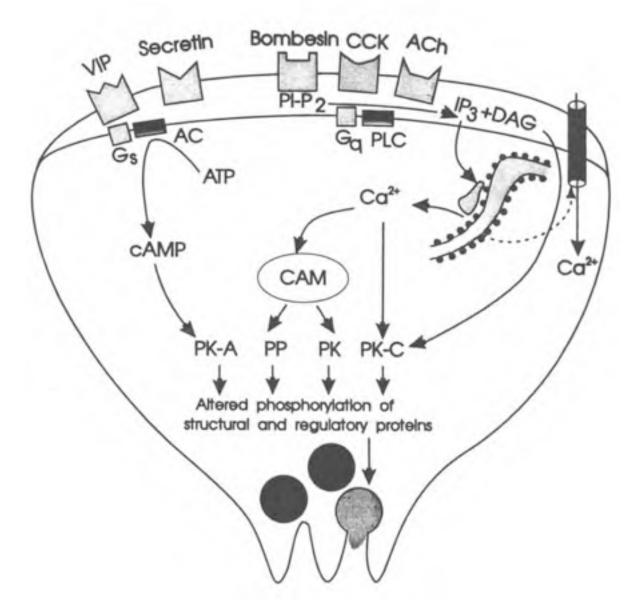


#### INTRACELLULAR TRANSPORT OF PANCREATIC SECRETORY PROTEINS



Source Undetermined

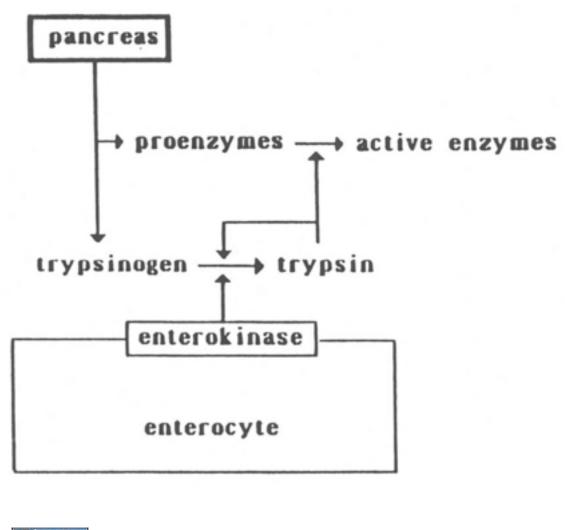
#### **Stimulus-secretion Coupling of Pancreatic Enzyme Secretion**



### Human pancreatic exocrine enzymes

Enzyme	Molecular weigh (daltons)
Proteases	
Trypsinogen 1	25,000
Trypsinogen 2	25,000
Trypsinogen 3	23,400
Chymotrypsinogen	24,000
proElastase 1	33,000
proElastase 2	26,600
Protease E	33,000
Kallikreinogen	35,000
proCarboxypeptidase A1	44,500
proCarboxypeptidase A2	47,000
proCarboxypeptidase B1	47,300
proCarboxypeptidase B2	47,300
Glycosidase	
Amylase	57,000
Lipases	
Triglyceride lipase	48,000
Colipase	10,000
Carboxyl ester hydrolase	100,000
Phospholipase A2	14,000
Nucleases	
DNase I	30,000
RNase	15,000

## Activation of Pancreatic Proenzymes in the Intestine involves Enterokinase and activated Trypsin



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Slide 9 – John Williams modified from undetermined

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Slide 11 – Fig. 9-2 Johnson, L. *Gastrointestinal Physiology*, 7<sup>th</sup> ed. Mosby Elsevier, Philadelphia, PA; 2007: 87.

Slide 12 – Fig. 9-5 Johnson, L. *Gastrointestinal Physiology*, 6<sup>th</sup> ed. Mosby Elsevier, St. Louis, MO; 2001: 102.

Slide 13 - John Williams

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