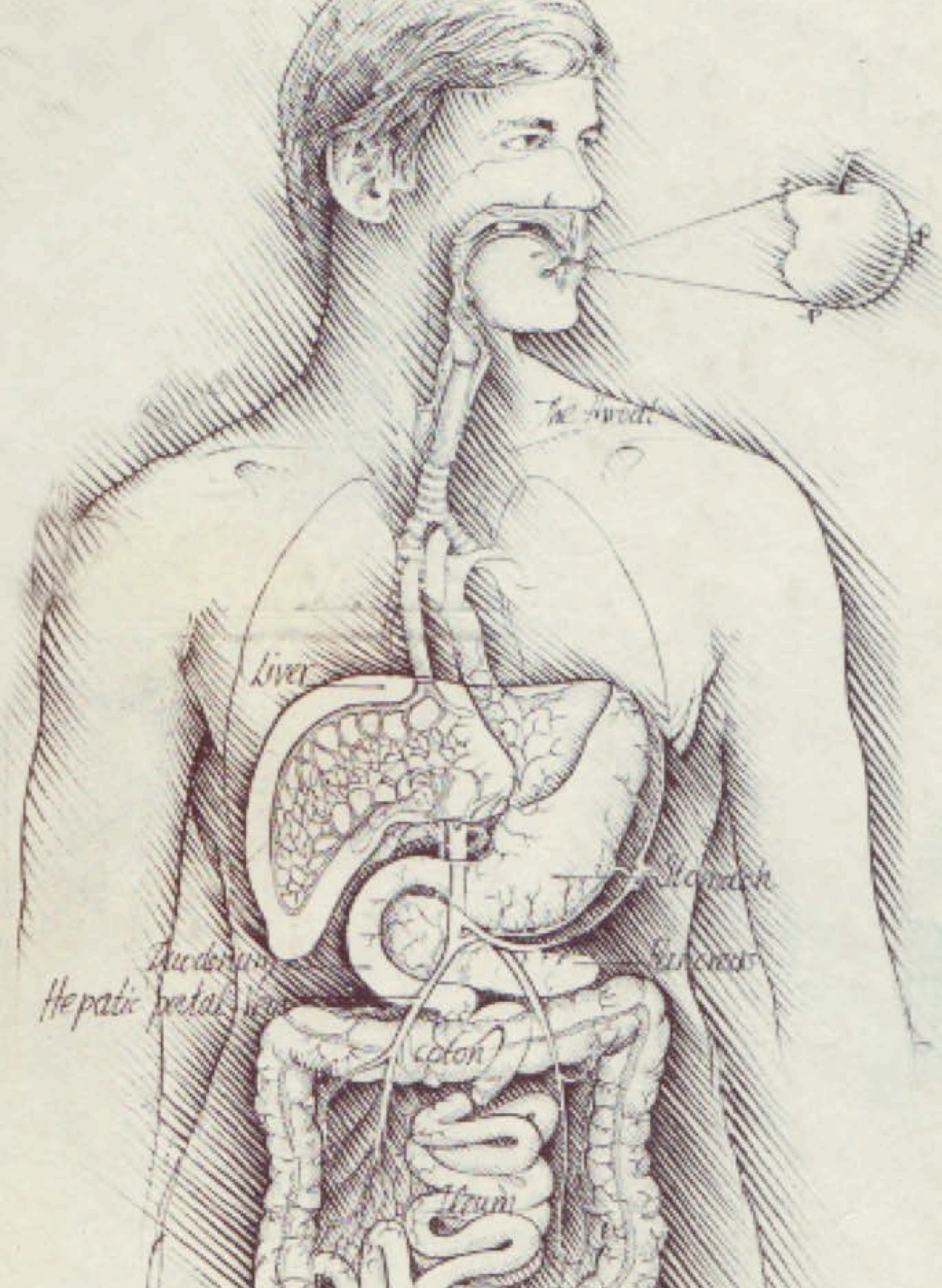
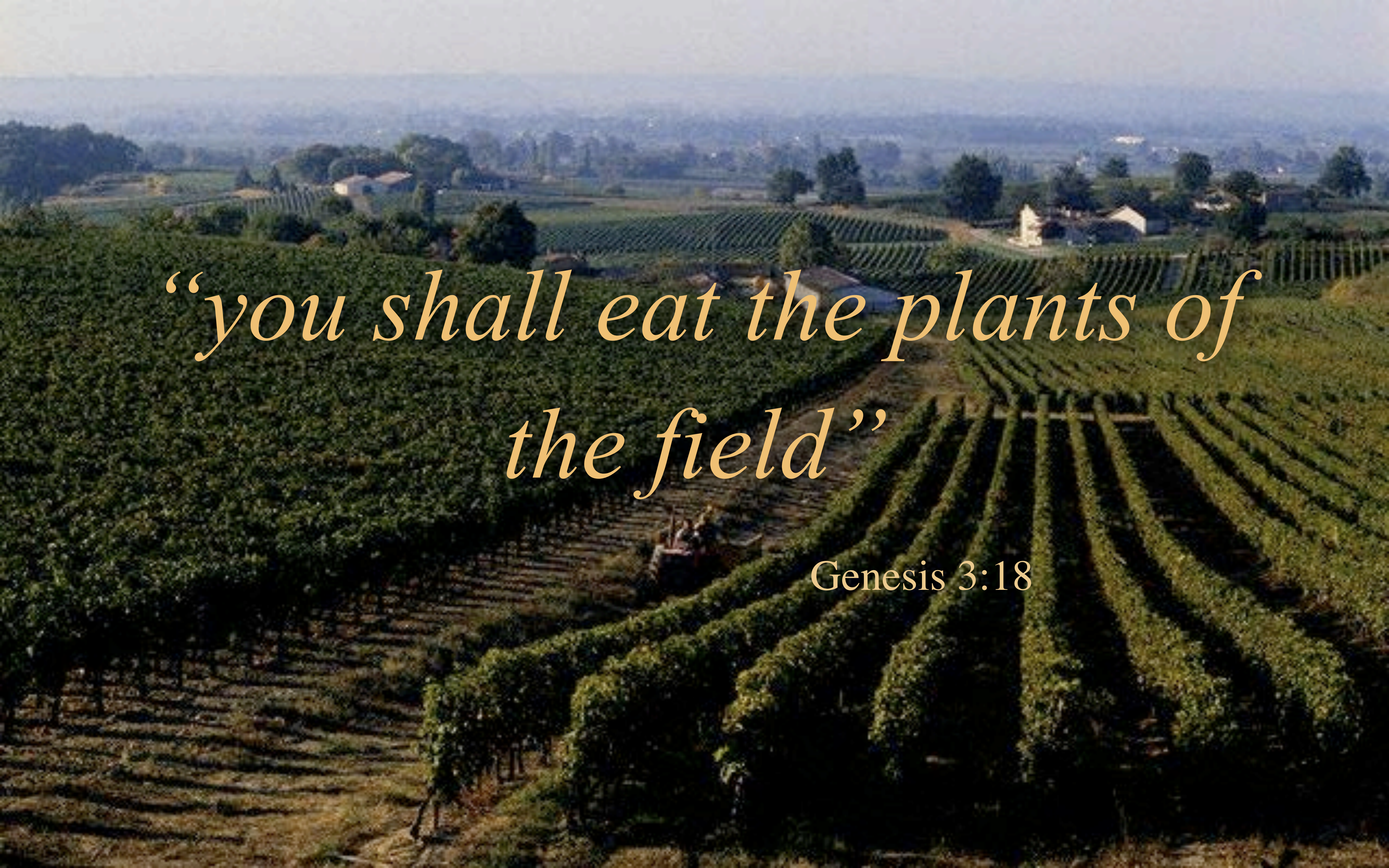




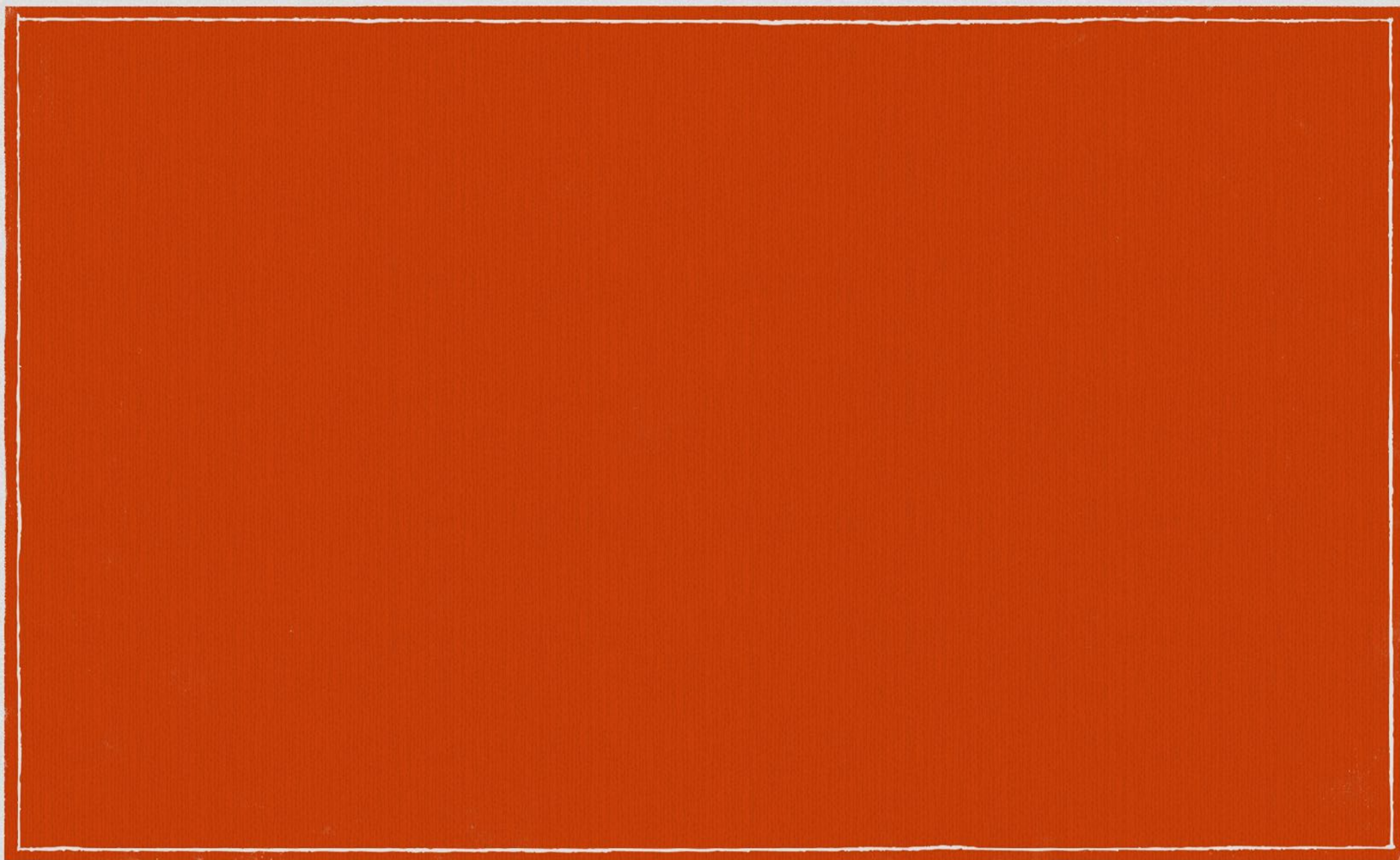
Are Humans
DESIGNED
to
EAT MEAT?





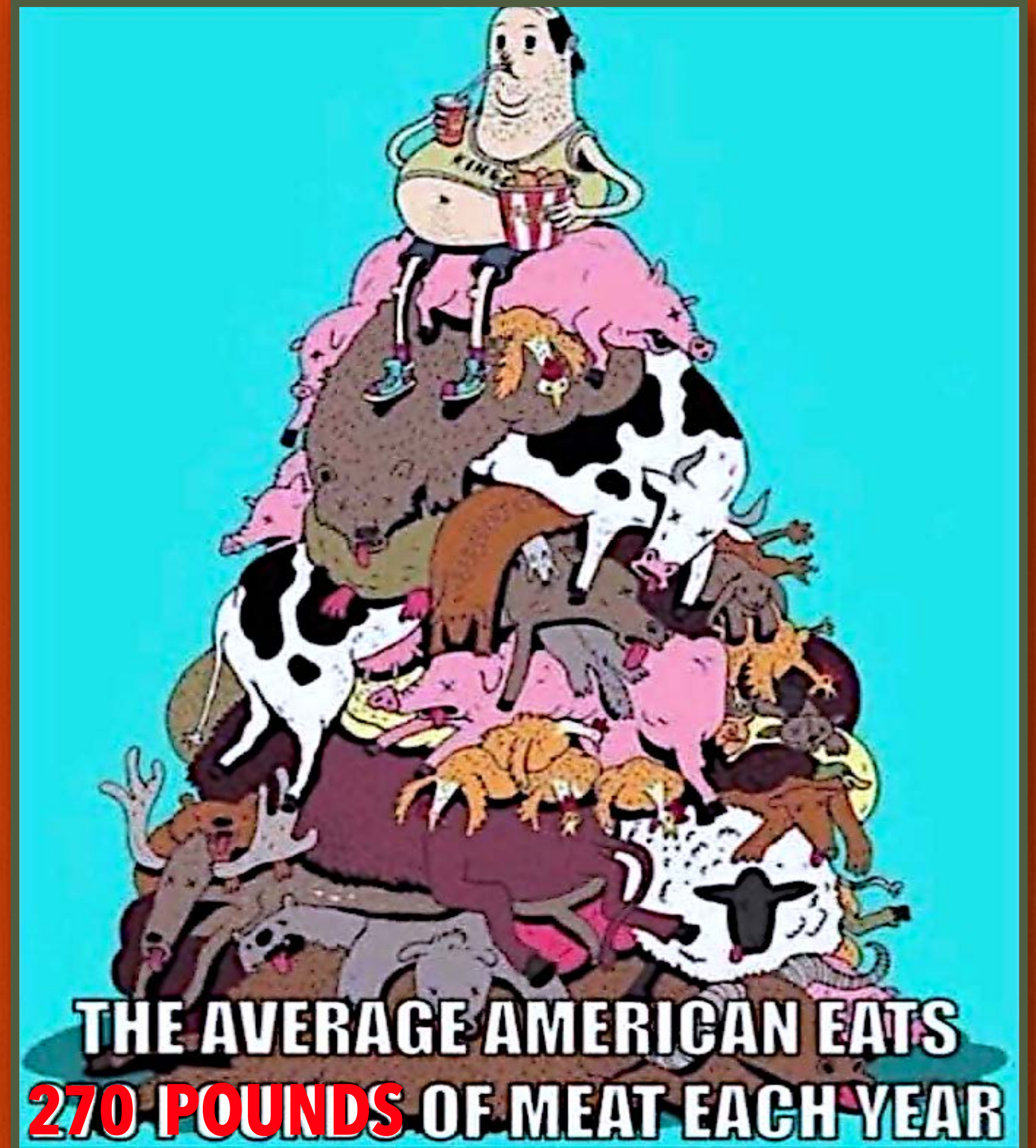
*“you shall eat the plants of
the field”*

Genesis 3:18



U.S. per capita Meat/Cheese Consumption

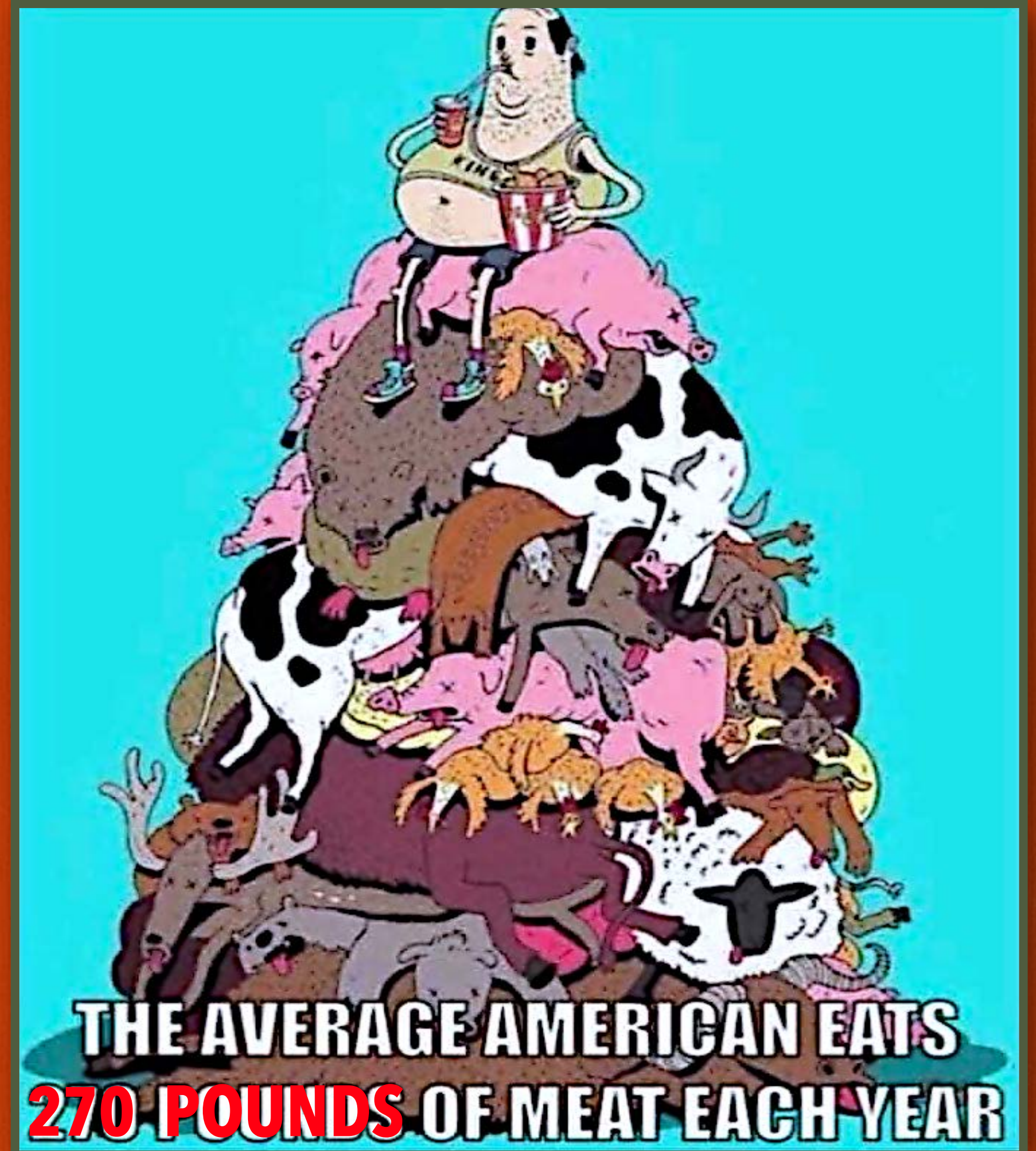
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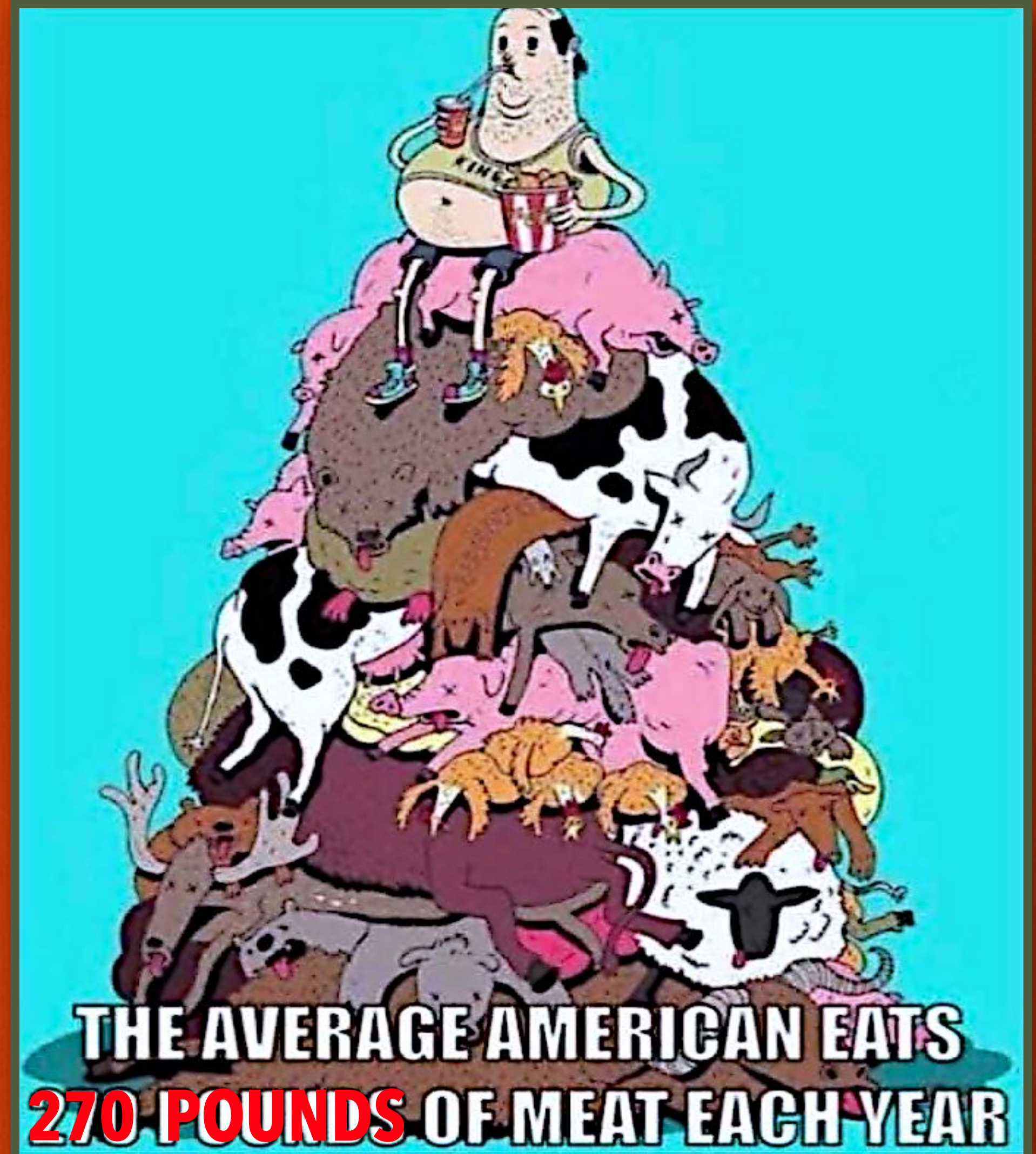


* Department of Agricultural & Consumer Economics; University of Illinois: May 12, 2021 - *Farmdoc daily* (11): 76

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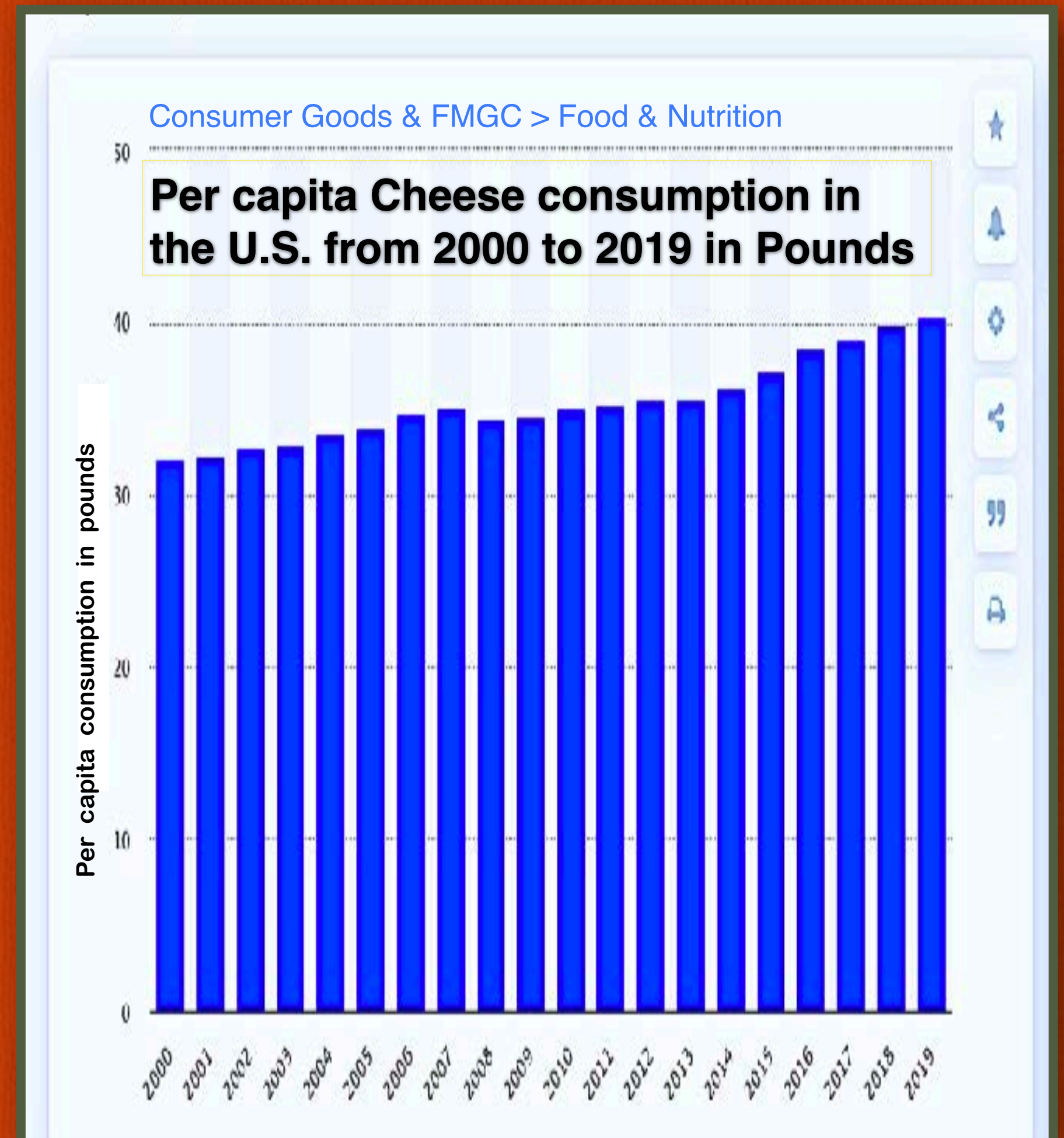


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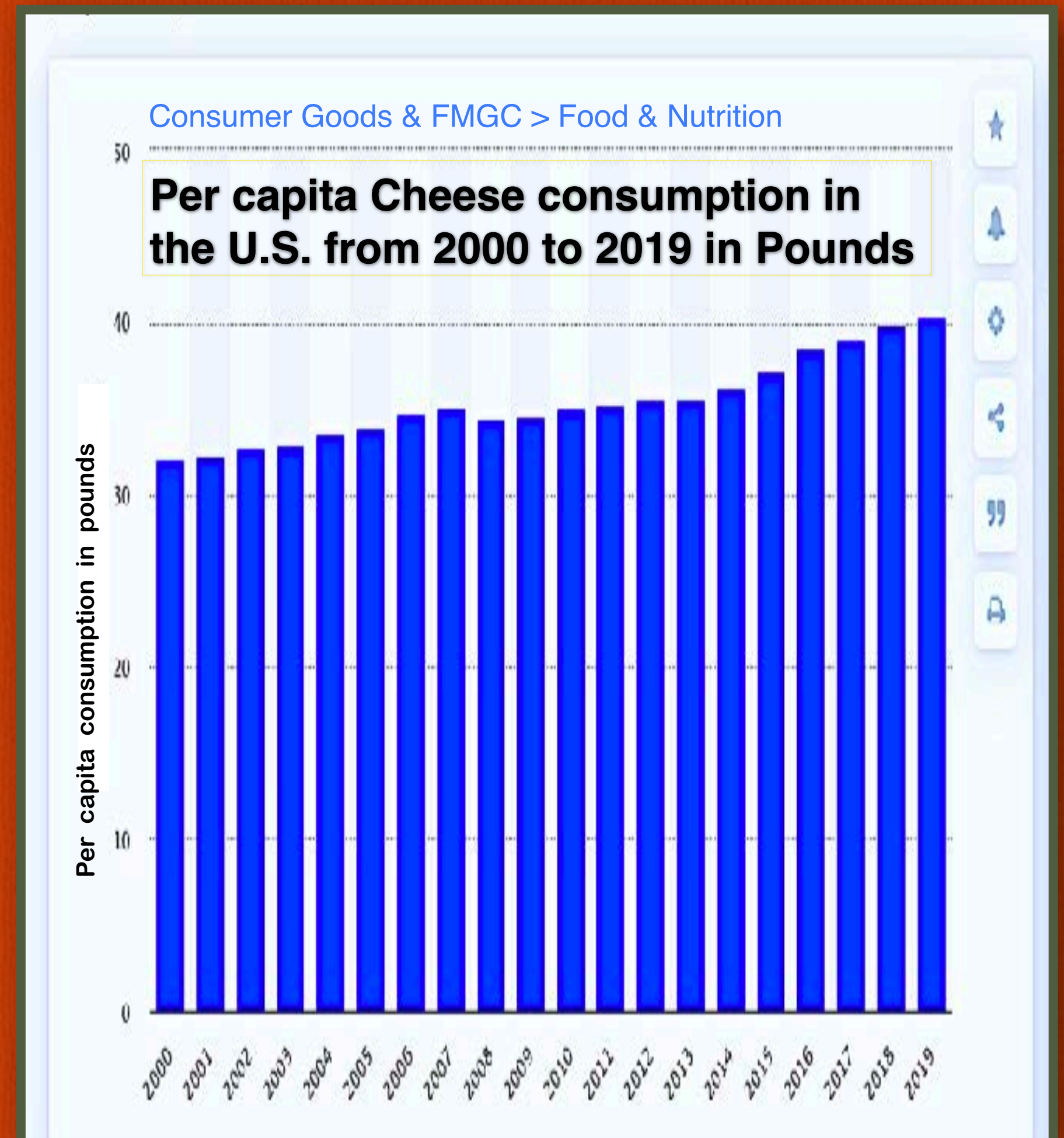


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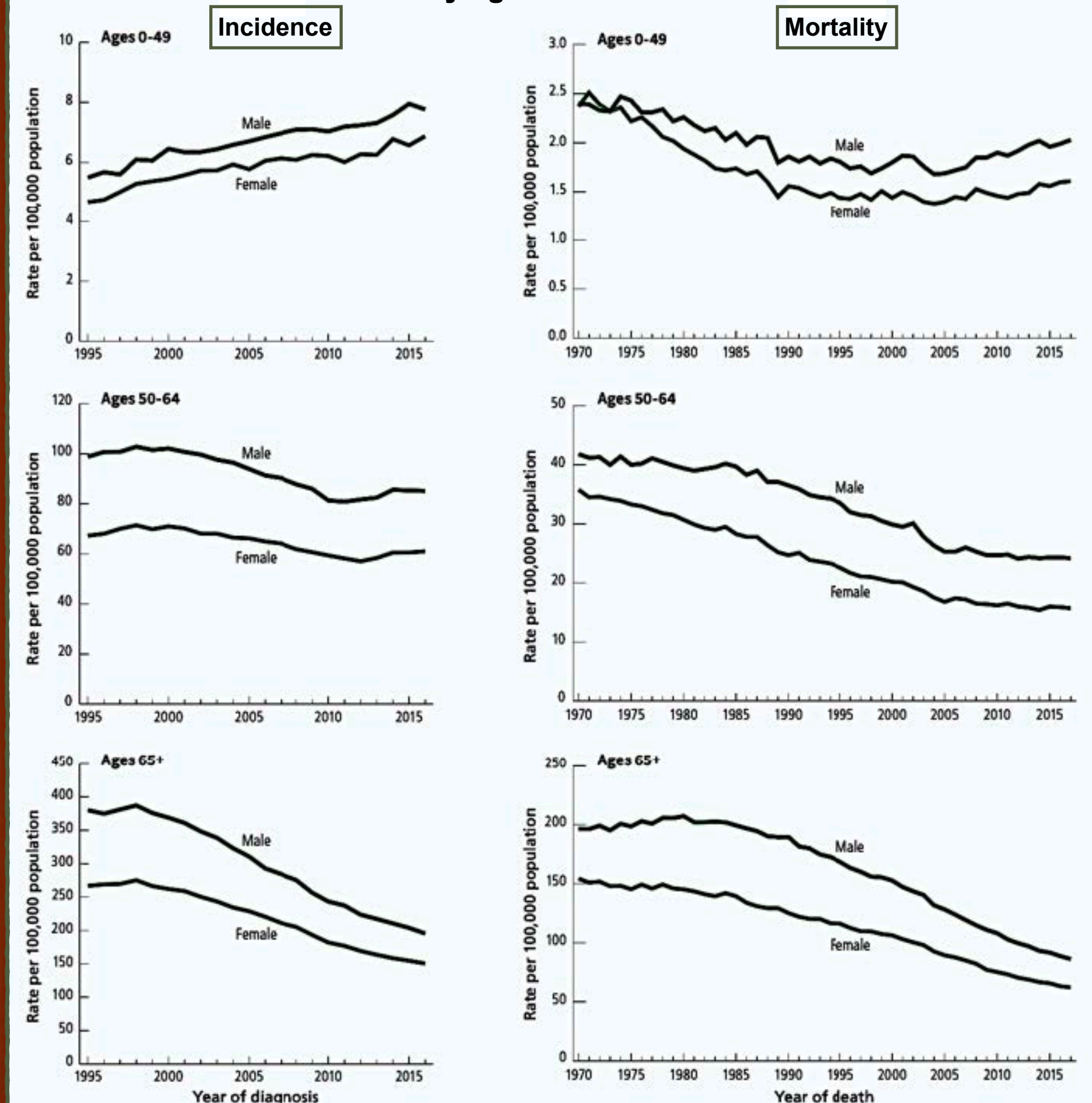
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Trends in Colorectal Cancer Incidence (1995 - 2017) & Mortality (1970 - 2017) Rates by Age & Sex in US



Rates are age adjusted to the 2000 US standard population. Incidence rates are adjusted for reporting delays and exclude appendix.
Source: Incidence - NAACCR, 2019. Mortality - NCHS, 2019.

©2020, American Cancer Society, Inc., Surveillance Research

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Mortality (1970 - 2017) Rates

Mortality

Male
Female

1990 1995 2000 2005 2010 2015

Male
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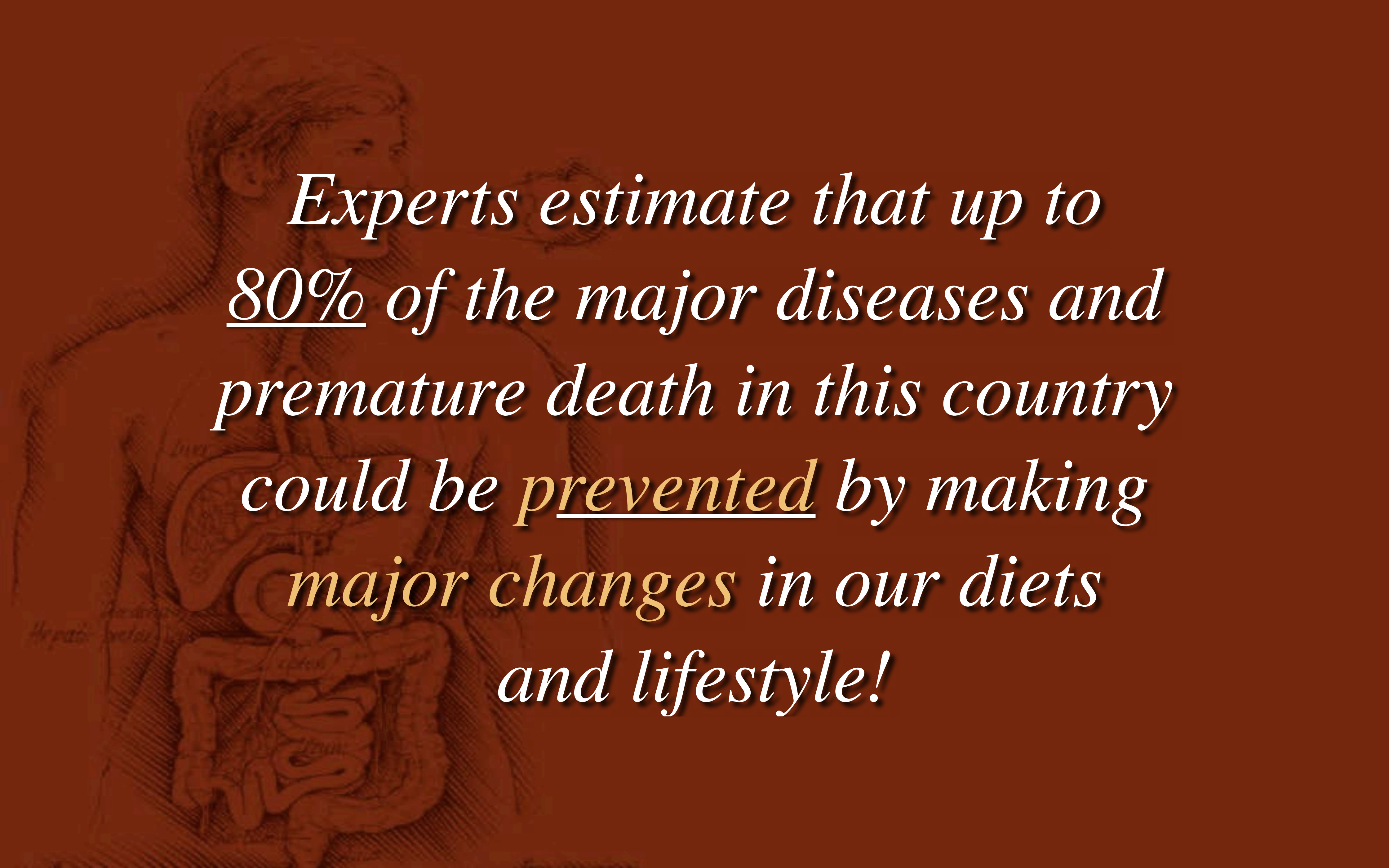
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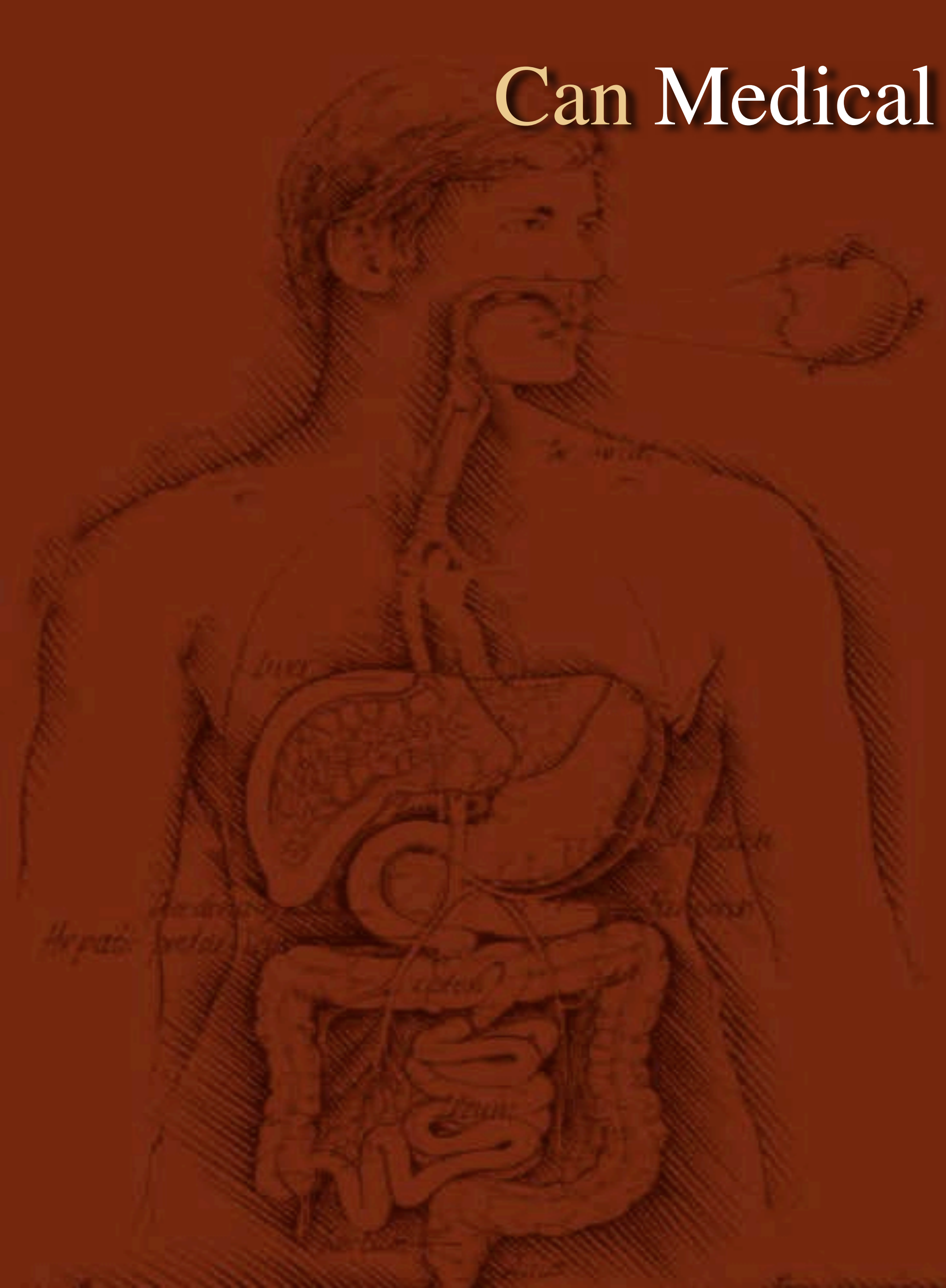


An anatomical illustration of a human torso, showing internal organs including the liver, stomach, intestines, and kidneys. The illustration is rendered in a dark, reddish-brown color, matching the background. The text is overlaid on the right side of the image.

*Experts estimate that up to
80% of the major diseases and
premature death in this country
could be prevented by making
major changes in our diets
and lifestyle!*

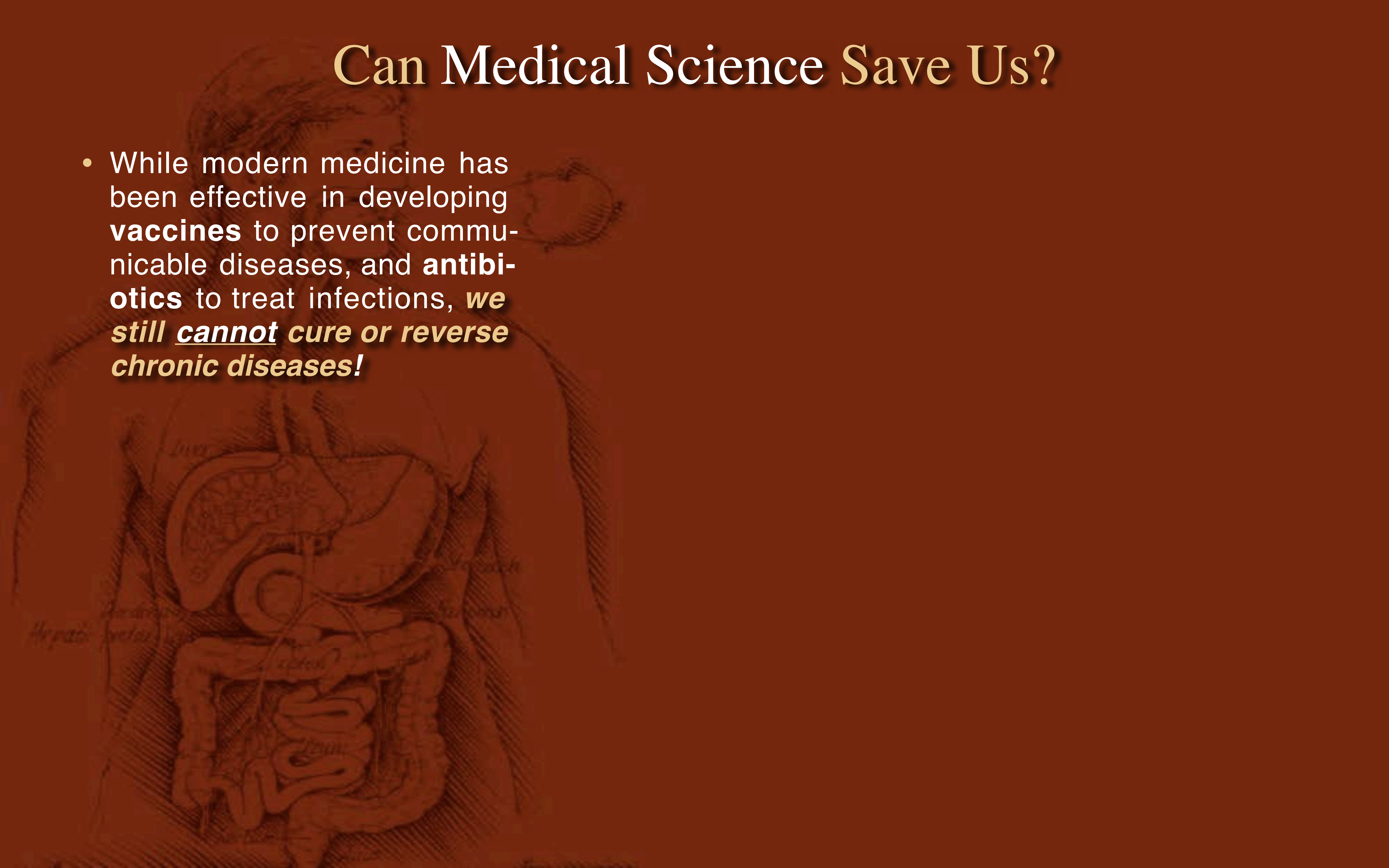


Can Medical Science Save Us?



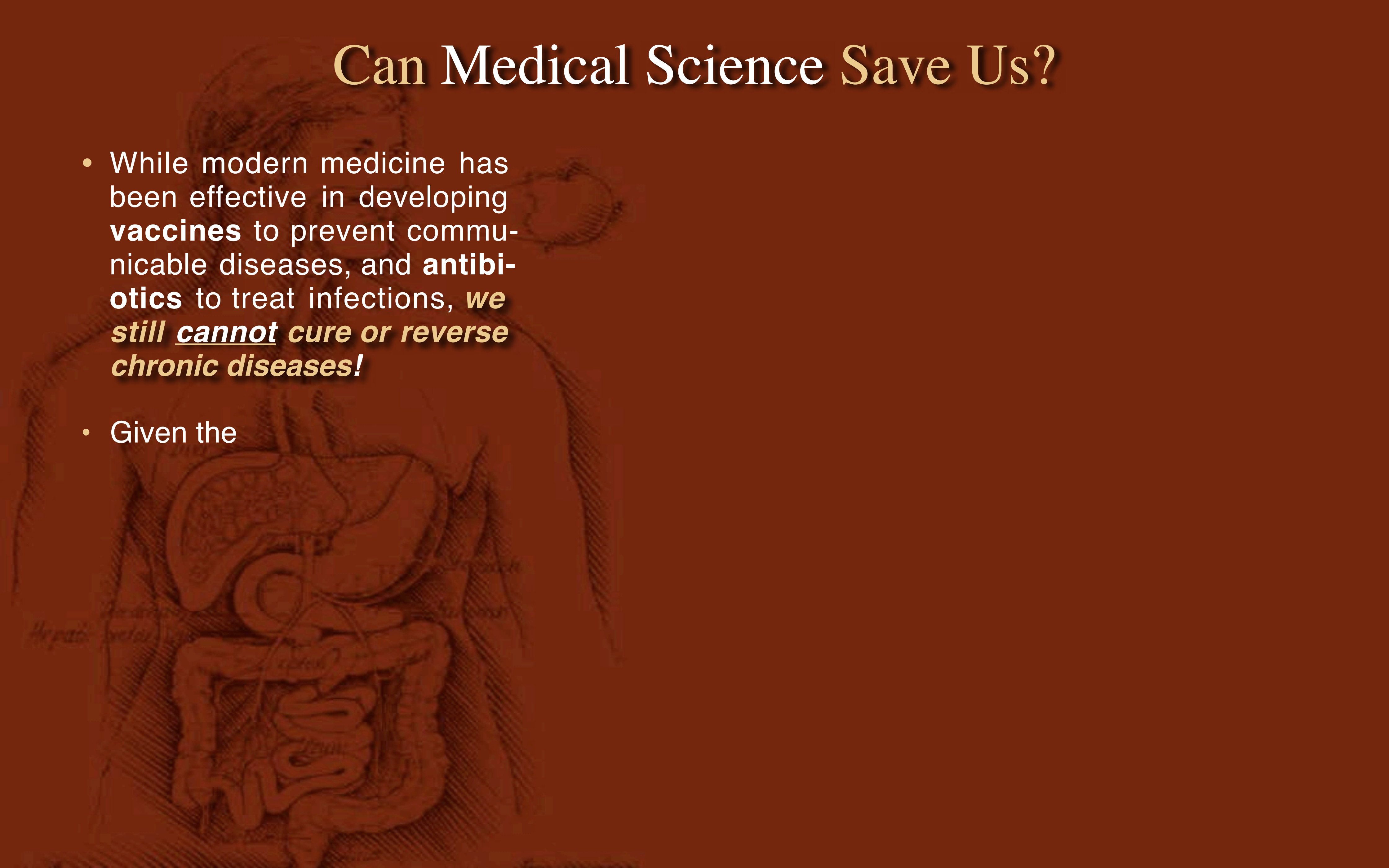
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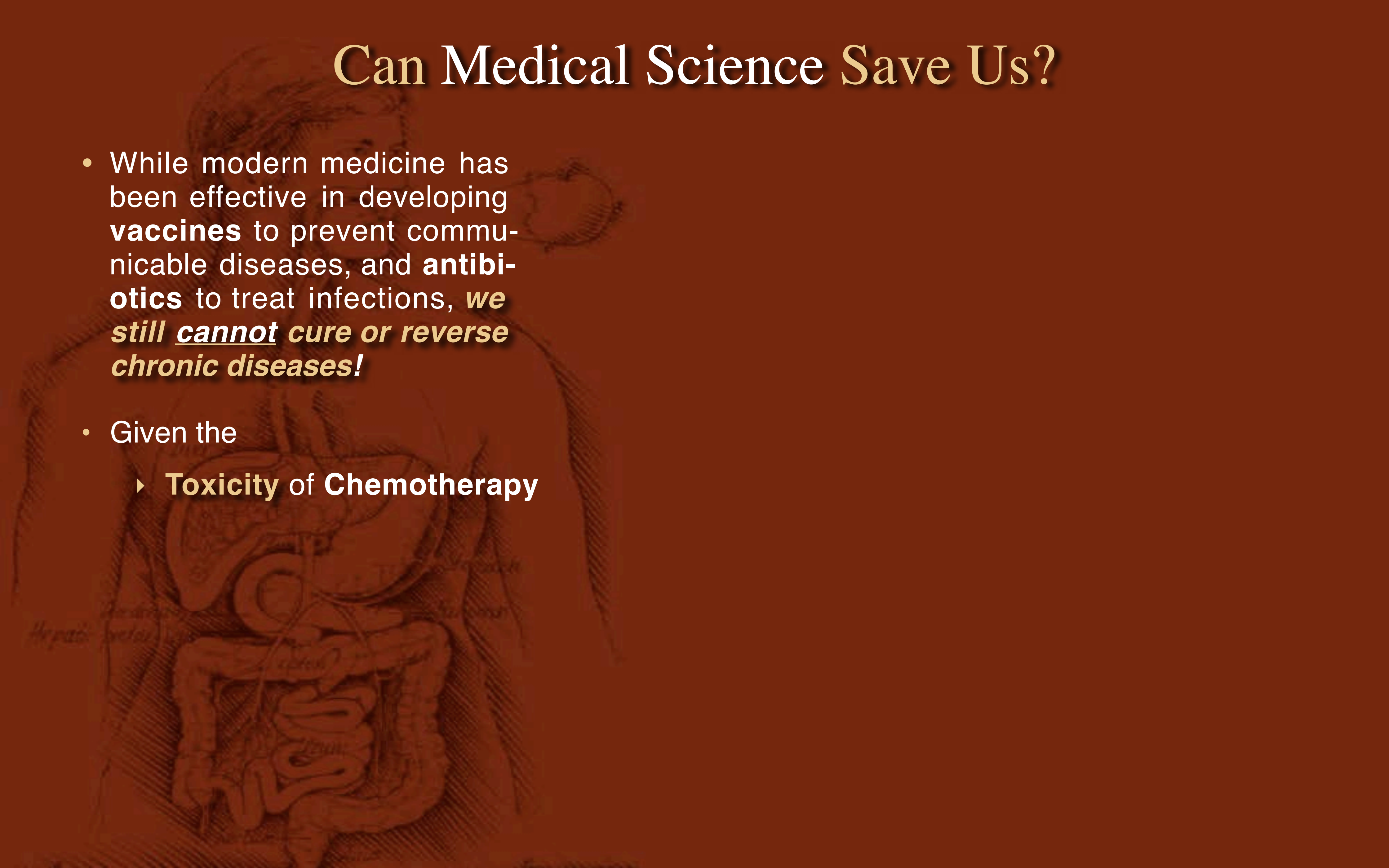
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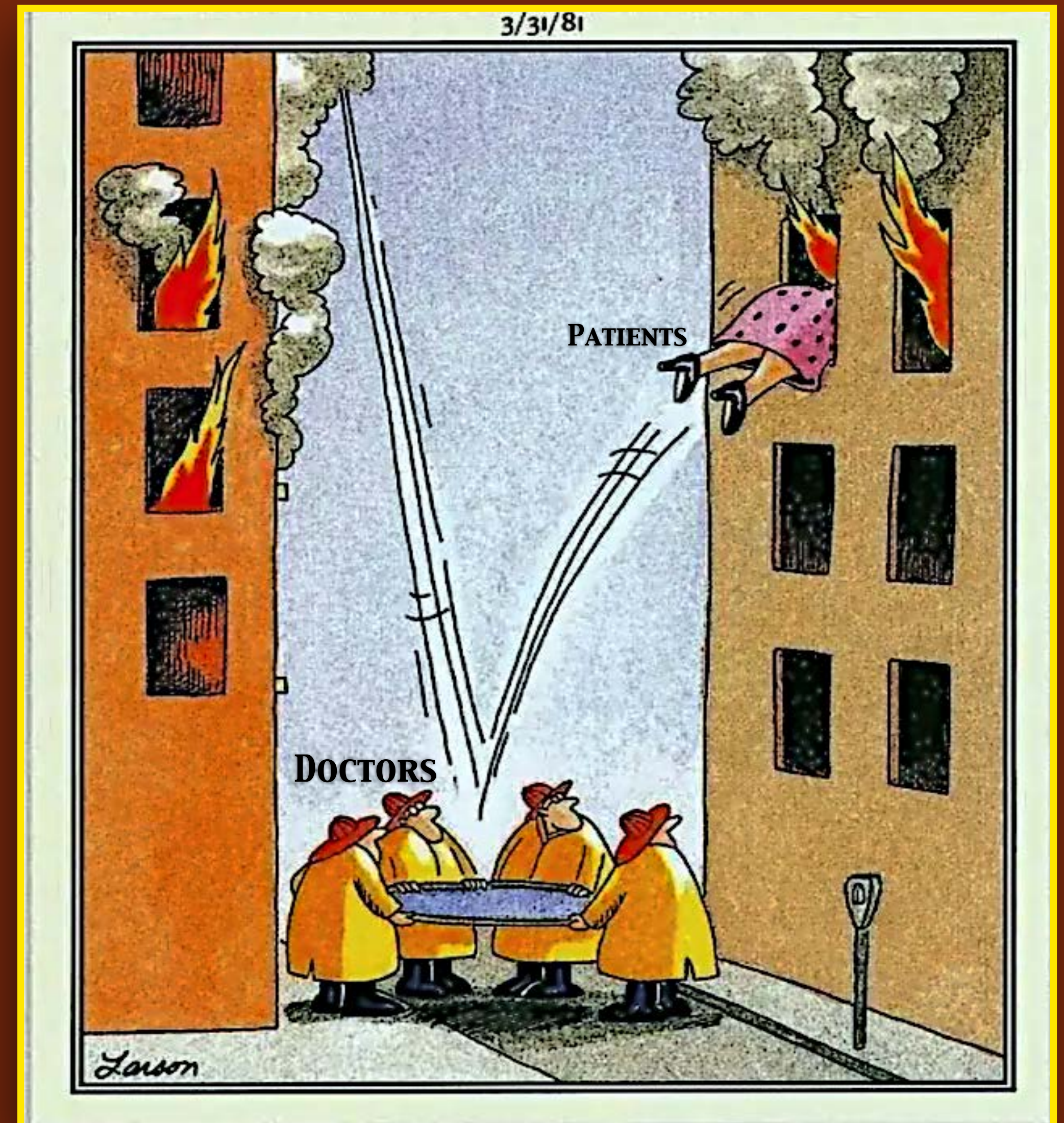
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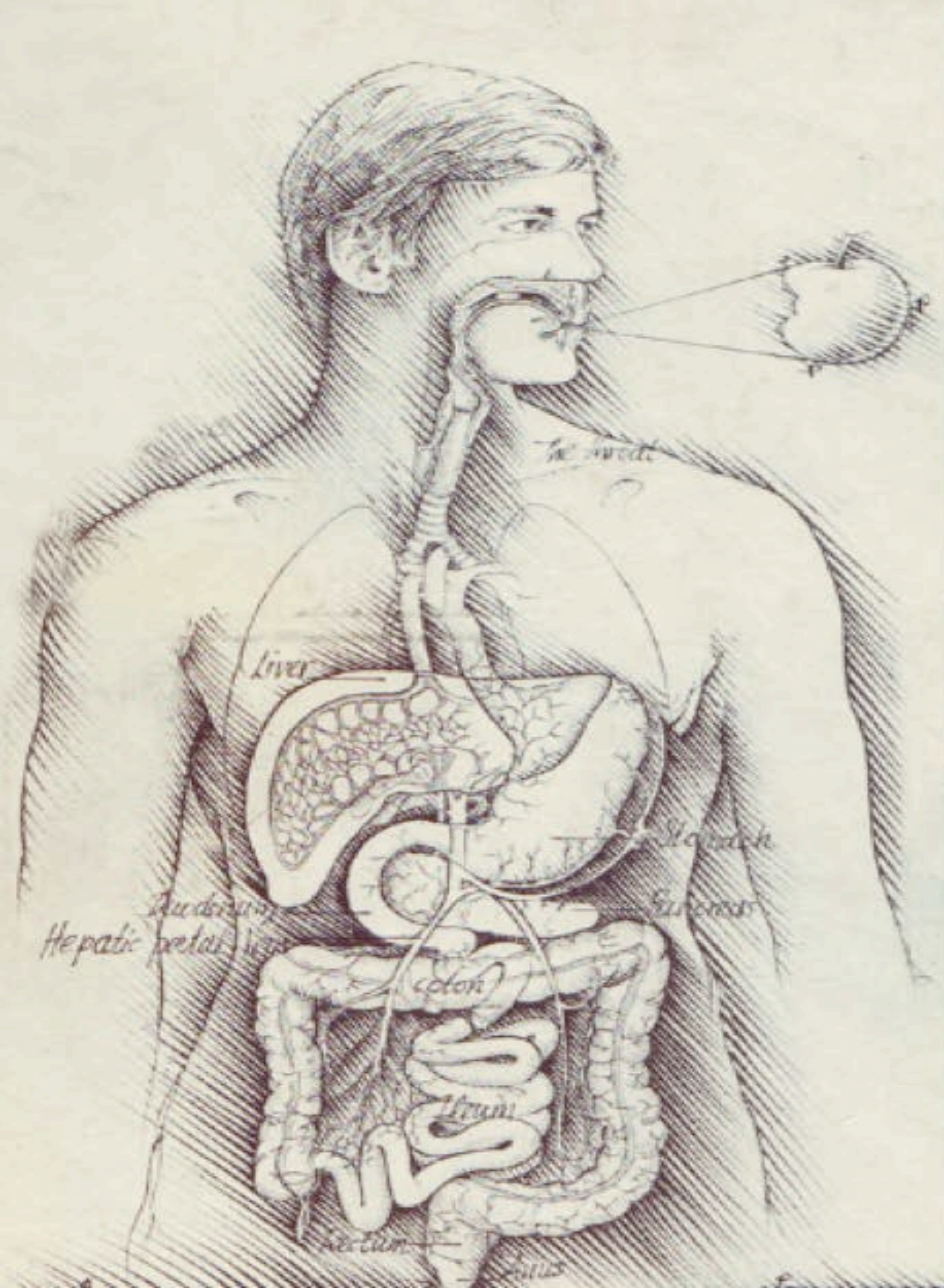
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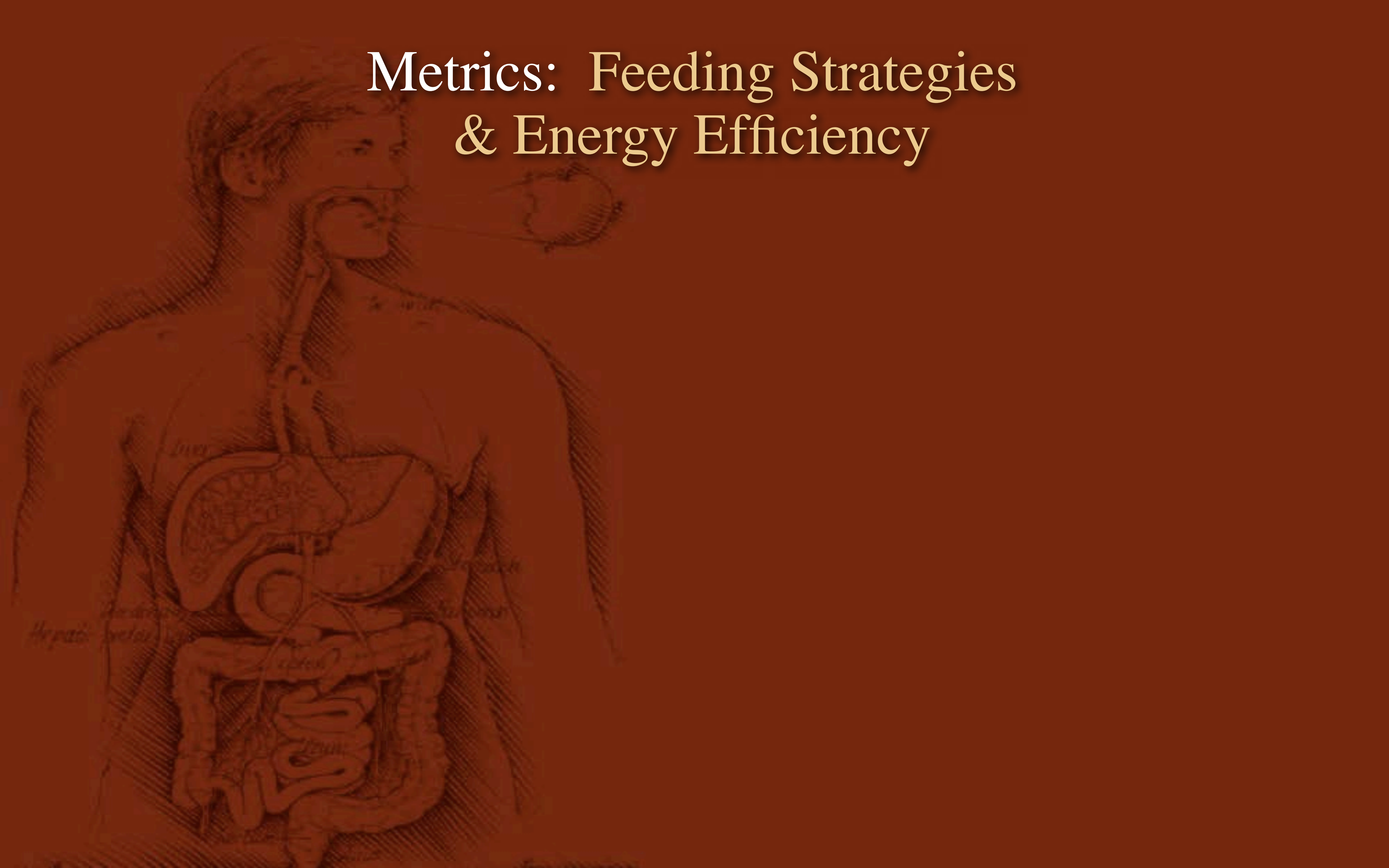
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- The ***net effect*** of many medical treatments is ***best*** illustrated by this cartoon:





BODY PLANS

Metrics: Feeding Strategies & Energy Efficiency



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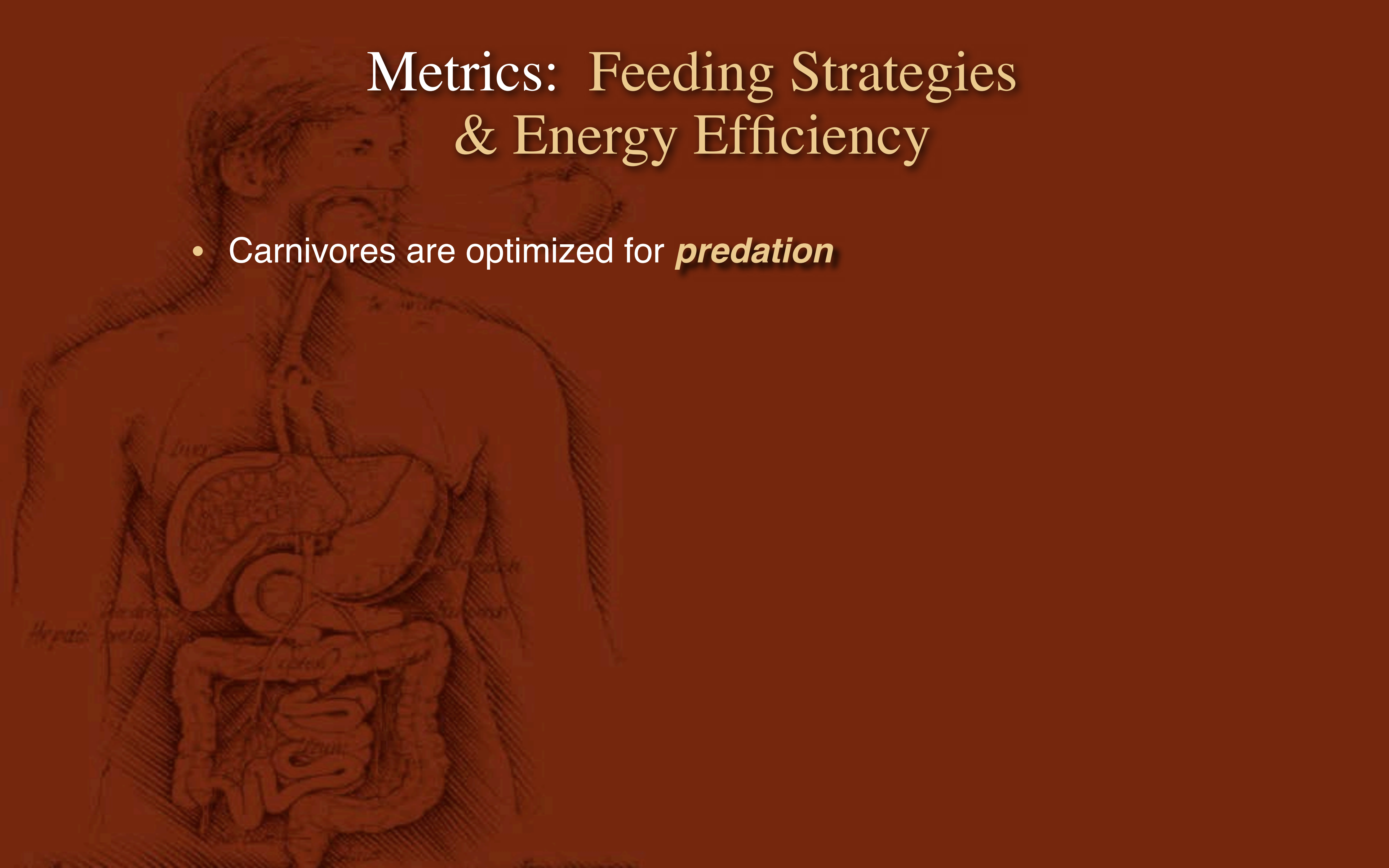


Metrics: Feeding Strategies & Energy Efficiency



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- Carnivores are optimized for ***predation***



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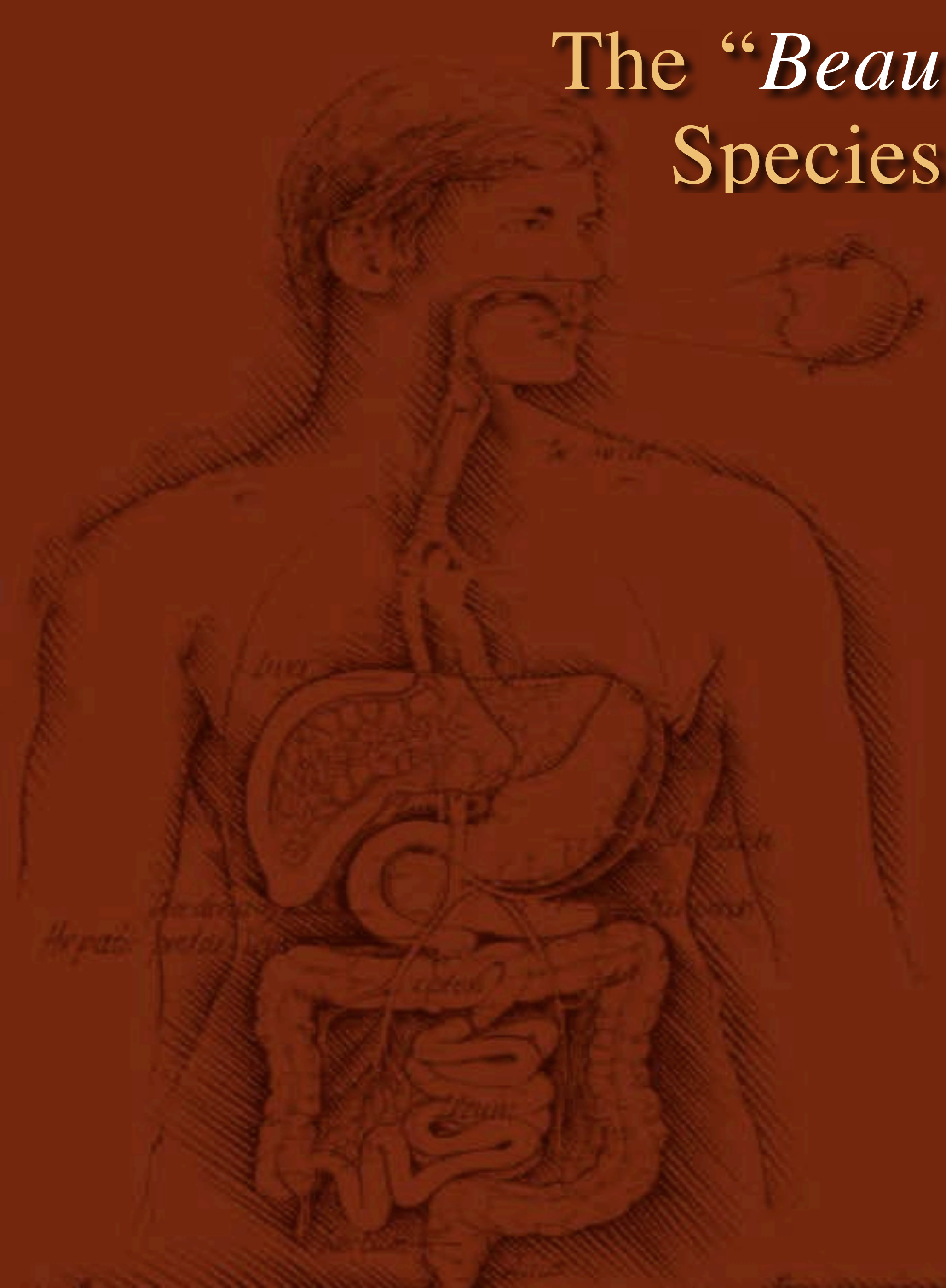
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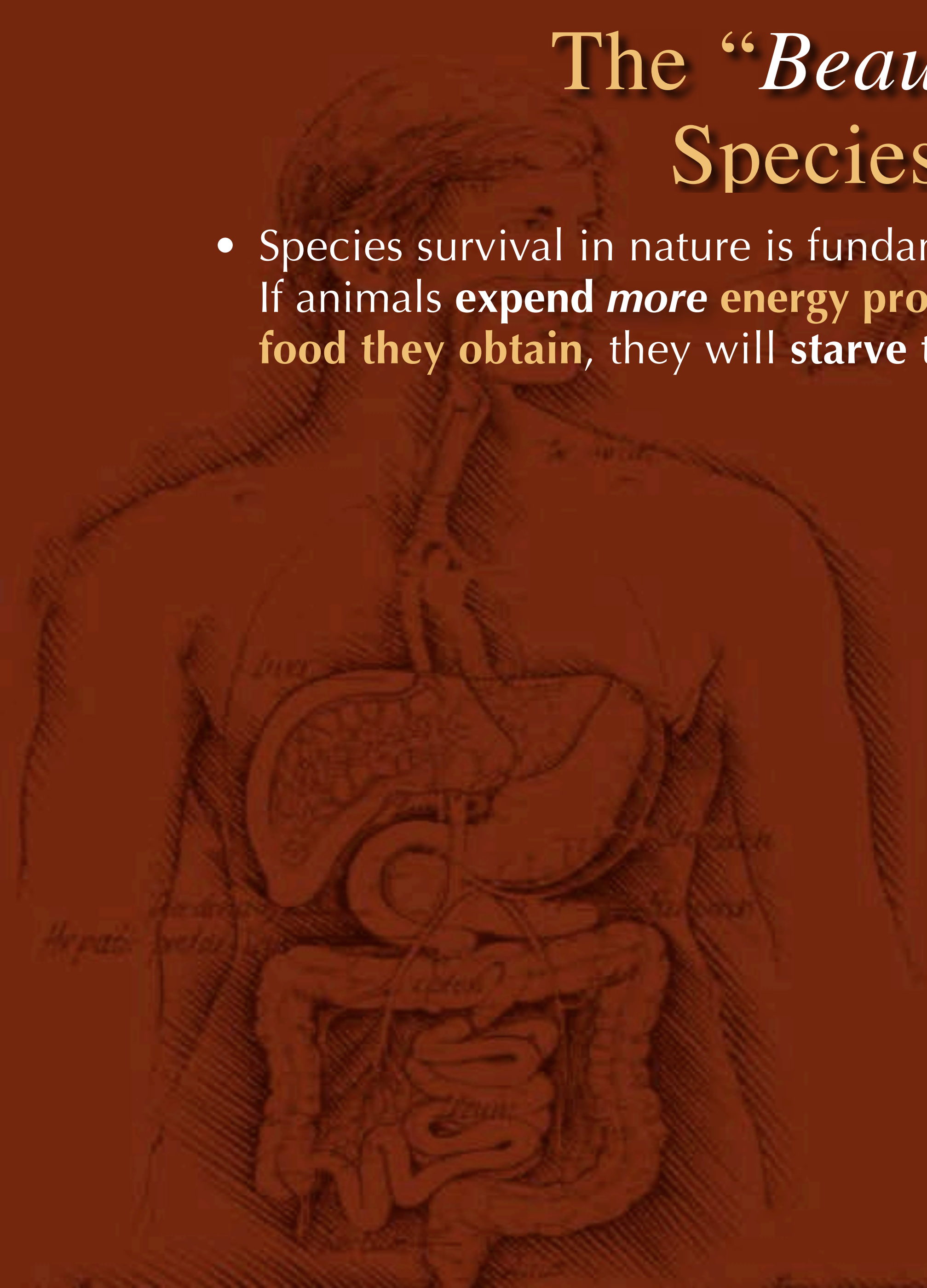
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- Predation using an “herbivore mentality” is **environmentally destructive** because it **depletes** the prey species’ “gene pool” of the “**best**” —i.e., *most healthy and robust* — genes!

The “*Beauty* Paradigm” & Species Destruction



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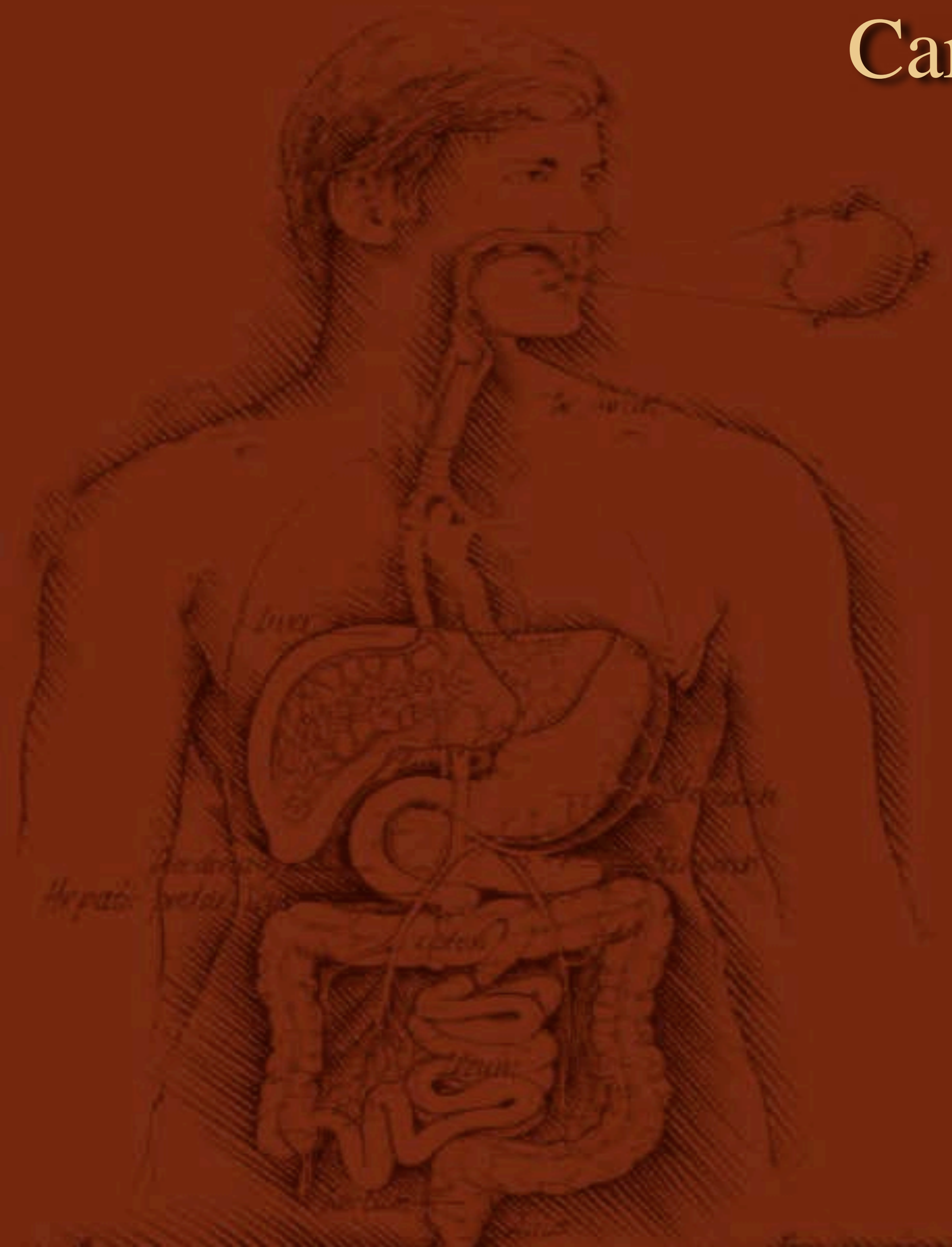
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- When we, because of our “**herbivore mindset**,” cull the most *beautiful* and *robust* members of species we choose to prey on, we **weaken** the **gene pool** of those species and **drive them towards extinction!**

*Eating and spreading the seeds of the “**healthiest**” plants helps ensure the survival of these plant species!

Carnivores



Carnivores

- Streamlined “*torpedo*” shape



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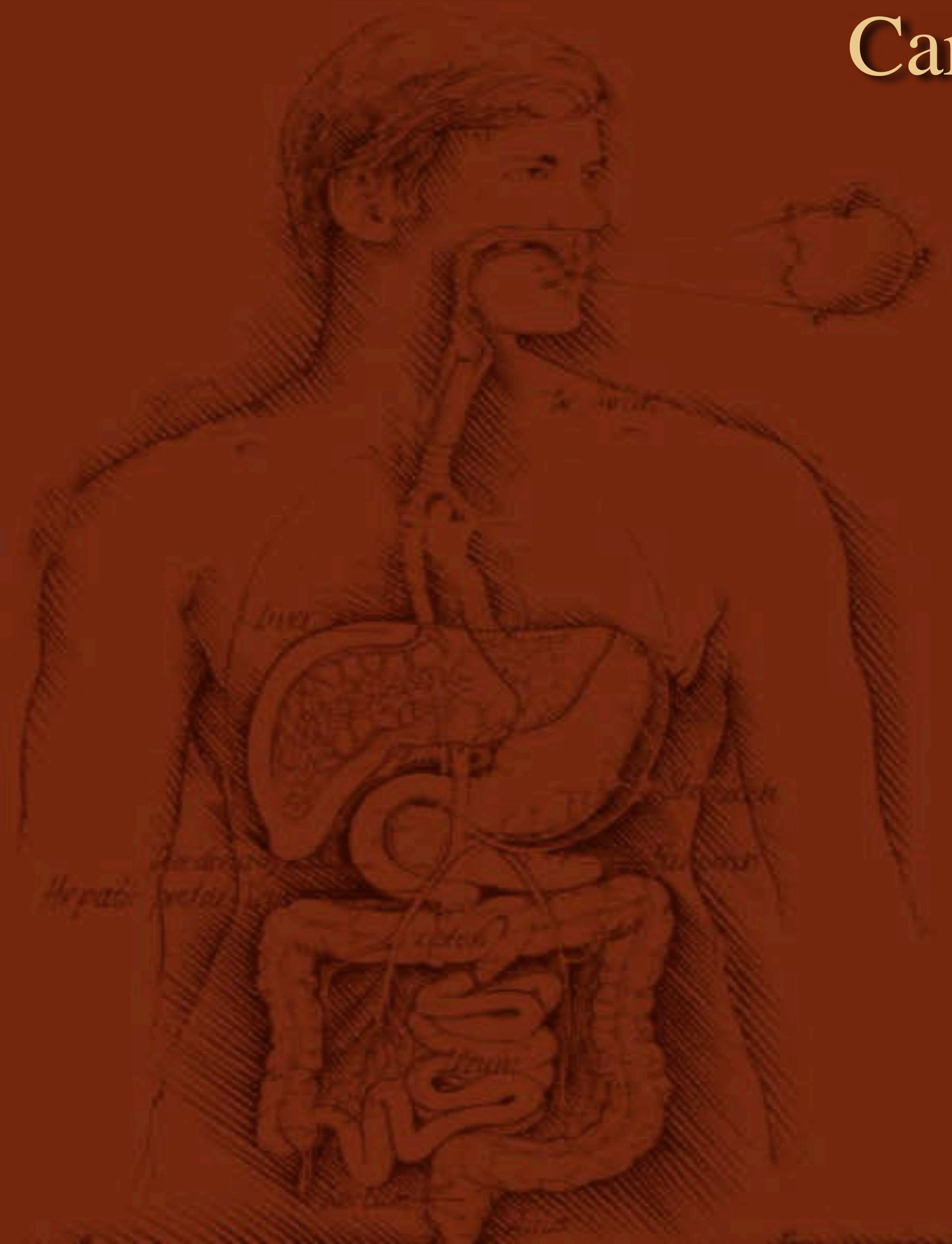


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- Ears *swivel* like mobile radar dishes to help localize prey



Carnivores

- Eyesight optimized for
 - night vision
 - following movement*
 - detecting weak or injured prey
 - but — has *low resolution*

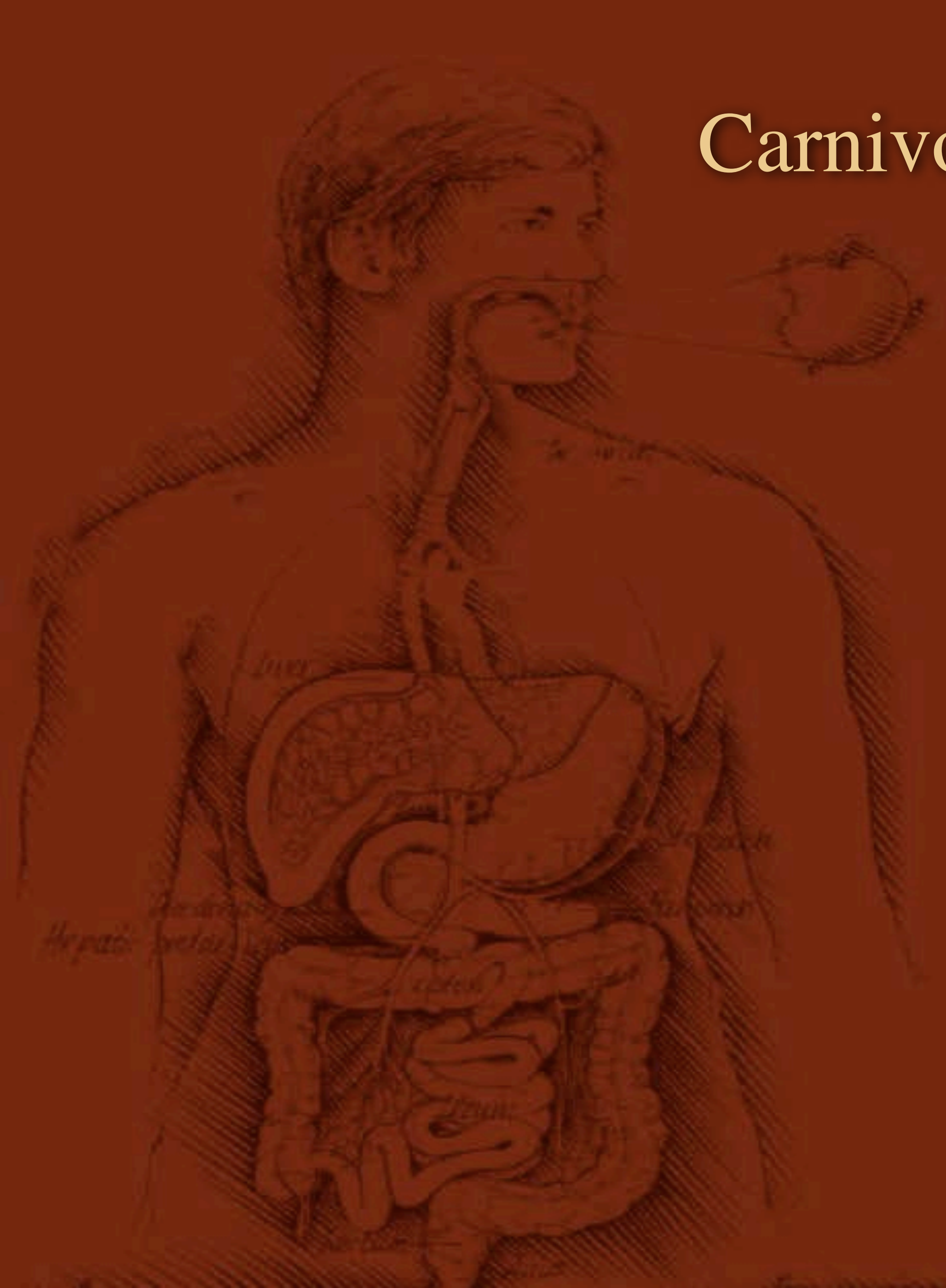


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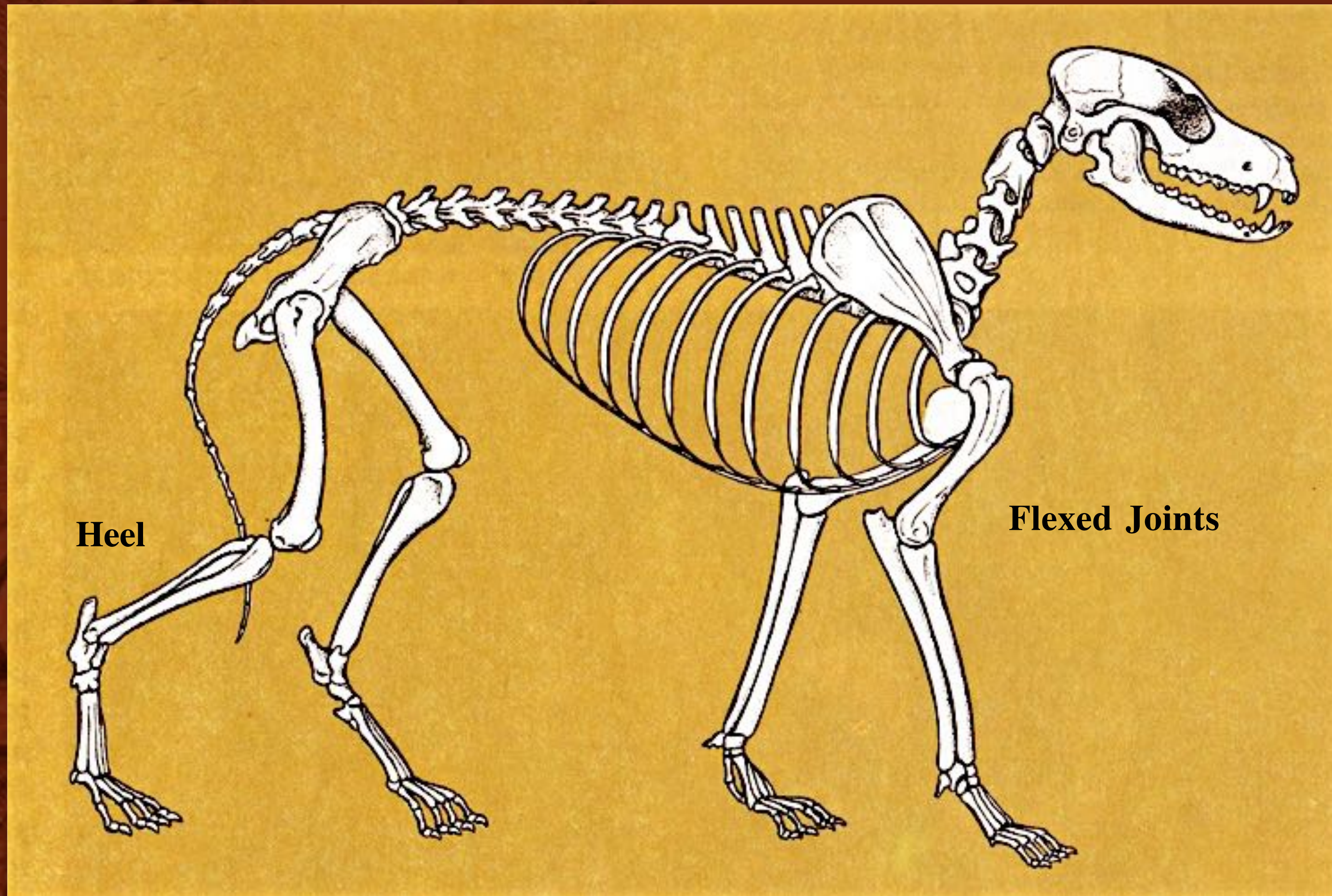
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- Sense of smell is $\geq 100,000$ **times more powerful** than humans
- It is **sensitive enough to detect and track** prey at great distances
- And can **also** identify prey with **cancers, infections and metabolic disorders**



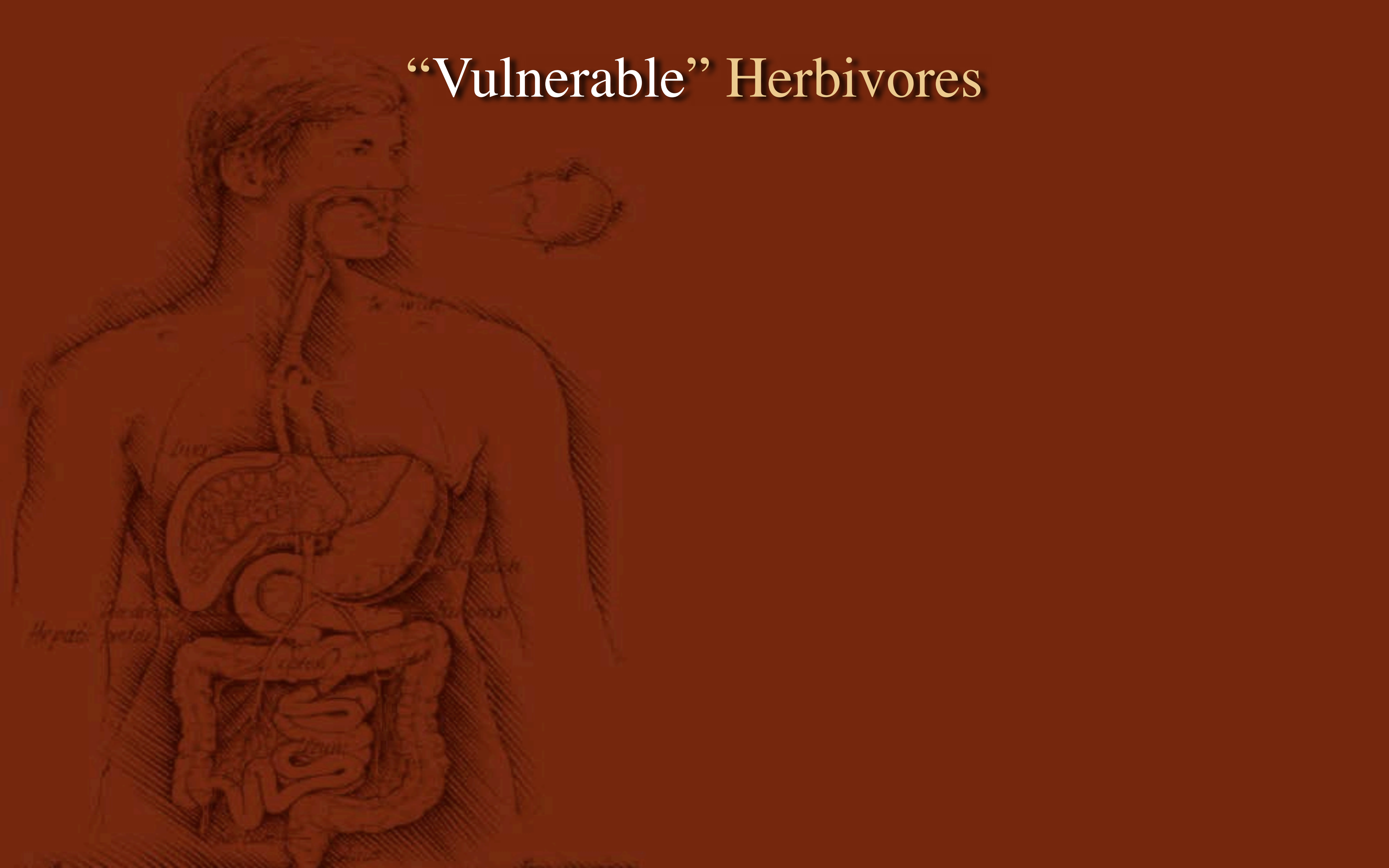
Carnivore Skeleton



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“Vulnerable” Herbivores



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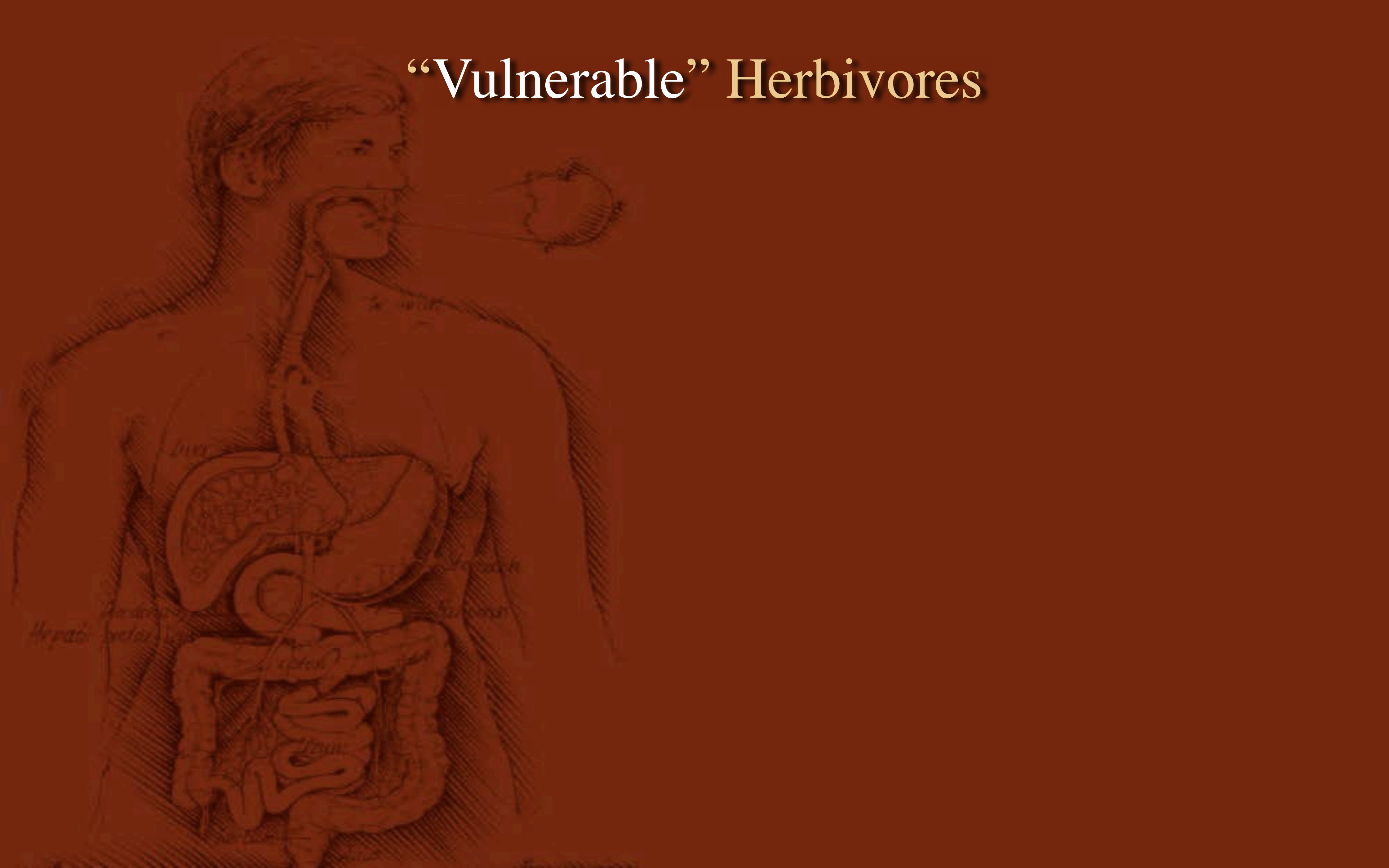


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- Limbs are **lengthened** and **extremely** light weight

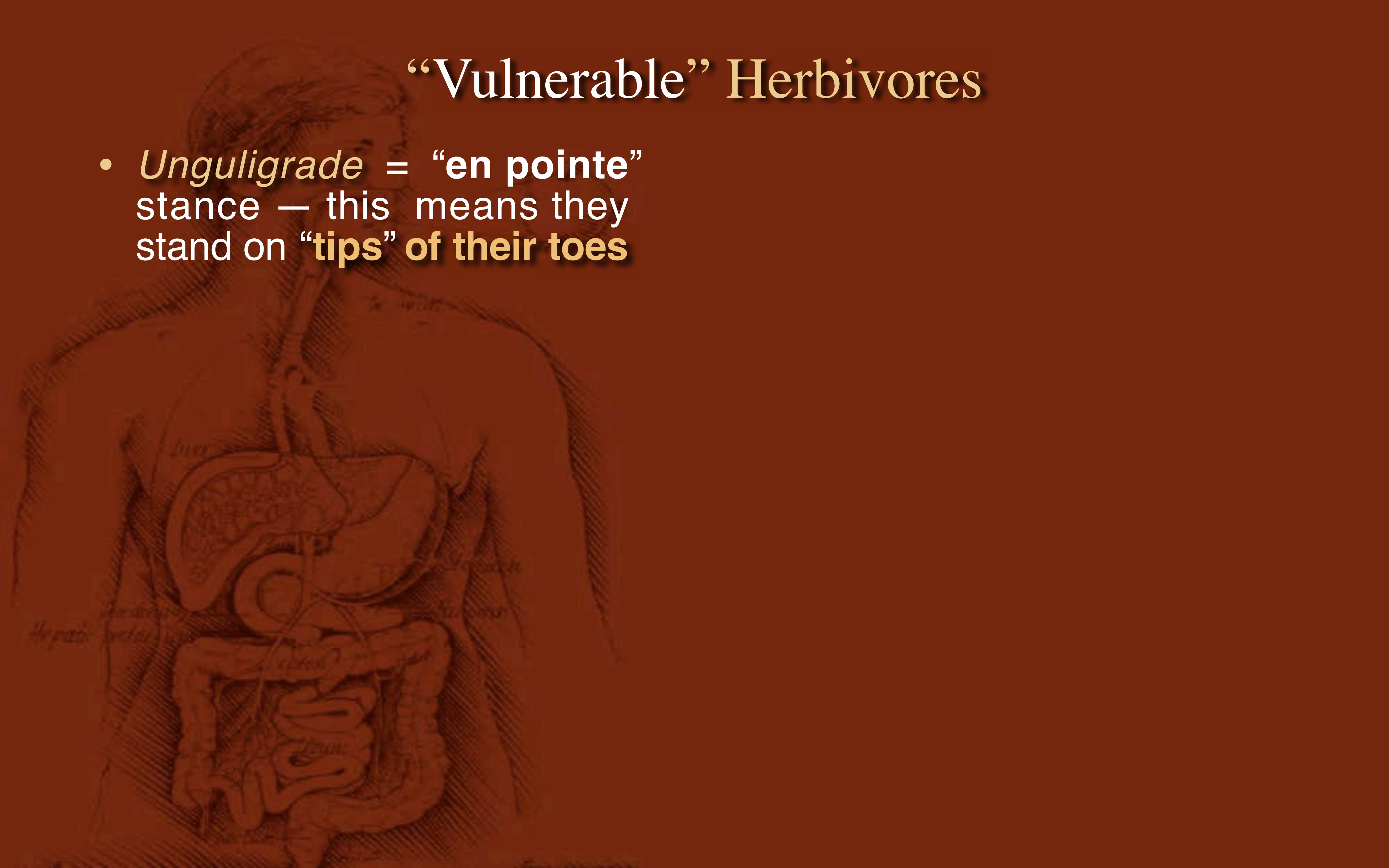


“Vulnerable” Herbivores



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- *Unguligrade* = “en pointe” stance — this means they stand on “**tips**” of their **toes**



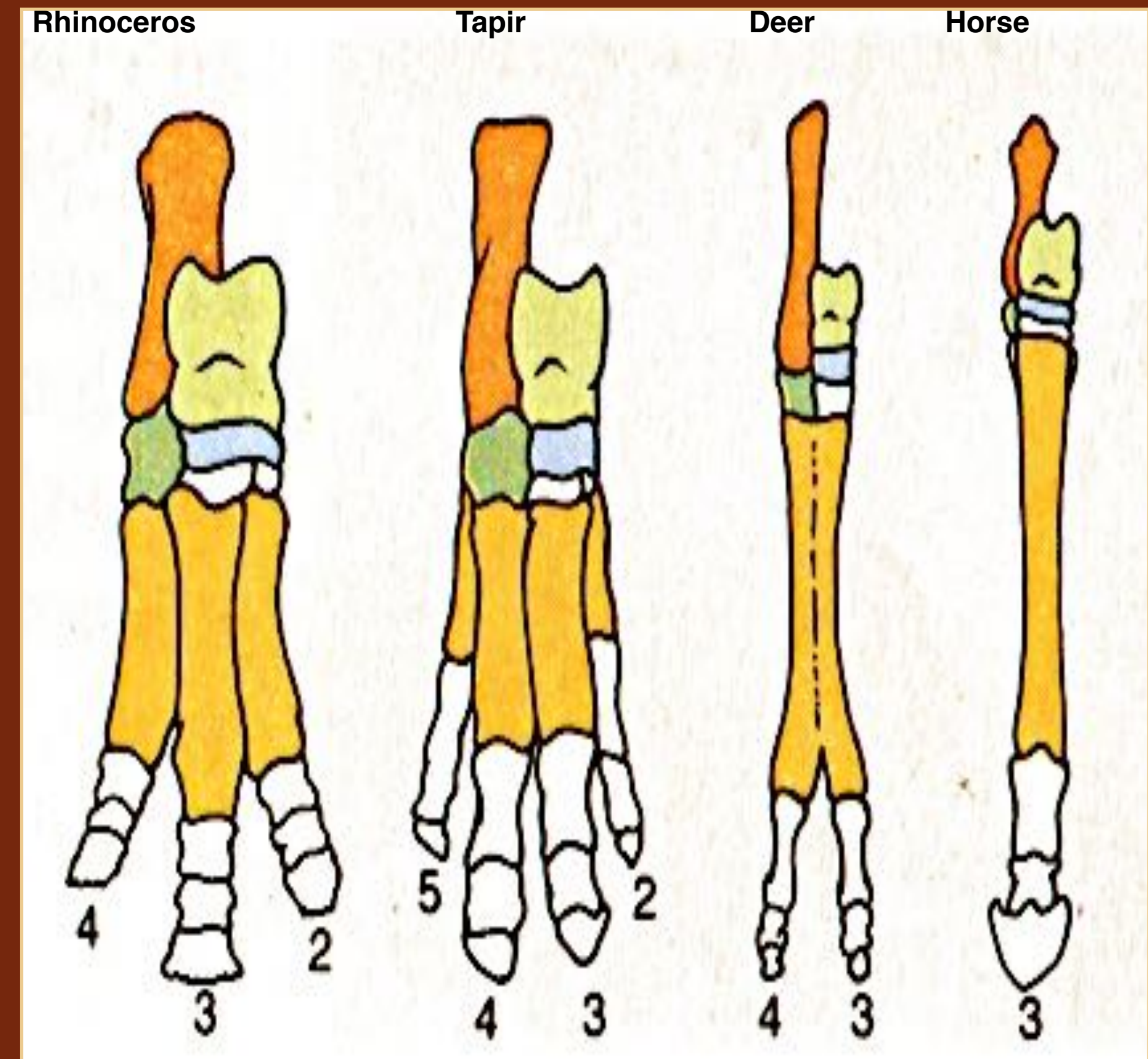
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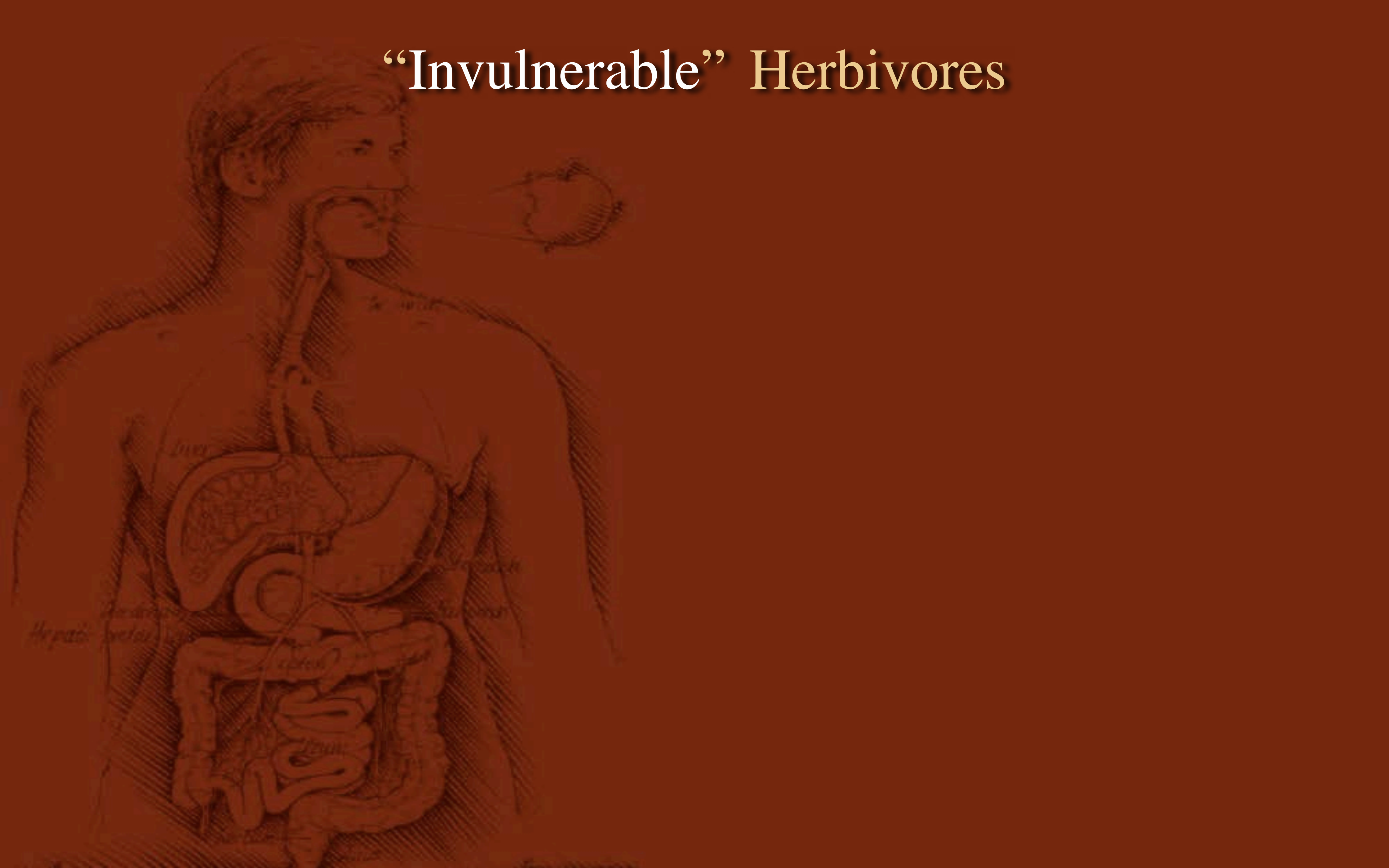


“Vulnerable” Herbivores

- *Unguligrade* = “en pointe” stance — this means they stand on “**tips**” of their **toes**
- Standing on tips of toes **maximally** lengthens stride
- To lower the *energy cost* of running/walking, feet are **reduced** in size and weight by *decreasing the number of toes*
- Nails are **flat** and **blunt**
- May have **COLOR** vision
- Are usually *Diurnal*
- Top speed is $\geq 45 - 50$ mph



“Invulnerable” Herbivores



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- So large and powerful they are essentially **immune** to predation



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Like humans, Elephants are **long-lived social mammals** that live in **family groups** of various sizes

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Terrestrial **herbivorous mammals** generally live *much longer* than **carnivores**

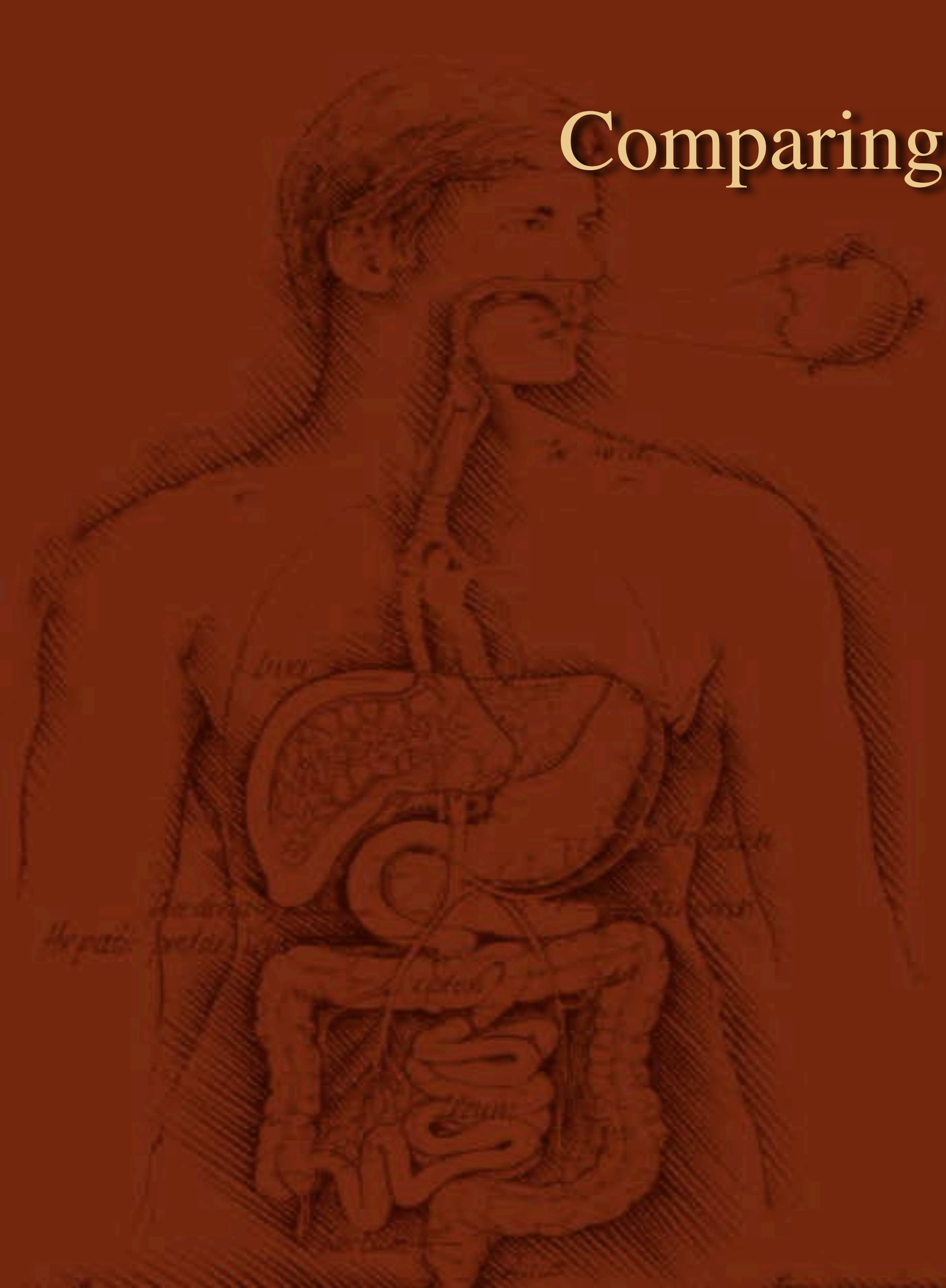
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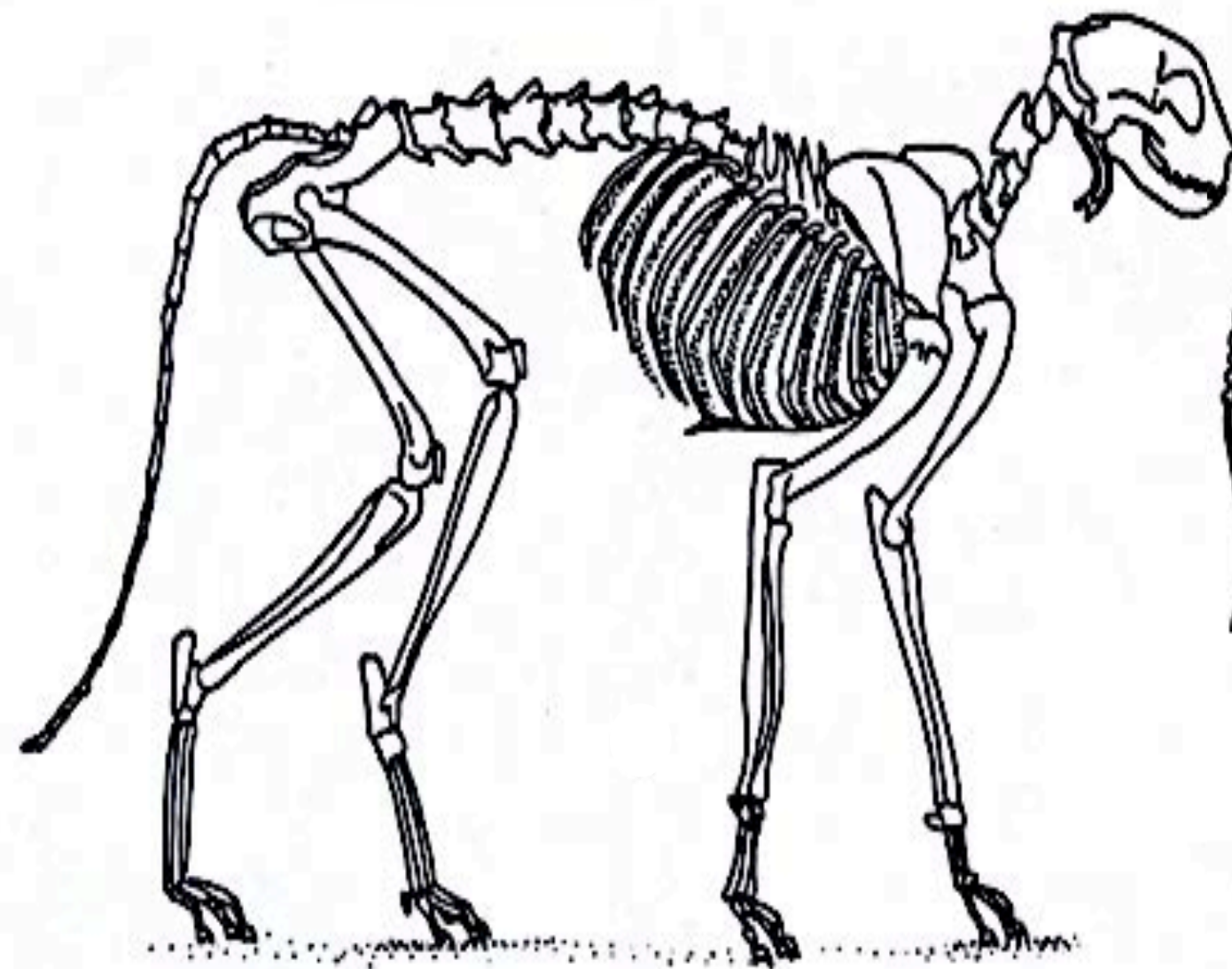
These animals are a living testament to the adequacy of plant protein! *ALL protein is initially made by plants*. Any protein found in animal tissues is actually **second-hand** plant protein!

Comparing Limb Structure



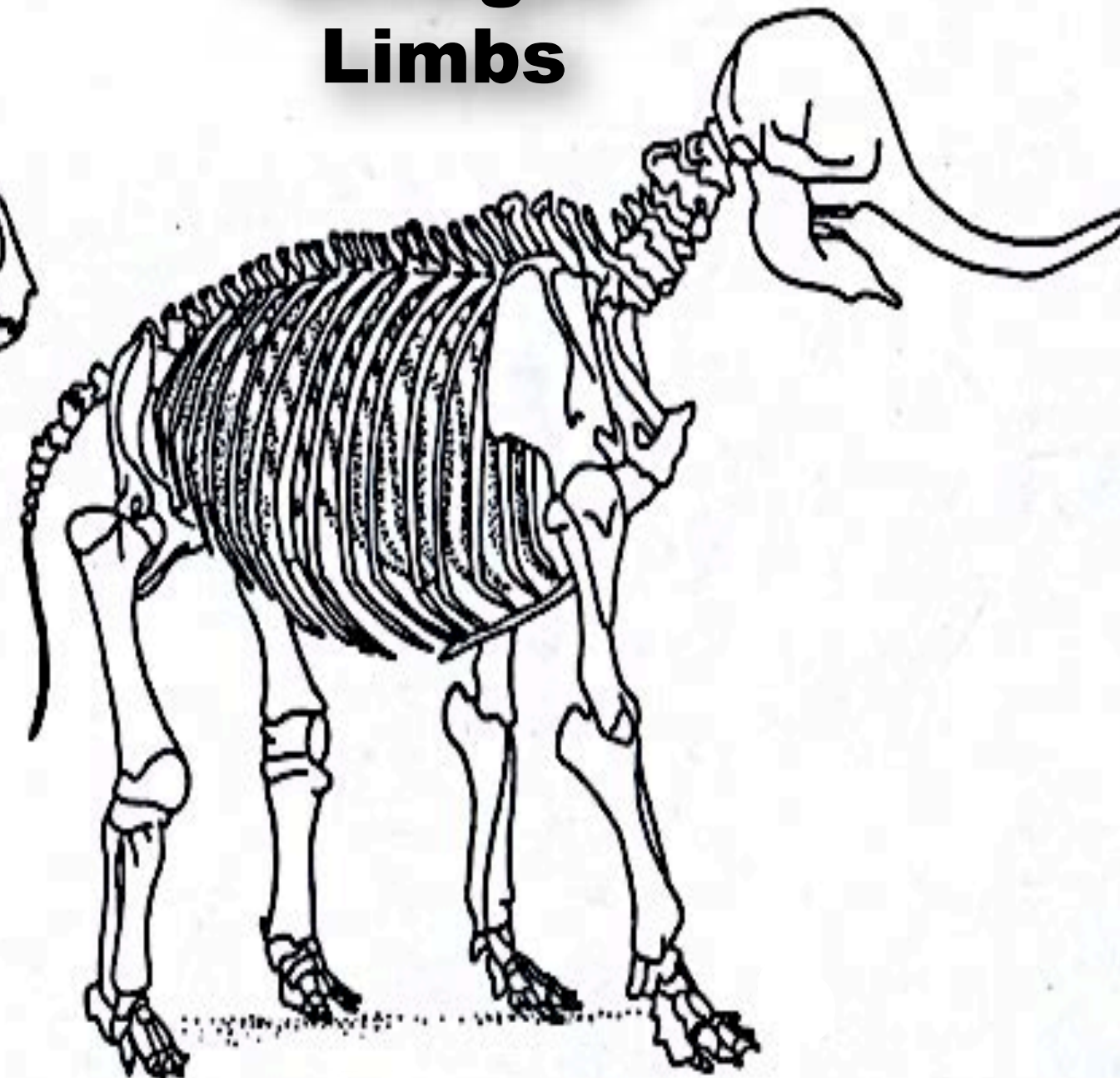
Comparing Limb Structure

**“Flexed-
joint” Limbs**



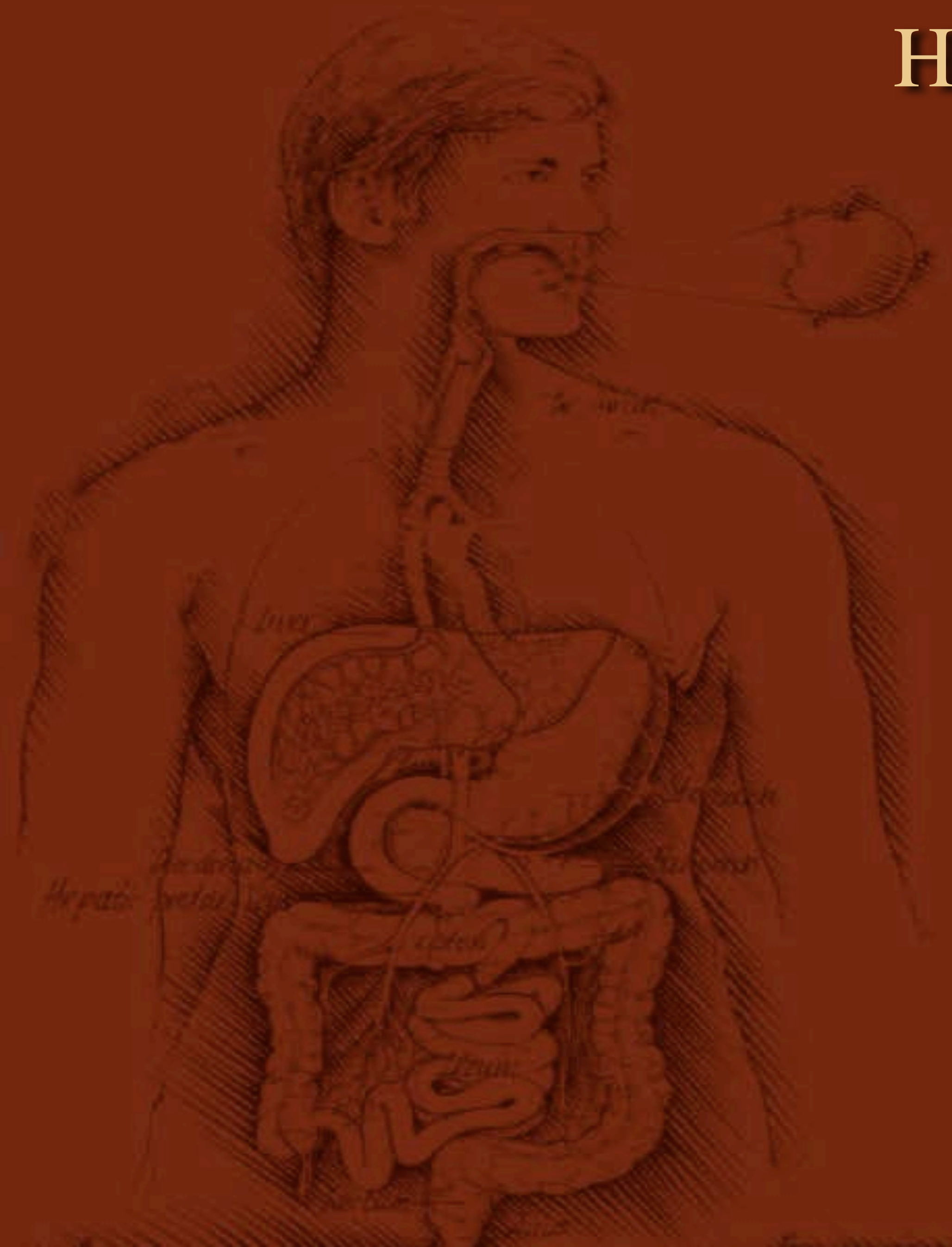
Cat

**“Straight”
Limbs**



Elephant

Humans



Humans

- Designed for walking while **foraging**



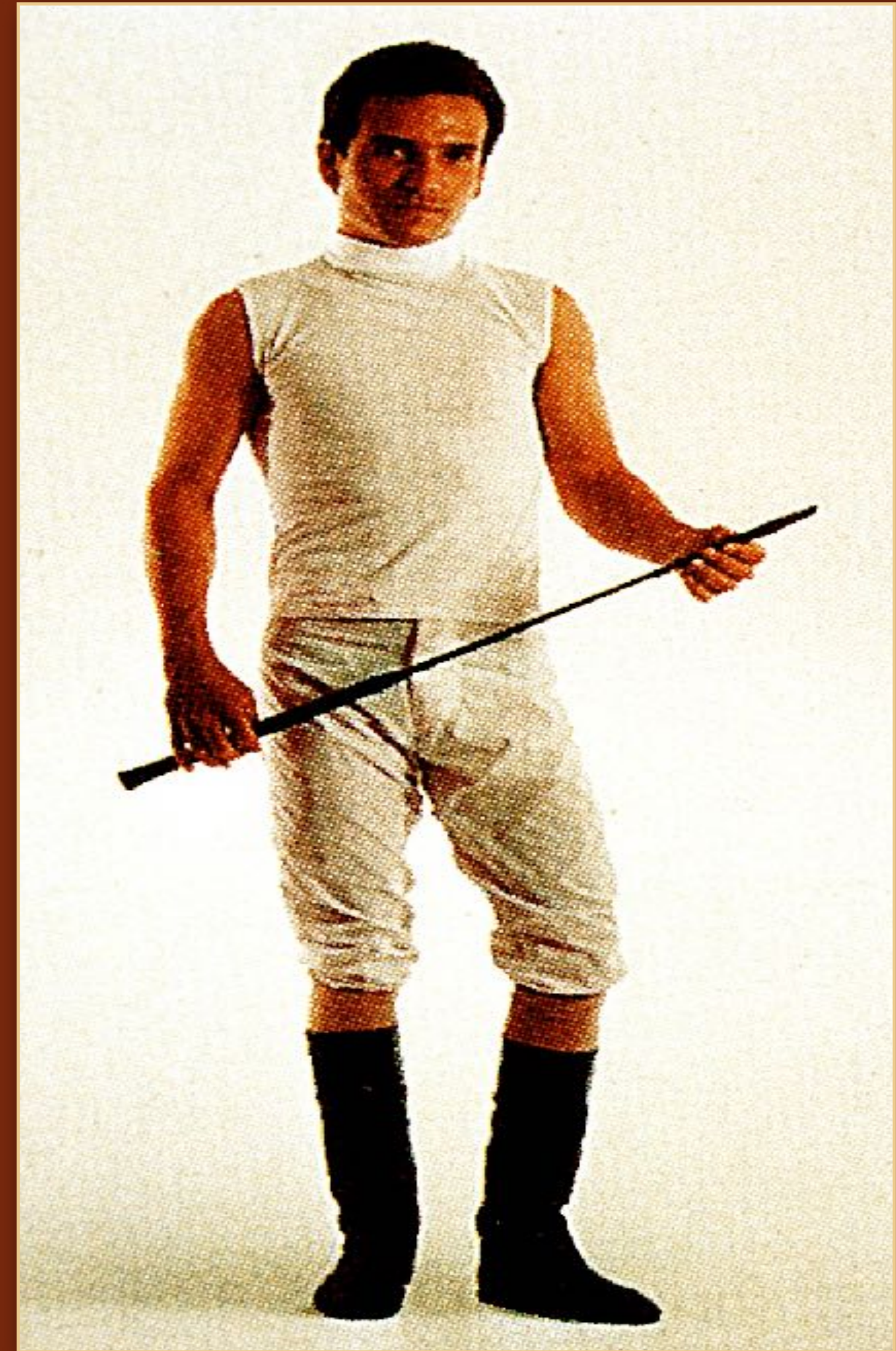
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- Unprotected “**exposed**” anatomy



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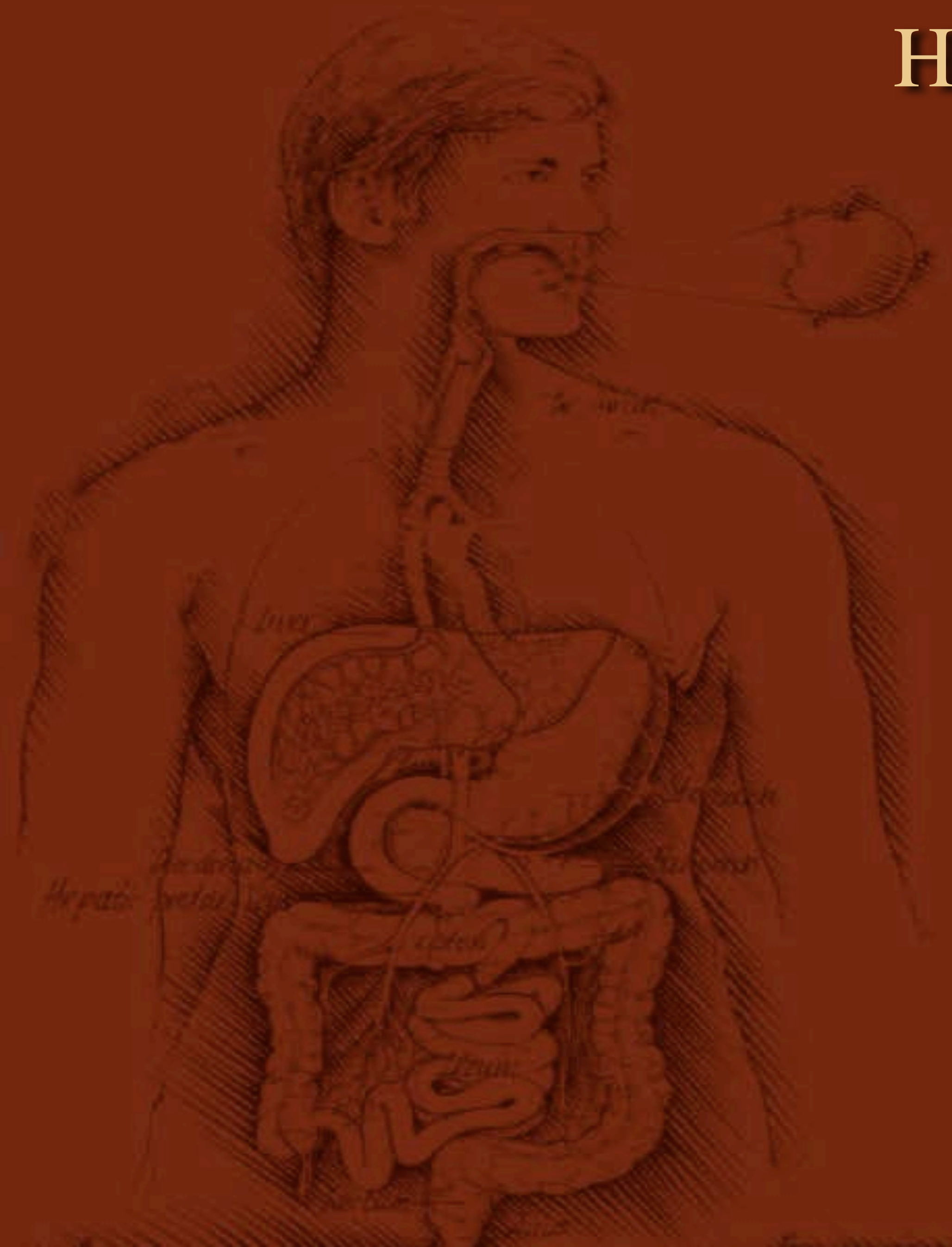


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- Slow speed and poor endurance are **most useful** for escaping stinging insects



Humans



Humans

- Pregnancy and lower upper body strength make “stone age” hunting **impractical** if not *impossible*



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- Neonate’s eyes are **open**



Humans

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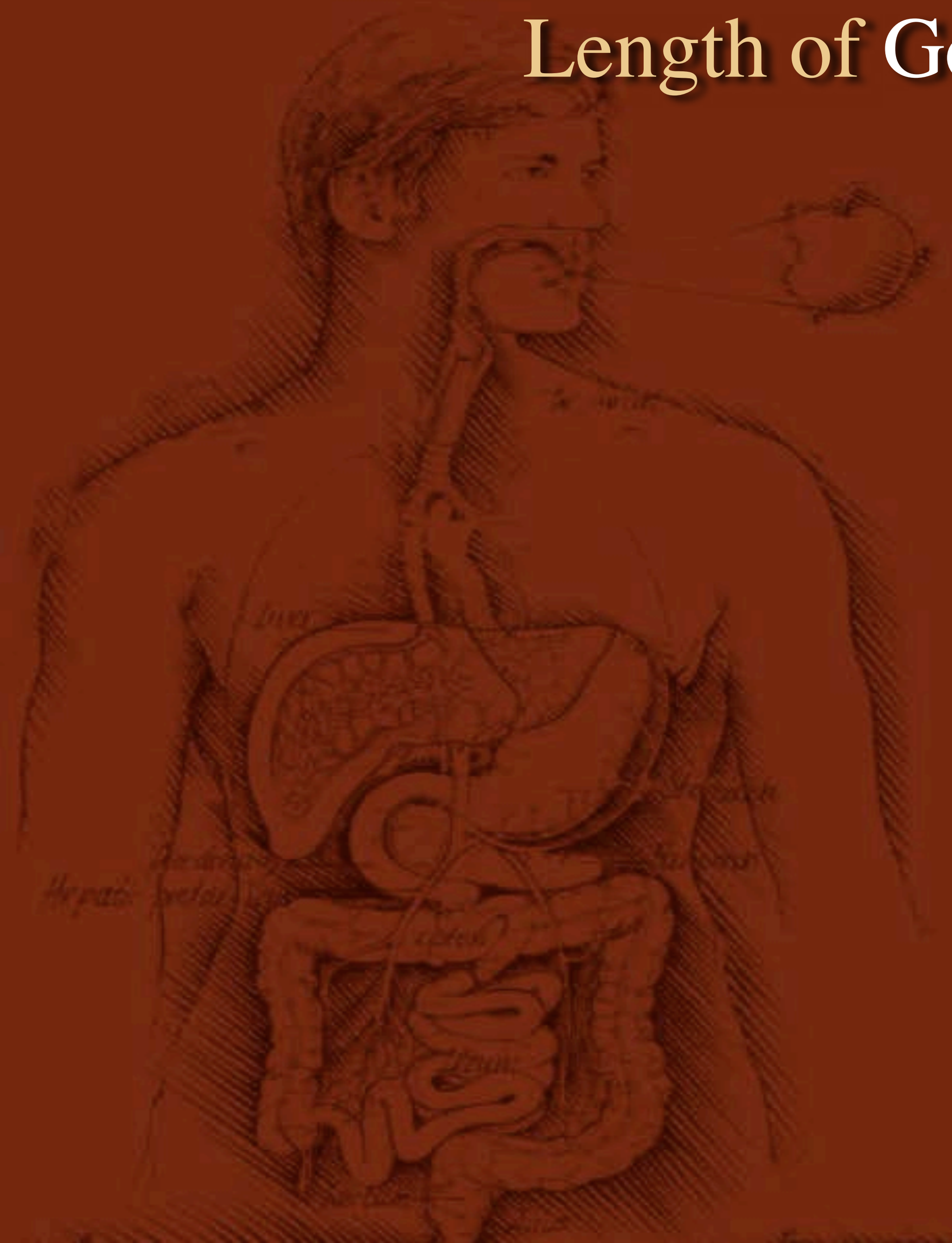
“Hot dog consumption during pregnancy may increase childhood brain tumor risk by 33 percent, and sausage consumption may increase it by 44 percent. Bacon consumption may increase childhood brain tumor odds by 60 to 70 percent.”



nutritionfacts.org/video/cancer-causing-ndma-in-medications-zantac-metformin-and-meat

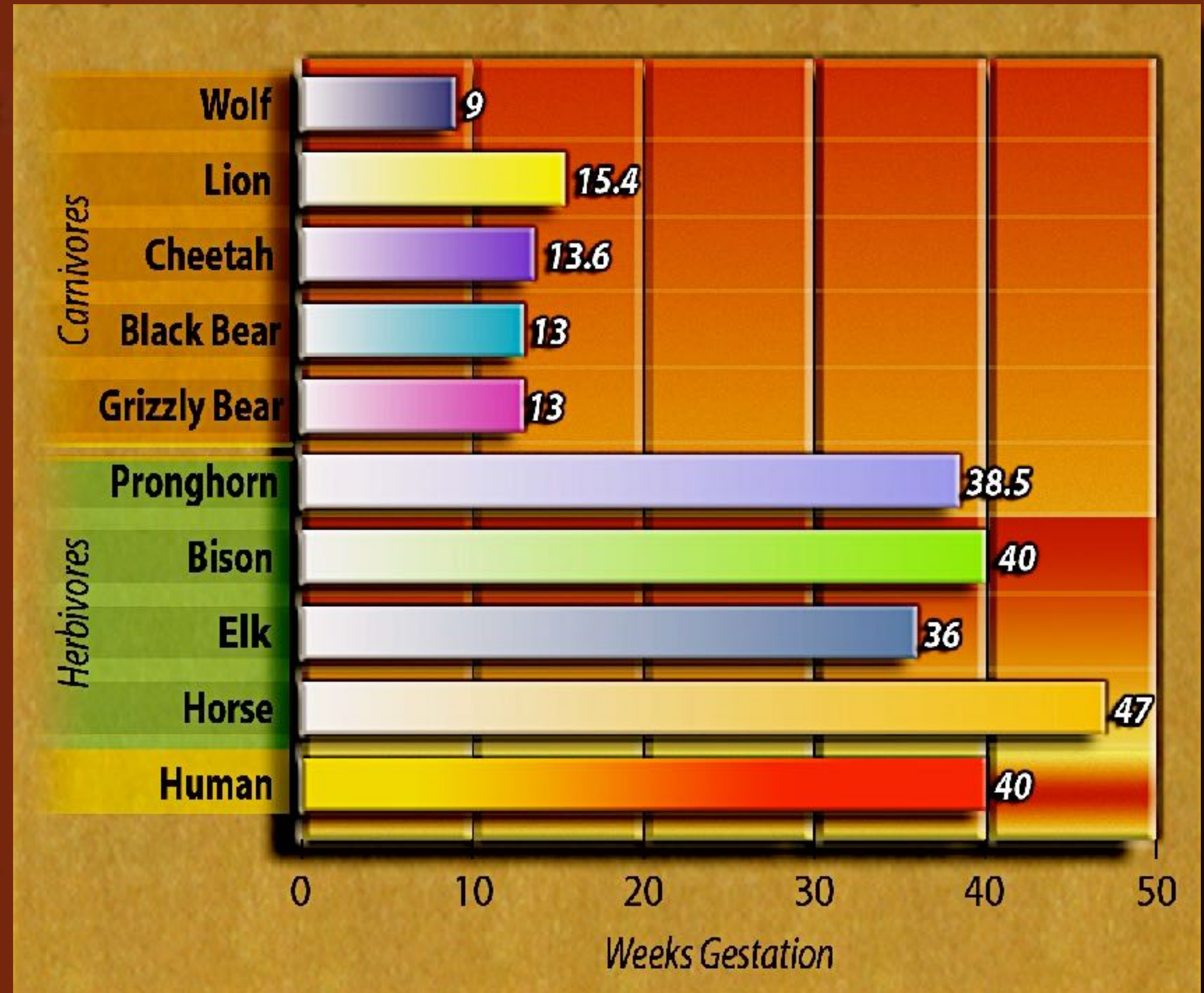
N NutritionFacts.org

Length of Gestation in Weeks



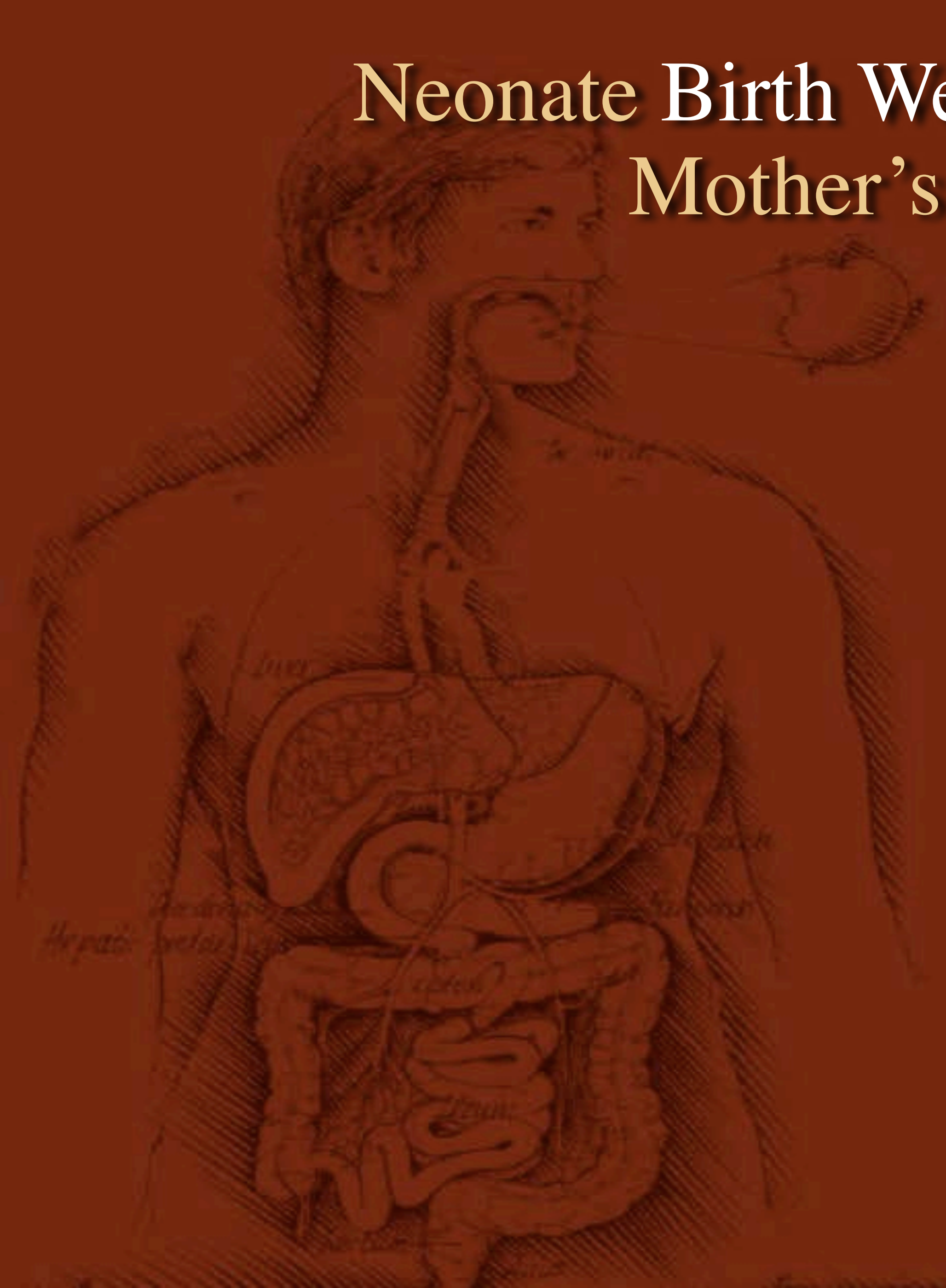
Length of Gestation in Weeks

- Carnivores have **extremely short** gestations
- **Multiple** births (“litters”) are the rule with carnivores
- Herbivore gestation $> 2.5 - 3$ times that of carnivores
- **All are ≥ 34 weeks**
- **Singleton** births are *generally the rule* with large herbivores
- All **large-bodied apes** have **gestation periods** of between 34 - 40 weeks:
 - Chimpanzee ~ 34 weeks
 - Gorilla ~ 36 weeks
 - Orangutan ~ 38 weeks
- Bears may have “**delayed implantation**”
time listed is the **actual** gestation period



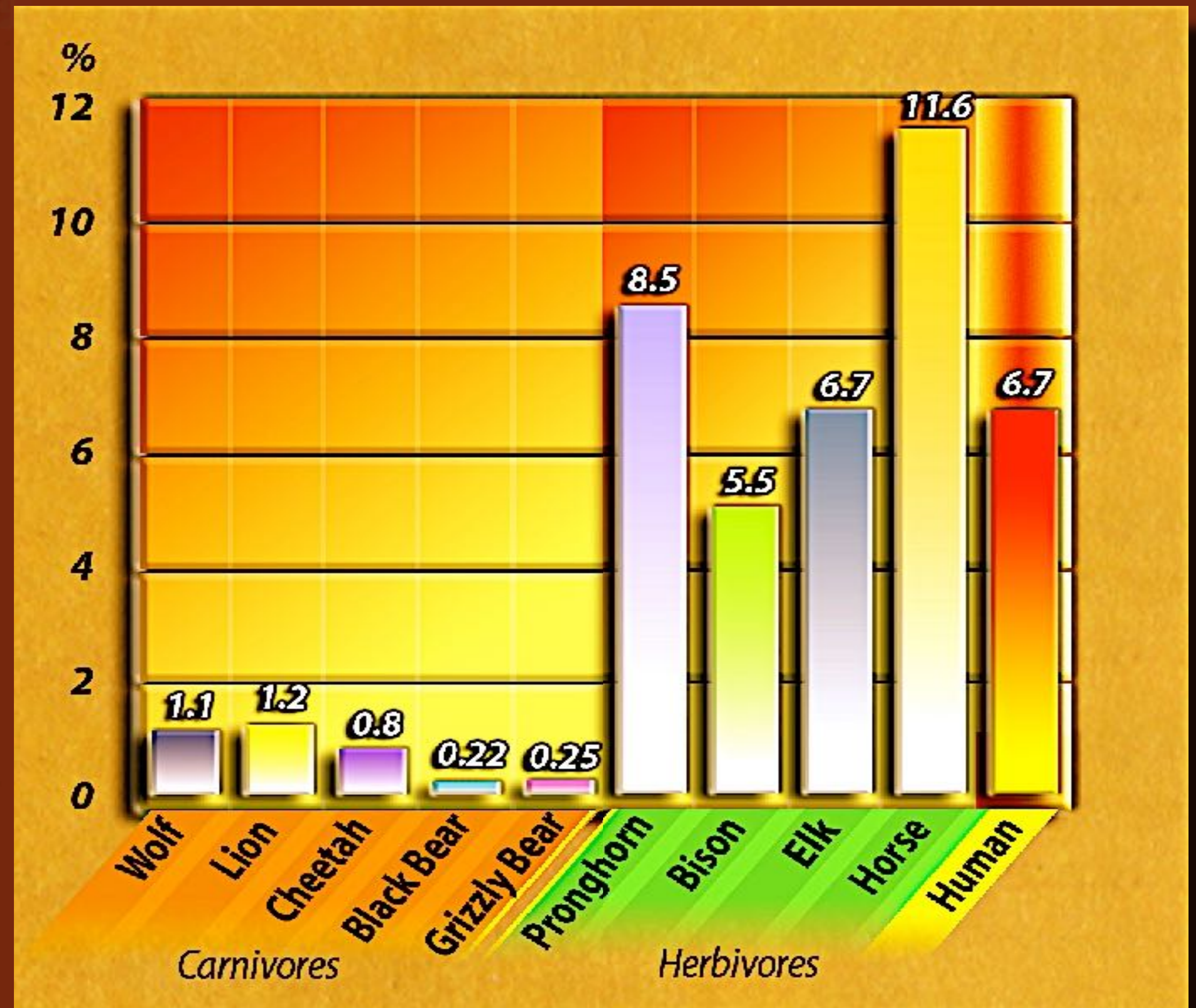
Data listed are for **non-marsupial** terrestrial mammals > 40 kg adult weight

Neonate Birth Weight as Percentage of Mother's Body Weight

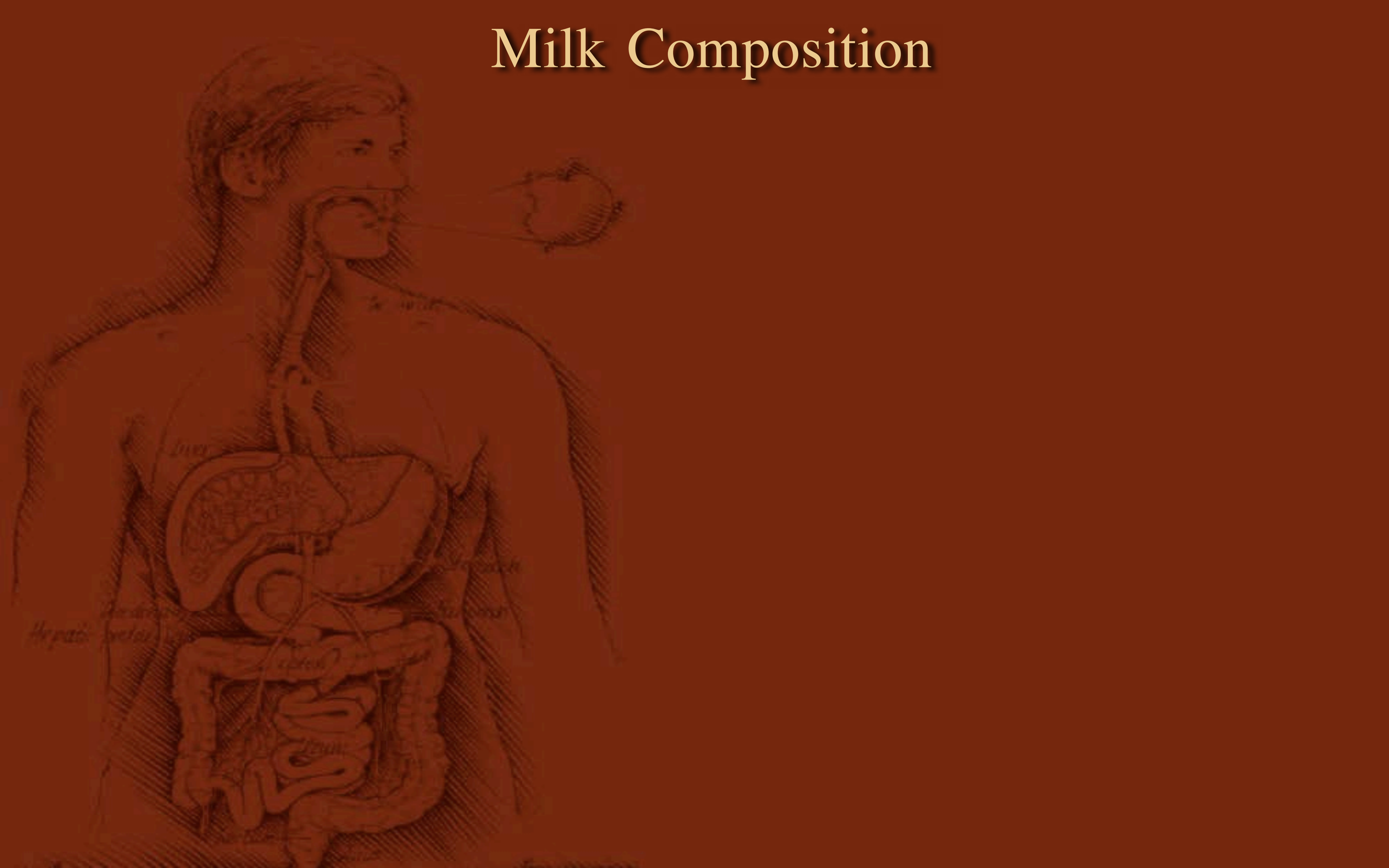


Neonate Birth Weight as Percentage of Mother's Body Weight

- **Short gestation** and **low birth weight** of carnivore neonates enable gravid females to **continue to hunt**
- **Carnivore young** are born at an **extremely early** stage of development
- Carnivore neonates **cannot** regulate their body temperature
- Carnivore infants are born with their **eyes closed**
- In effect, carnivore neonates complete their “fetal” maturation **outside** the womb



Milk Composition



Milk Composition

- Mammalian milks provide the **correct ratio of nutrients** for a **particular species'** growing infants.
- Milks are designed to **stimulate growth** and **boost immune function**.
- Carnivore infants require milk that contains **much more energy and protein** than herbivore or human milk
- Cow's milk has almost **3 TIMES the amount of protein** as human milk and the protein has a **different composition!**
- Human milk has **1.5 times as much sugar** as cow's milk due to human infant's **larger brain**. **Fat type** is different.

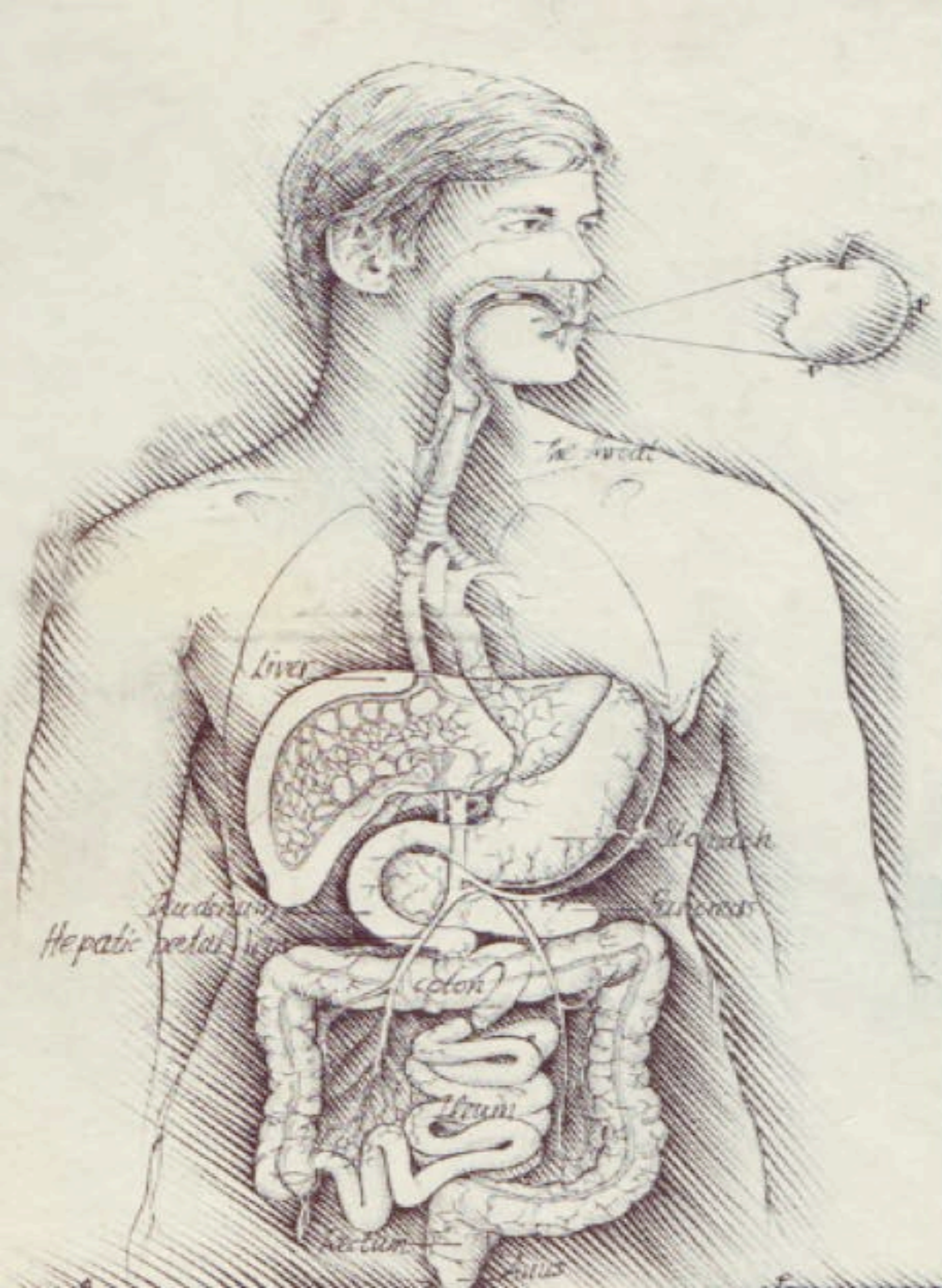
Species	Total Solids	% Fat	% Protein	% Lactose
Dogs (Various Breeds)	20.4 - 29.2	8.5 - 13.5	5.4 - 10.6	2.5 - 4.2
Husky Dogs (2)	24.5, 28.3	11.2, 13.4	8.2, 8.3	2.9, —
Wolf (arctic)	23.5	6.6	12.4	3.0
Wolf	23.1	9.6	9.2	3.4
Coyote	22.1	10.7	9.9	3.0
Golden Jackal	22.0	10.5	10.0	3.0
Fox	18.1	6.3	6.4	4.6
Black Bear	23.5	10.5	7.3	1.5
Polar Bear	43.5	30.6	10.1	0.5
Domestic Cat	18.4	6.3	10.1	4.4
European Lynx	18.5	6.2	10.2	4.5
Puma	35.0	18.6	12.0	3.9
Leopard	19.4	6.5	11.1	4.2
Lion	36.1	18.9	12.5	2.7
Cheetah	23.2	9.5	9.4	3.5
Cow	12.3	3.6	3.2	4.7
Human	12.0	3.7	1.2	6.8

Milk Composition

- Mammalian milks are “species-specific” *endocrine signaling systems* which activate TOR and other cellular proliferative genes and suppress cell destruction.
- Normally this type of sustained gene activation should only occur during a creature’s rapid growth phase *in its infancy*.
- Persistent activation of various growth genes during adulthood can lead to the development of benign and malignant tumors and other metabolic disorders

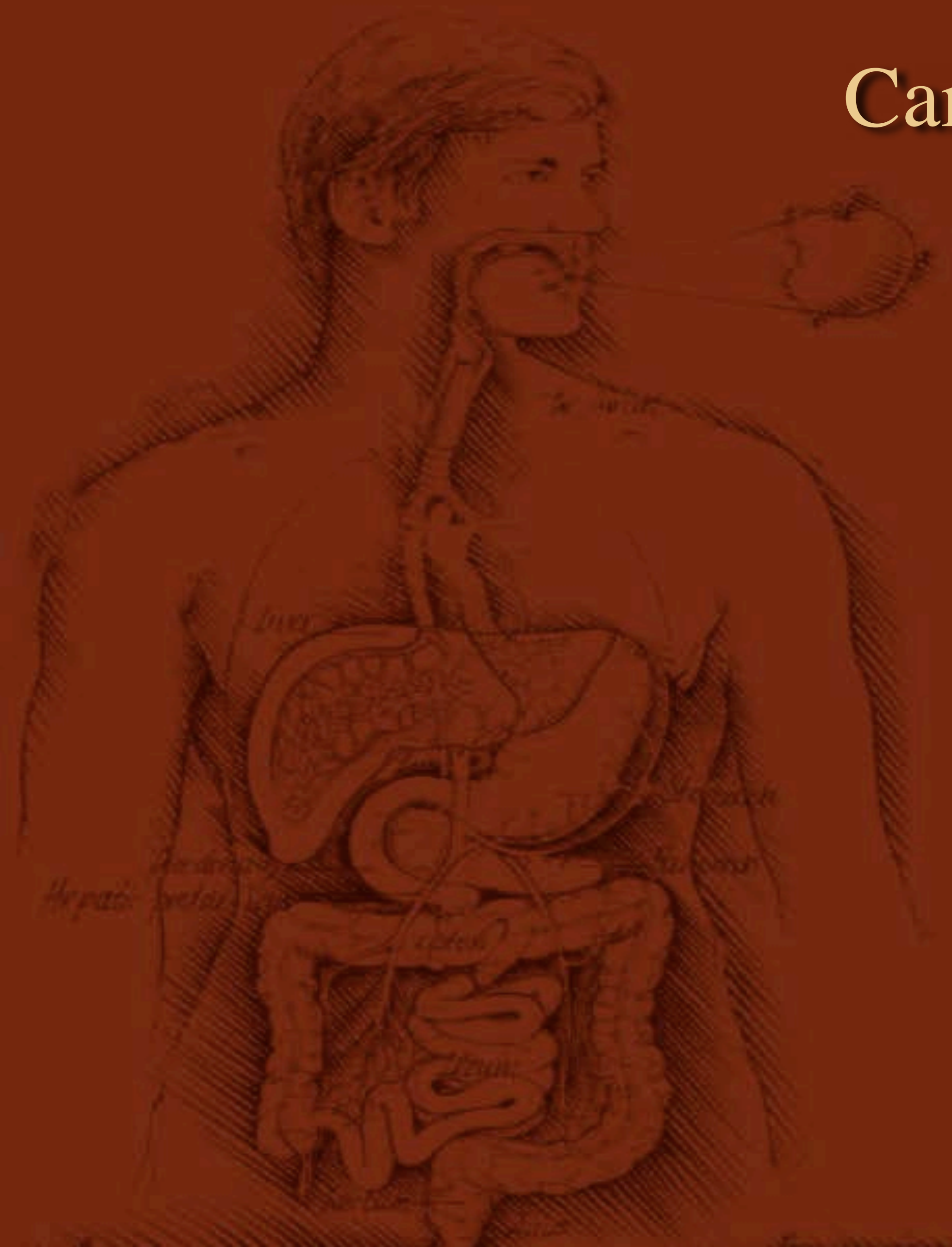
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You can't make butter & ice cream from human milk!



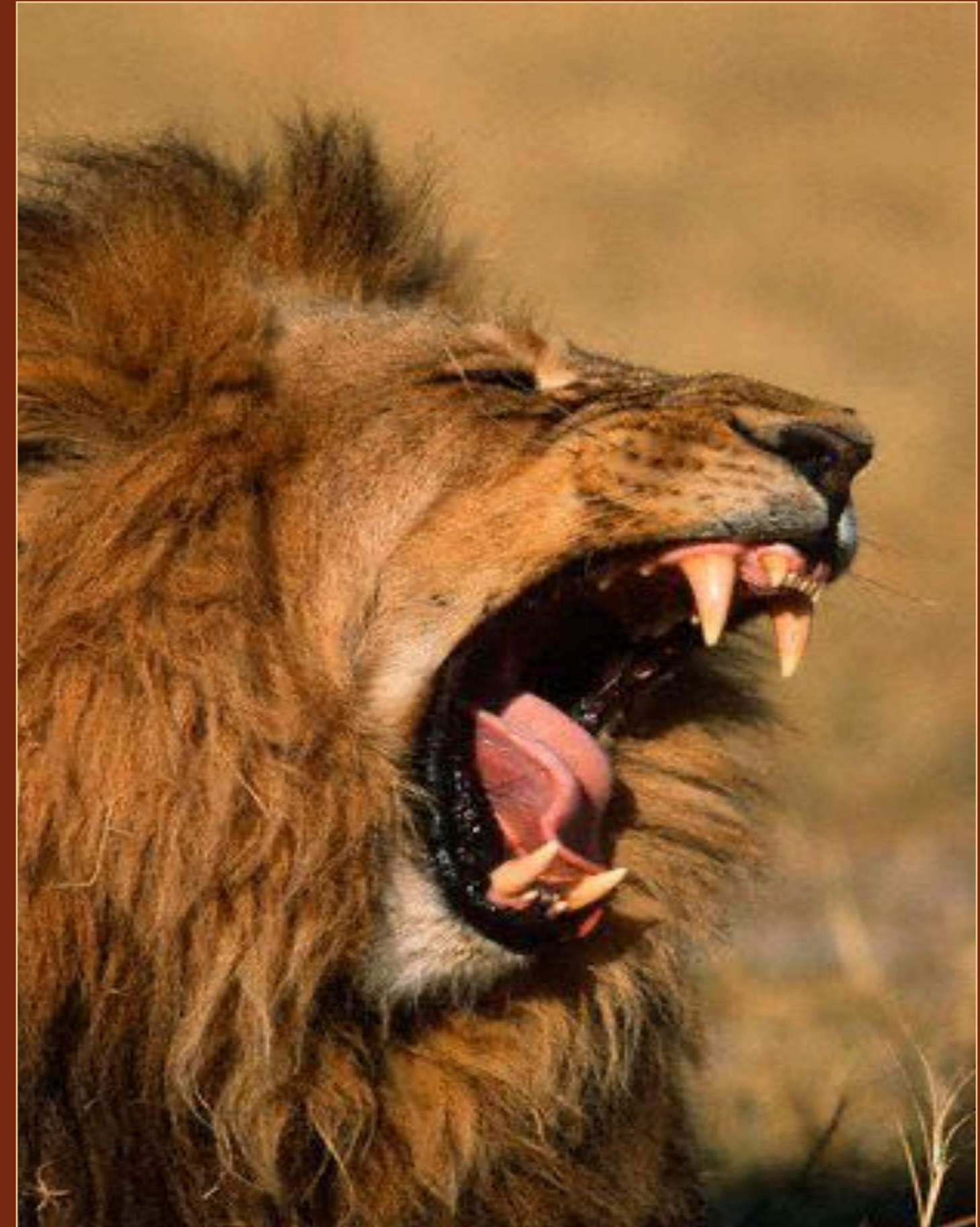
HEAD & NECK

Carnivores

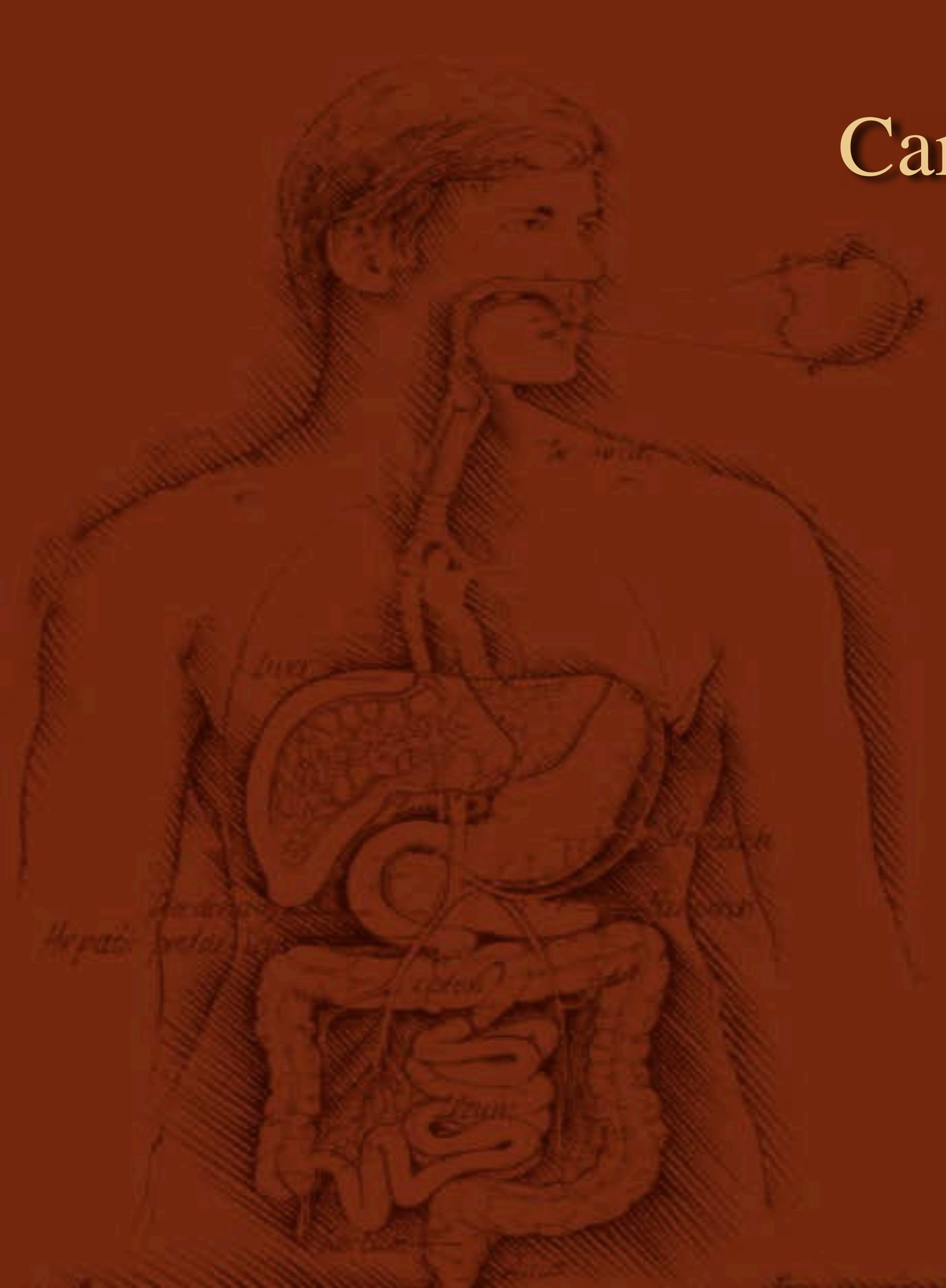


Carnivores

- *Reduced* facial muscles allow for a **wide gape**
- *Temporalis* is **massive** and is the main jaw muscle
- Teeth are designed for **ripping, tearing and cutting**
- Do **NOT** “chew”
- Jaw has **minimal** side-to-side motion and **cannot** move forward
- Saliva has **NO** enzymes



Carnivores



Carnivores

Wolf



Jaw joint is on the **same plane** as the cheek teeth so that jaws function like a pair of *shears* to **slice** flesh off bone and **cut through** tough hides

Carnivores

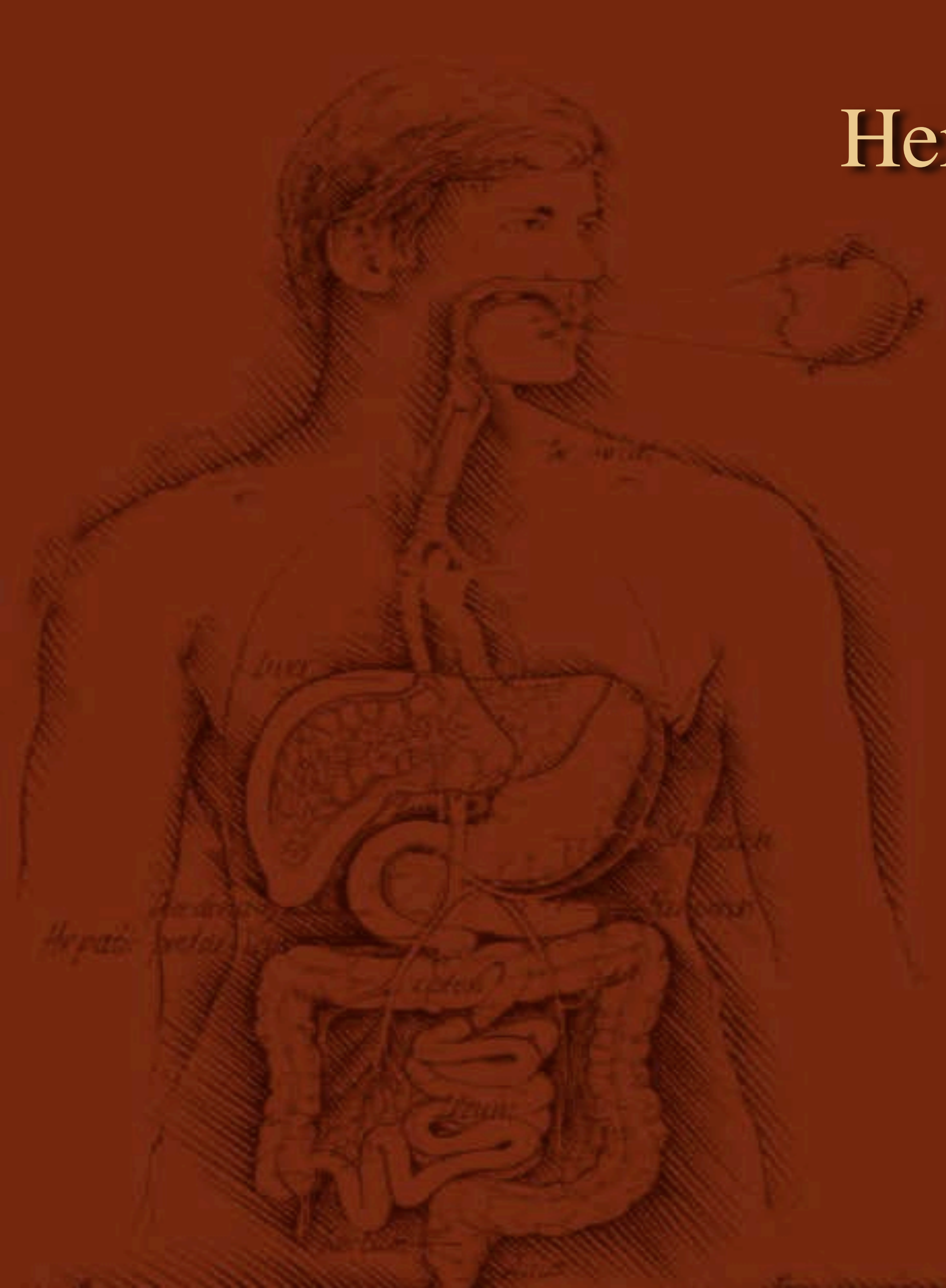
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Angle of mandible is NOT expanded

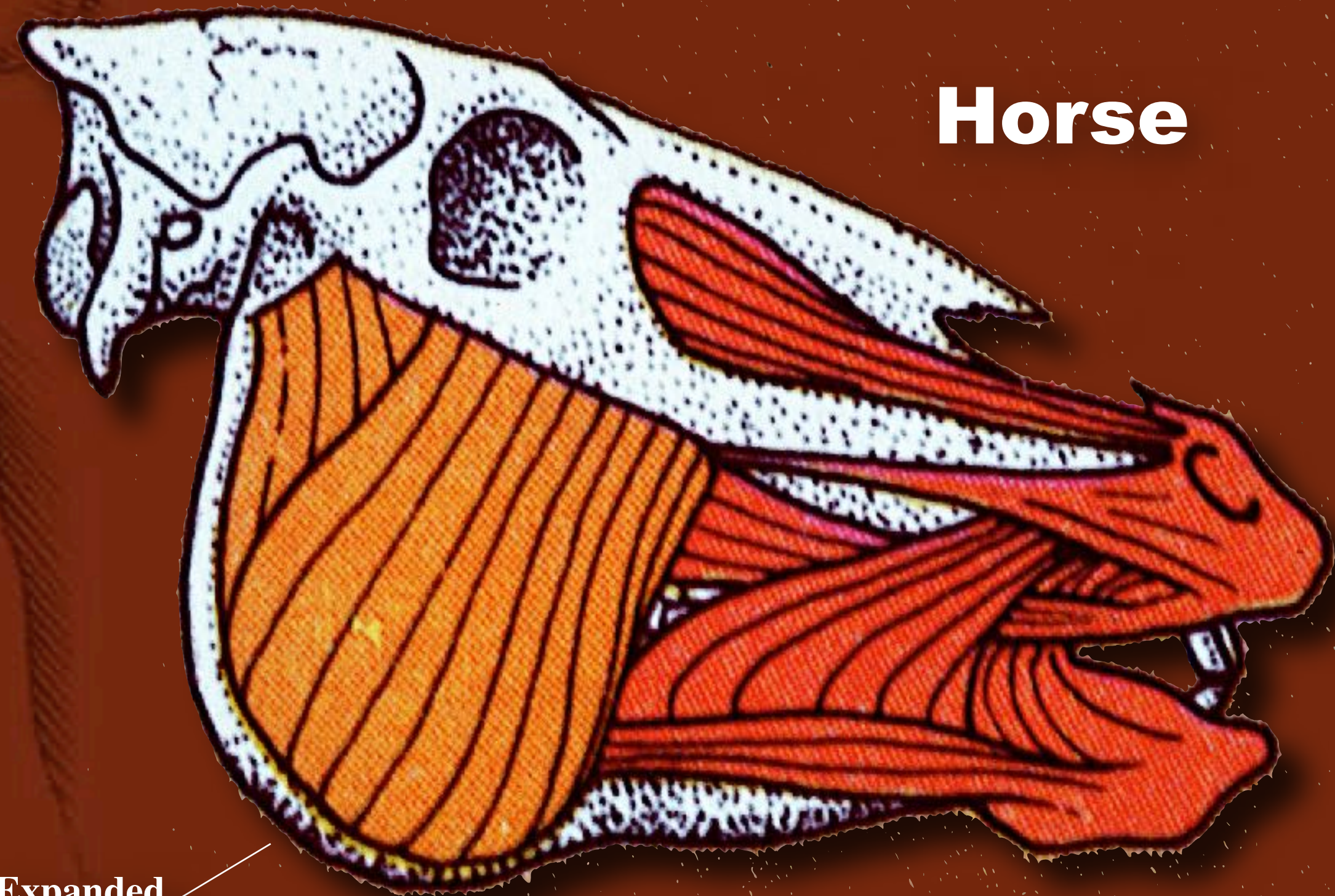
Herbivores



Herbivores

- Well-developed facial muscles
- Masseter and Pterygoids are the main jaw muscles
- These muscles attach on the *outside* and *inside* of the expanded angle of mandible

Horse



Expanded
Angle of
Mandible

Herbivores

Sheep



Expanded
Angle of
Mandible



Herbivores

Sheep



Expanded
Angle of
Mandible



Herbivores

- Jaw joint is **above** the plane of cheek teeth, therefore, jaws function like *nut-crackers*
- This **mobile** type of jaw structure is only found in animals that have “**committed**” to a plant food diet because it can be **easily dislocated**

Jaw joint ABOVE
plane of the teeth



Sheep

Expanded
Angle of
Mandible

Herbivores

- This type of jaw structure **is so important for processing plant foods**, it is *theorized* to have ***independently evolved more than 15 times***
- **Teeth** are designed for **cropping and grinding**
- **Angle of mandible is expanded**

Jaw joint ABOVE
plane of the teeth



Sheep

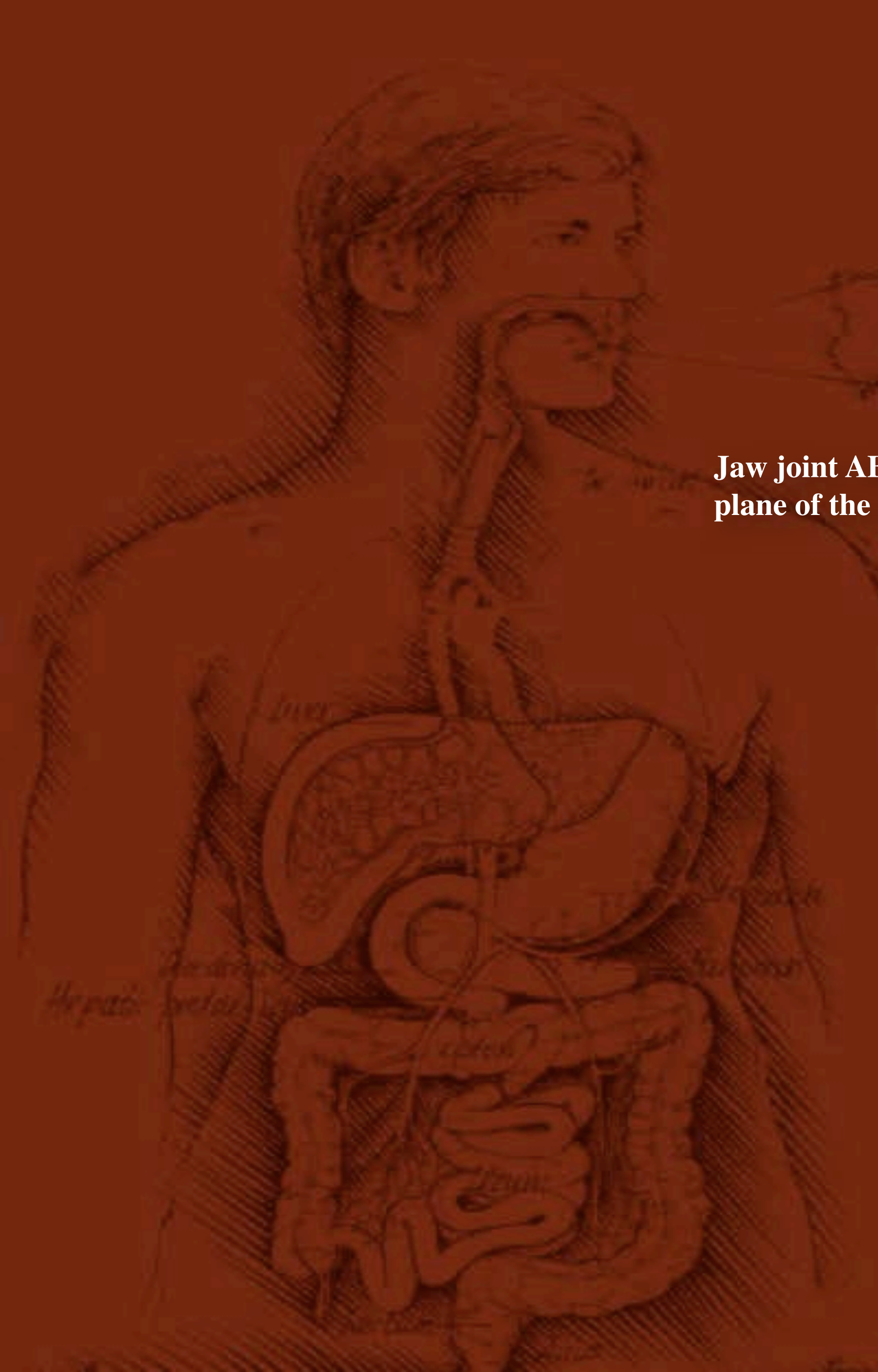
Expanded
Angle of
Mandible

Herbivores

Sheep

Jaw joint ABOVE
plane of the teeth

Expanded
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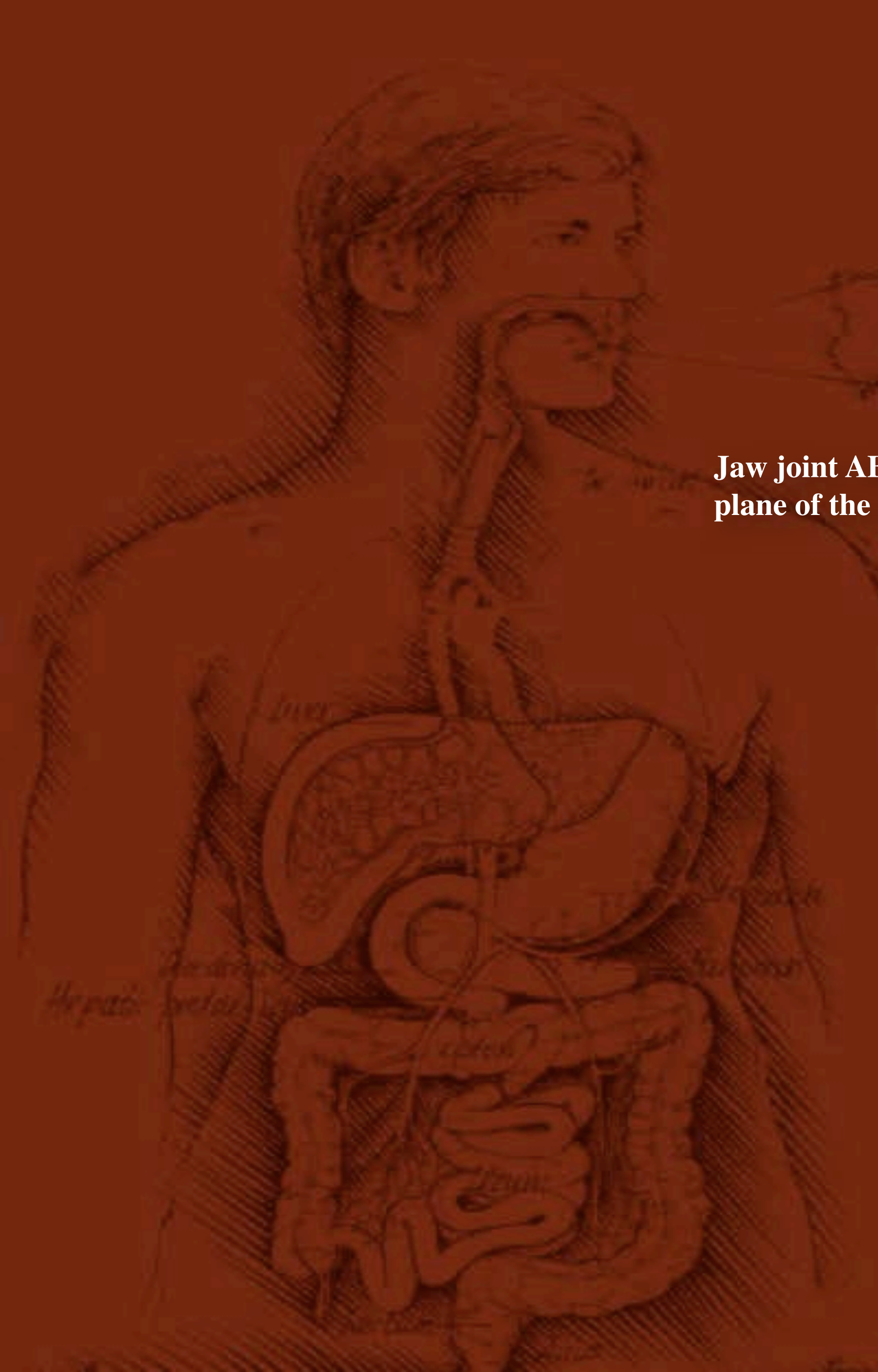
Expanded
Angle of
Mandible

Herbivores

Sheep

Jaw joint ABOVE
plane of the teeth

Expanded
Angle of
Mandible



Herbivores

Sheep

- Lower jaw has **pro-nounced side-to-side motion** and **can move forward**
- These movements enable the **grinding actions** of “chewing”
- Tongue is **thick and muscular** to aid in chewing
- *Salivary amylase* **enzyme** may be in saliva

Jaw joint ABOVE
plane of the teeth

Expanded
Angle of
Mandible



Molars

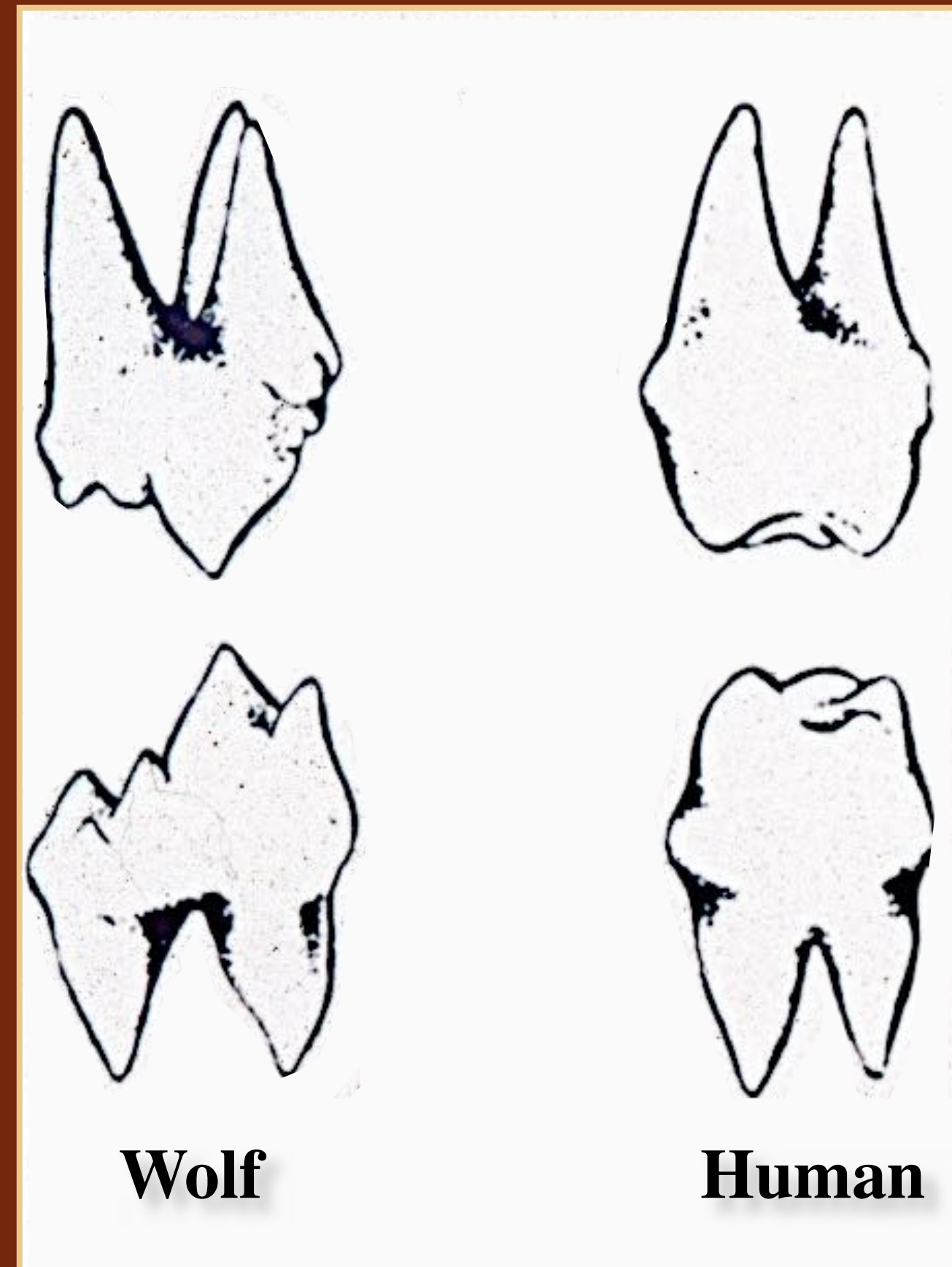


Wolf

Human

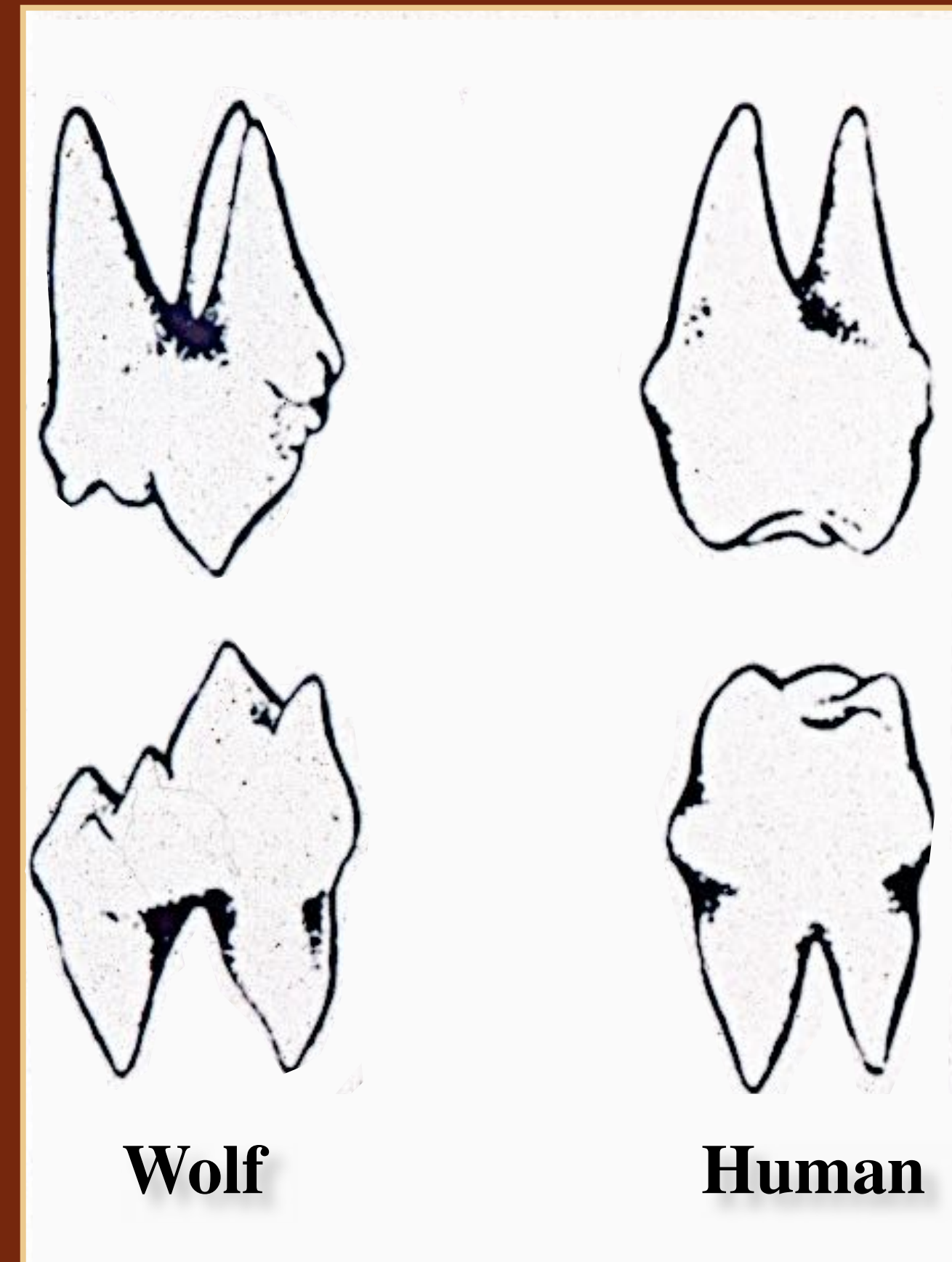
Molars

- Carnassial (cheek) teeth are the *key feature* of the order ***Carnivora***



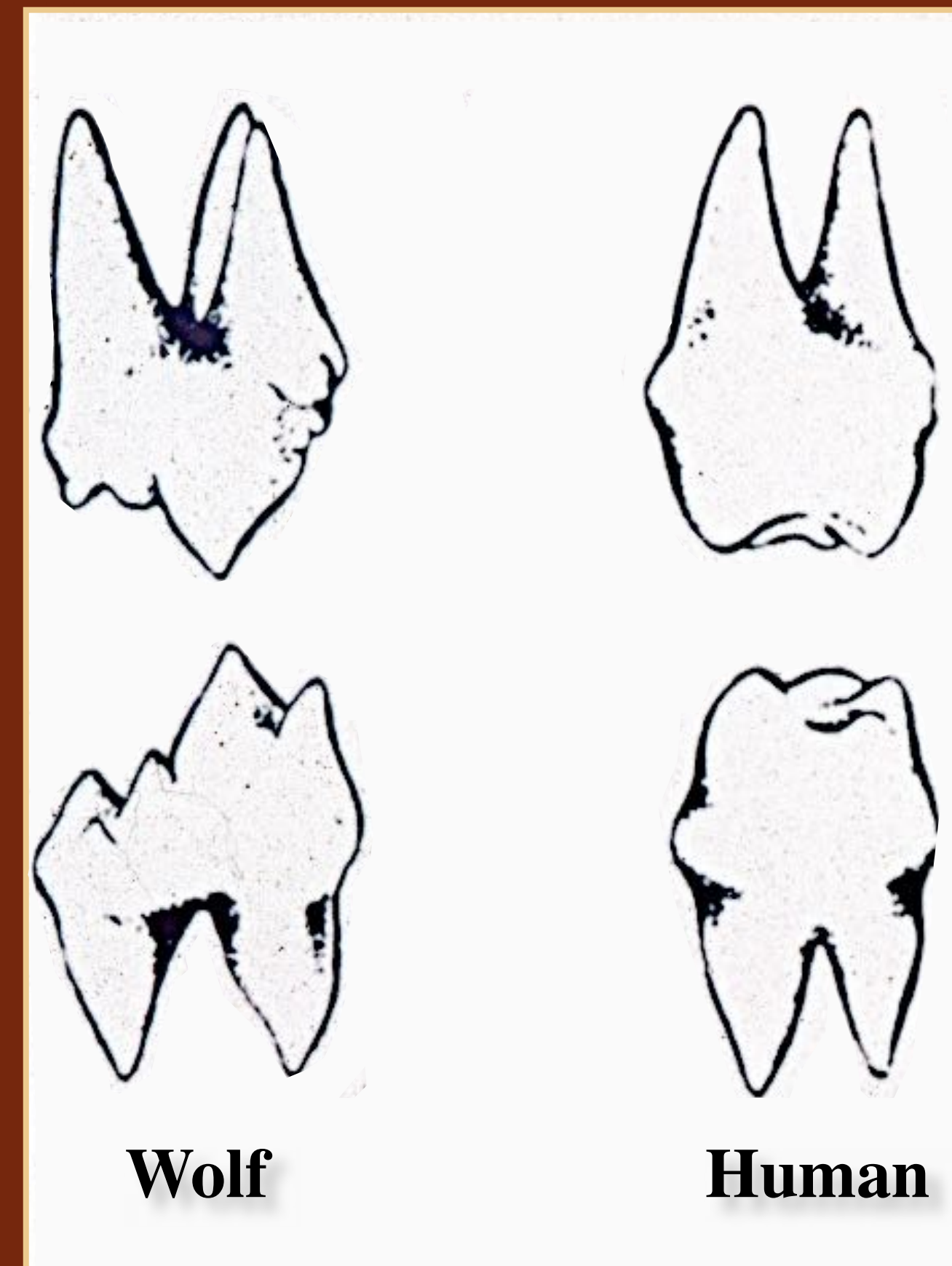
Molars

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- The blade-like **jagged edges** come together to provide a *shearing surface* to slice through flesh, hides tendons and bones

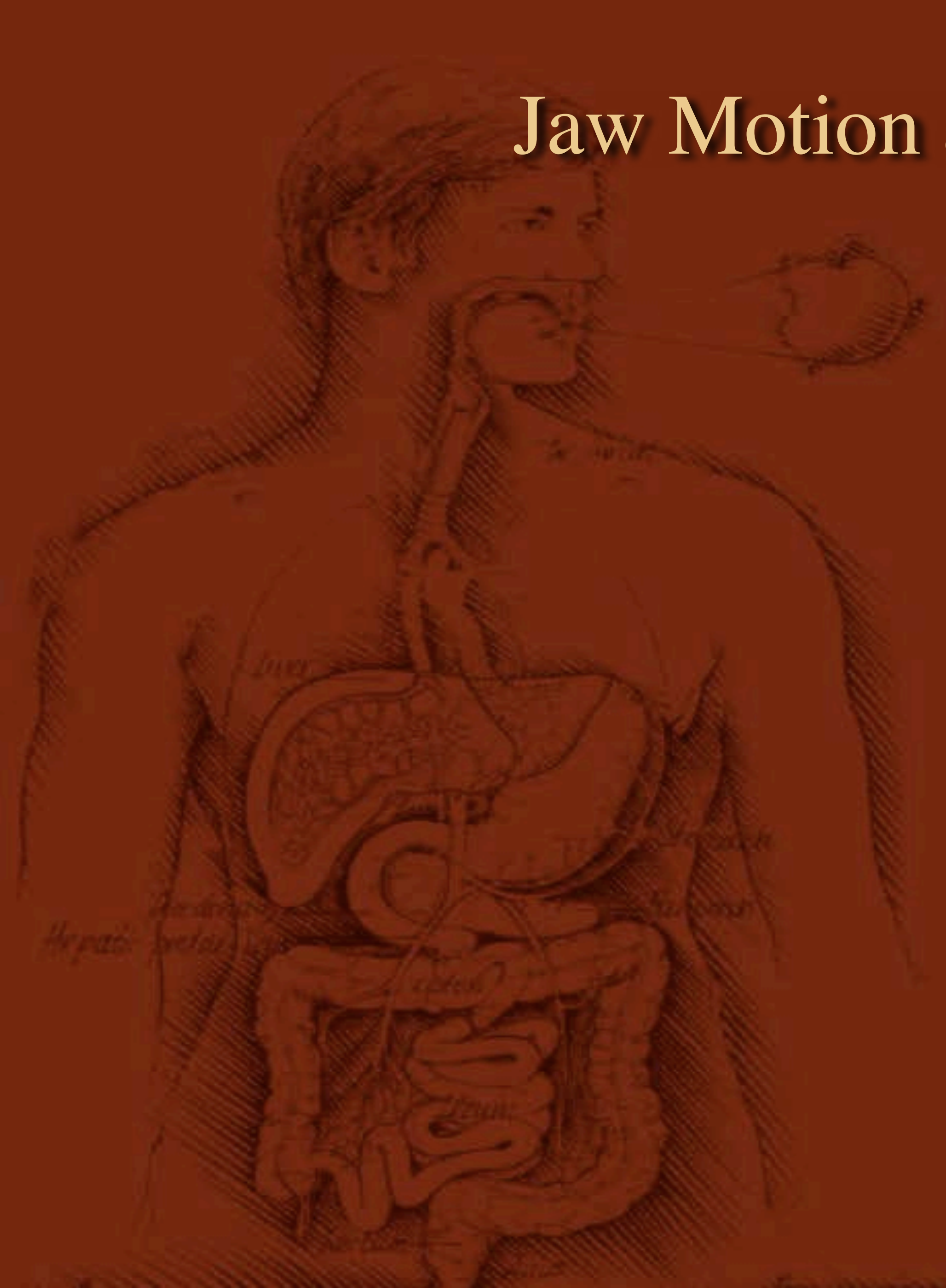


Molars

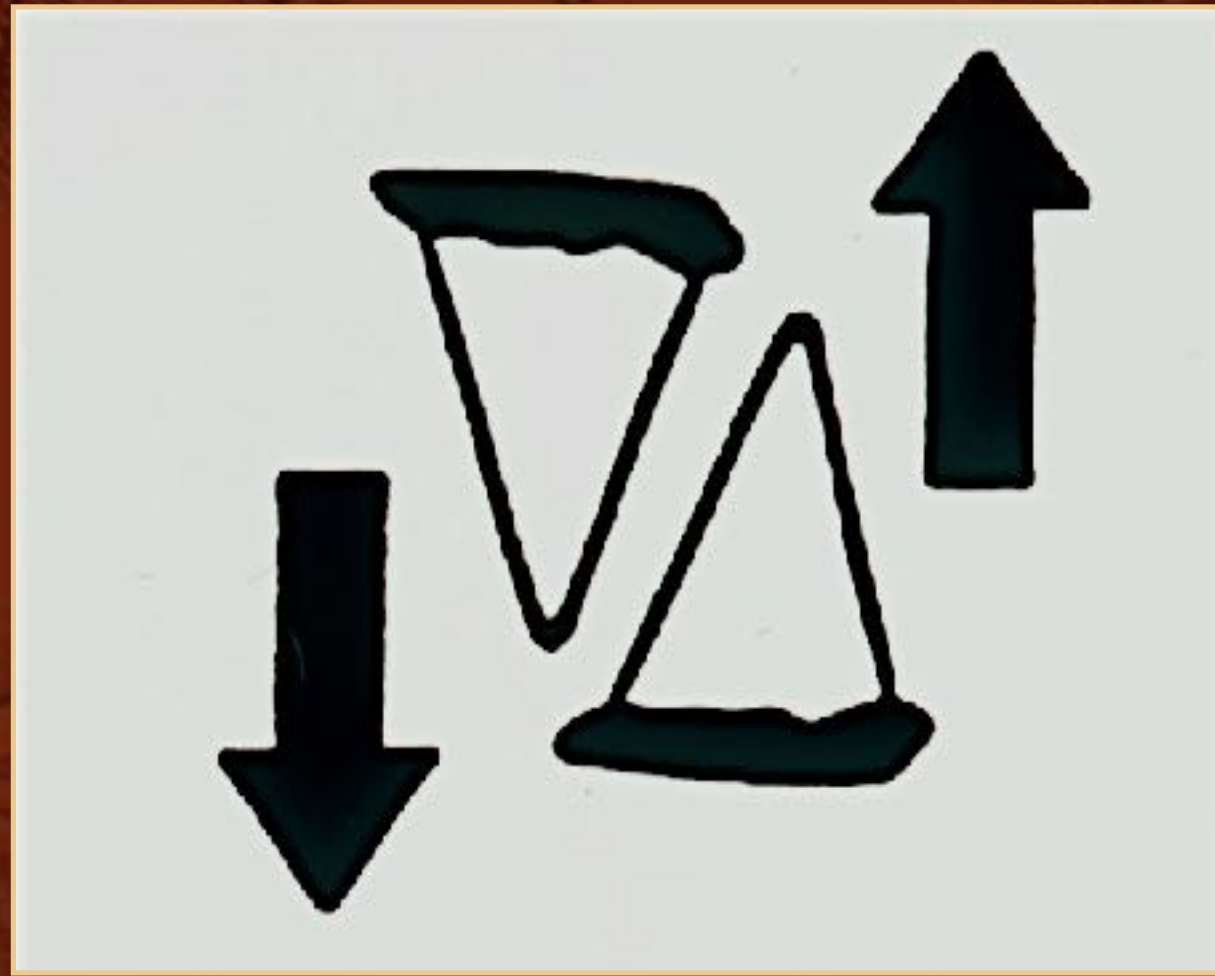
- Carnassial (cheek) teeth are the *key feature* of the order *Carnivora*
- The blade-like **jagged edges** come together to provide a *shearing surface* to slice through flesh, hides tendons and bones
- By contrast the molars in **Herbivores** are **flattened** to provide a **grinding** surface to shred fibrous plant foods



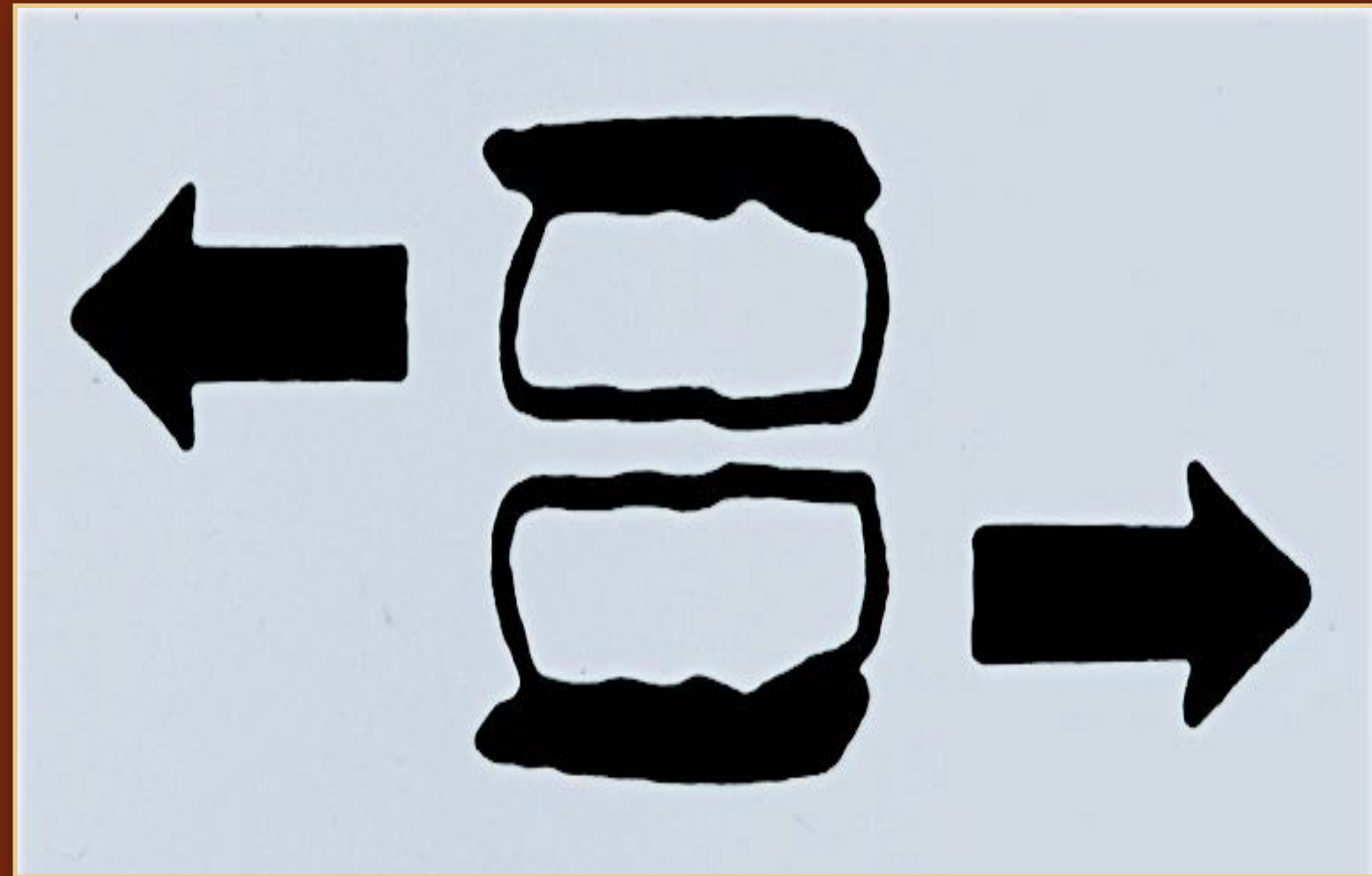
Jaw Motion and Molar Action



Jaw Motion and Molar Action

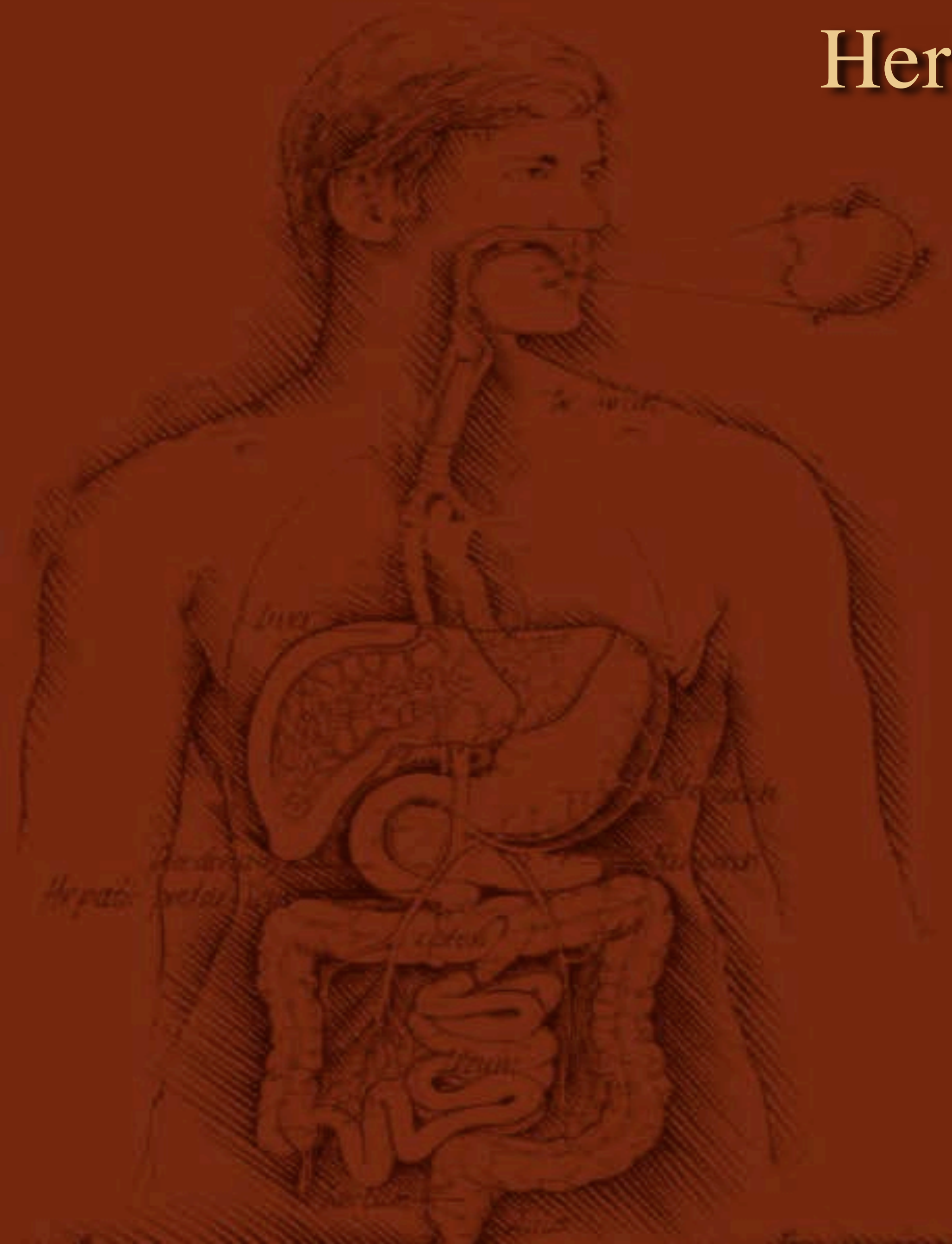


- Carnivore molars slide *past* each other **vertically**



- Herbivore molars slide *across* each other **horizontally**

Herbivores



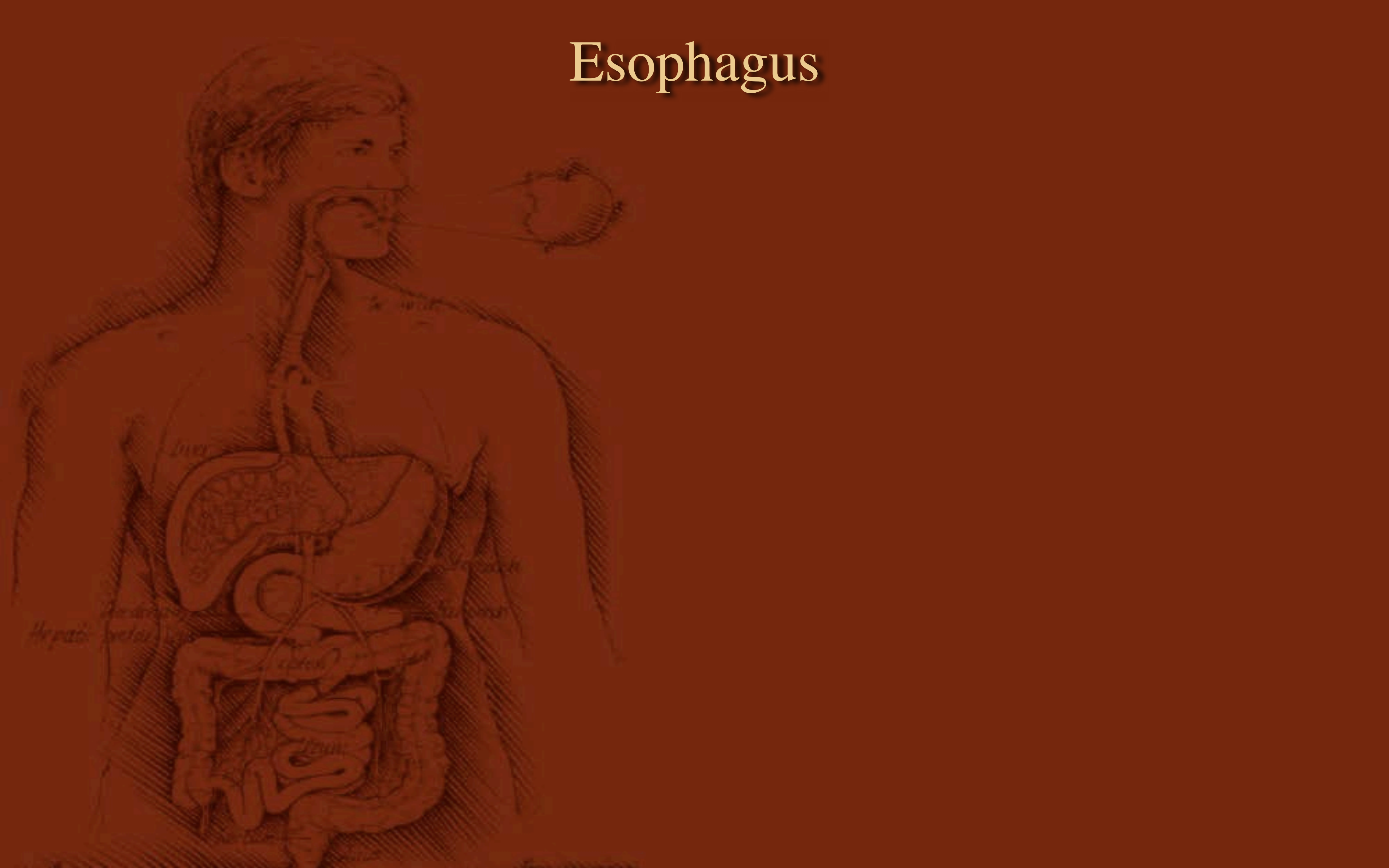
Herbivores

- Small opening into “**walled-in**” oral cavity



- Able to create a **vacuum** and **suck** liquids

Esophagus



Esophagus

Carnivore

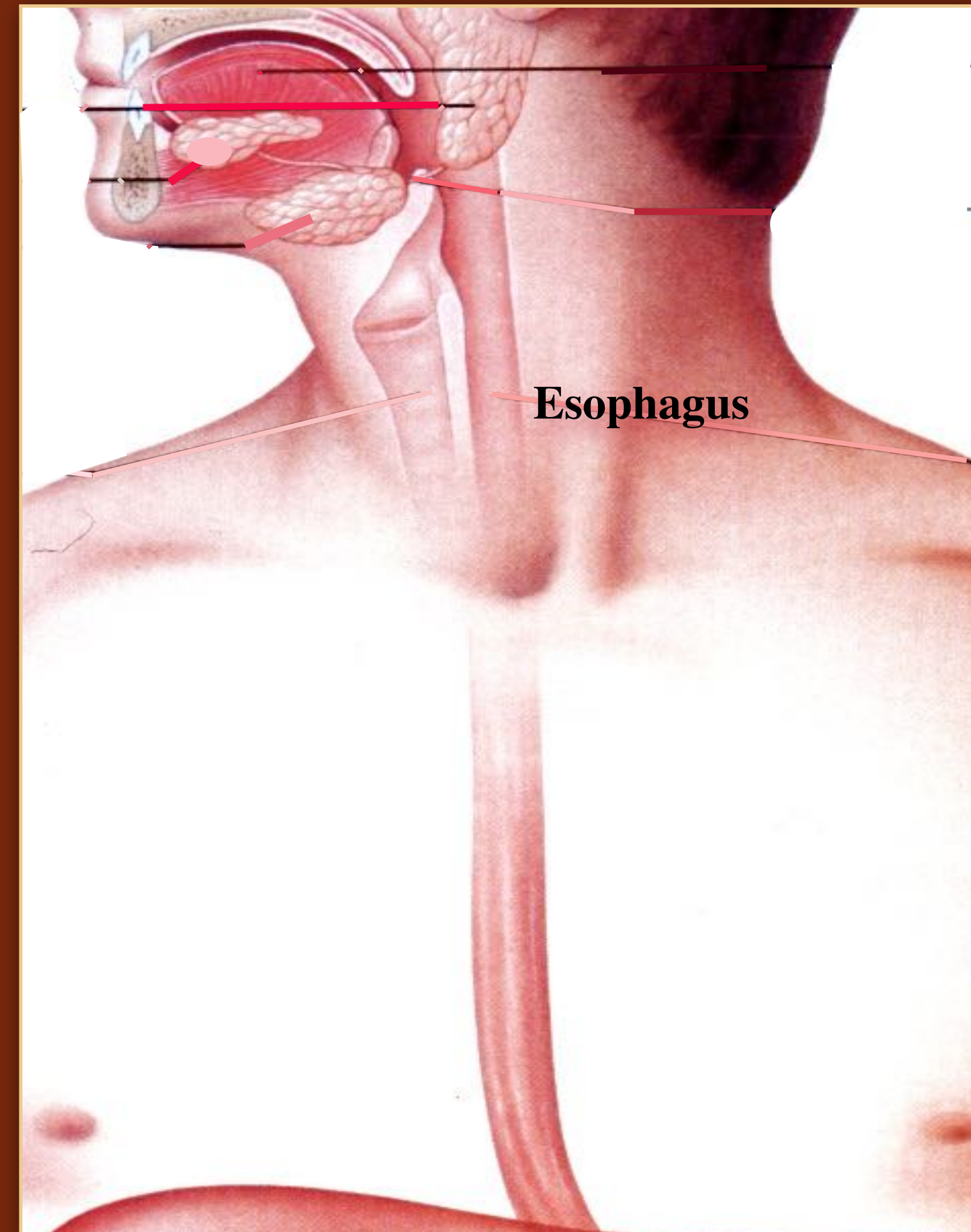
- **Wide** and distensible
- Swallow **chunks** and **bones** *without* **choking** or **lacerations**
- **Voluntary muscle** along entire length

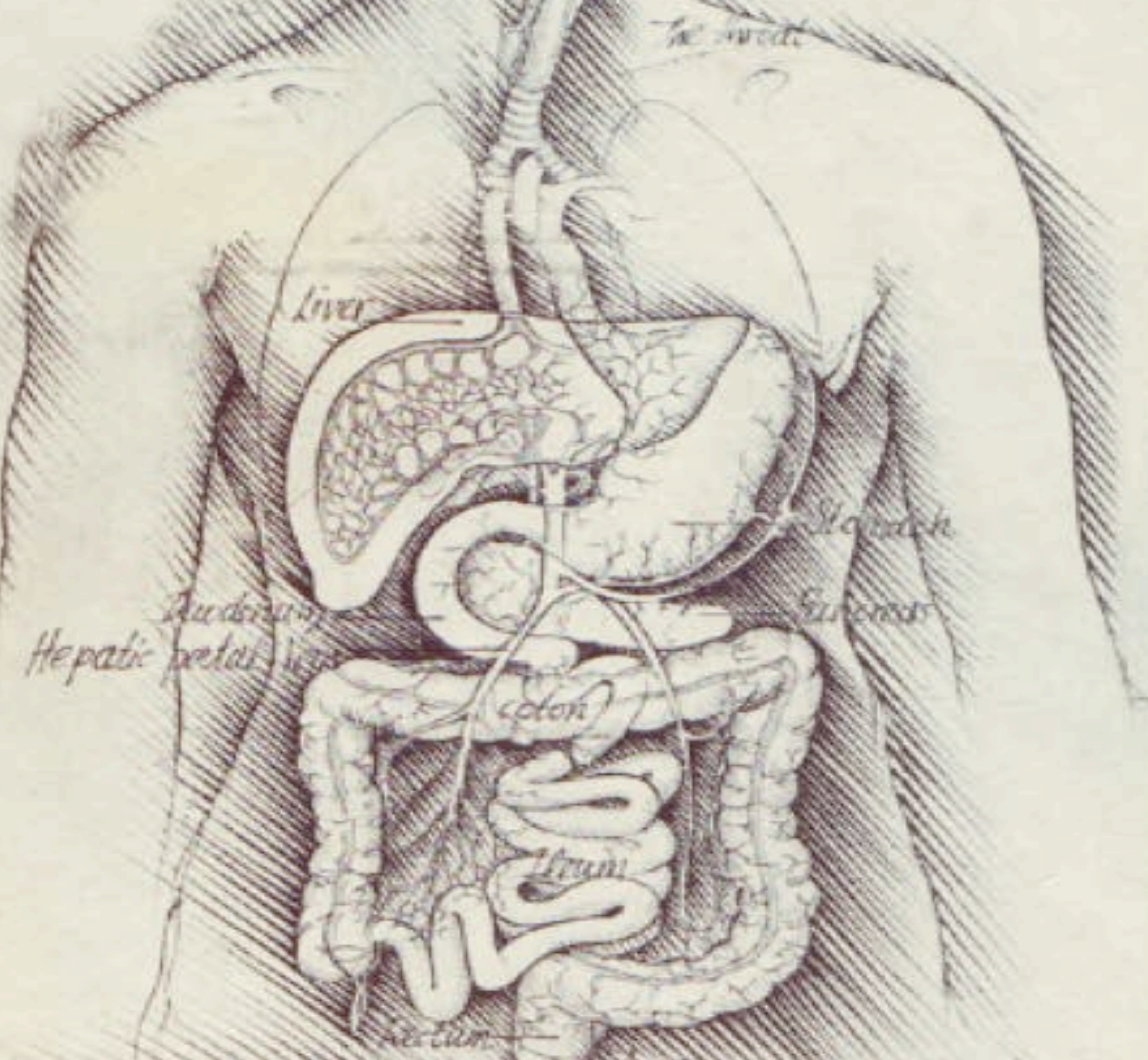
Herbivore

- **Narrow** and muscular
- Must swallow **small bolus** of soft chewed food

Humans

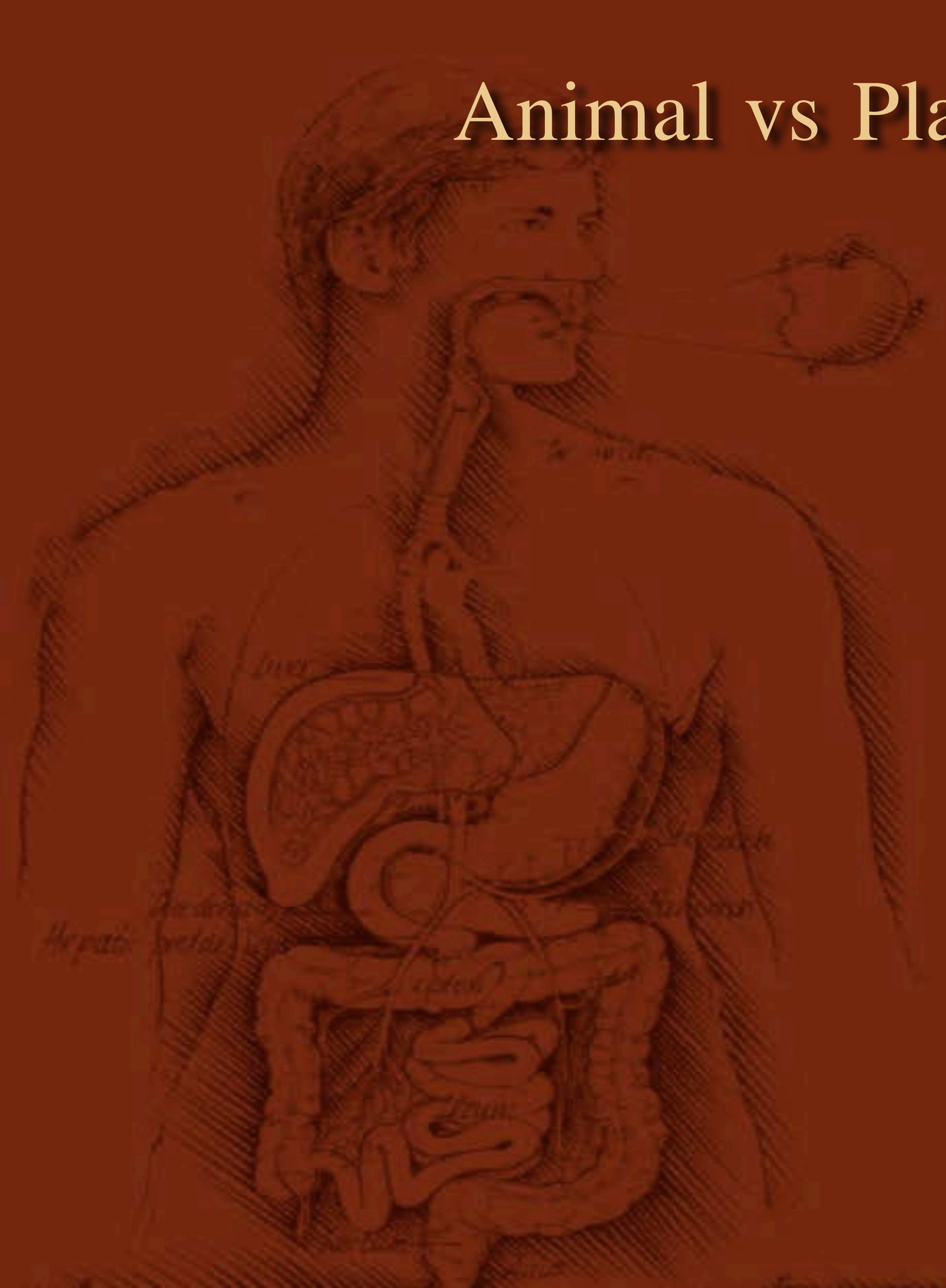
- **Narrow** and muscular
- Must swallow **small bolus** of soft chewed food
- > **90%** of people who choke to death **choke on meat**





UPPER GASTRO- INTESTINAL TRACT

Animal vs Plant Food Digestion



Animal vs Plant Food Digestion

Animal tissues:

- Very **quickly** and **easily** digested
- Mainly **proteins** and **fat**
- **No cell wall**
- **NO FIBER**
- Therefore, meat eaters **do not** require a long, elaborate GI tract

Cell
Membrane

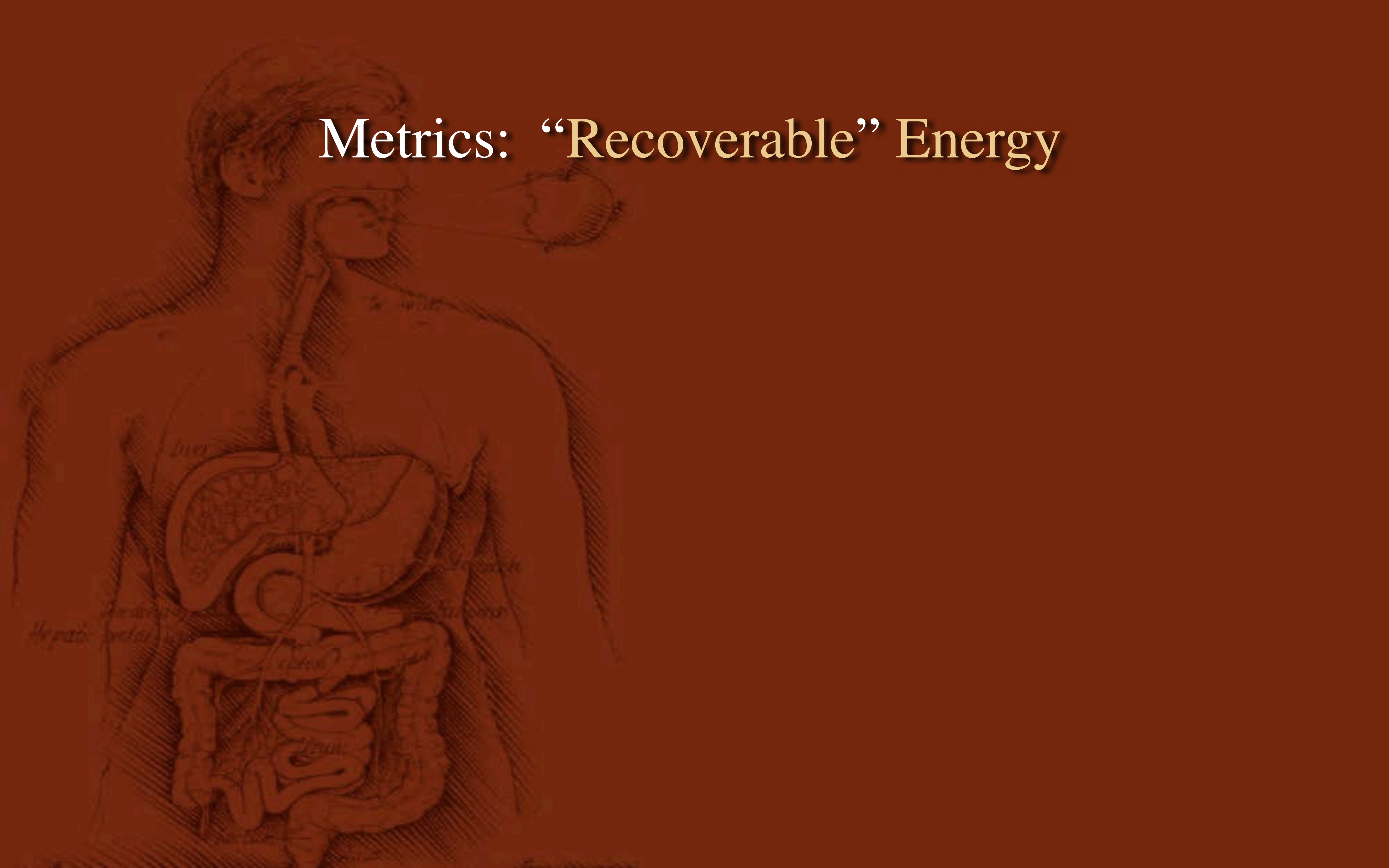


Animal cell

Carnivore Stomach

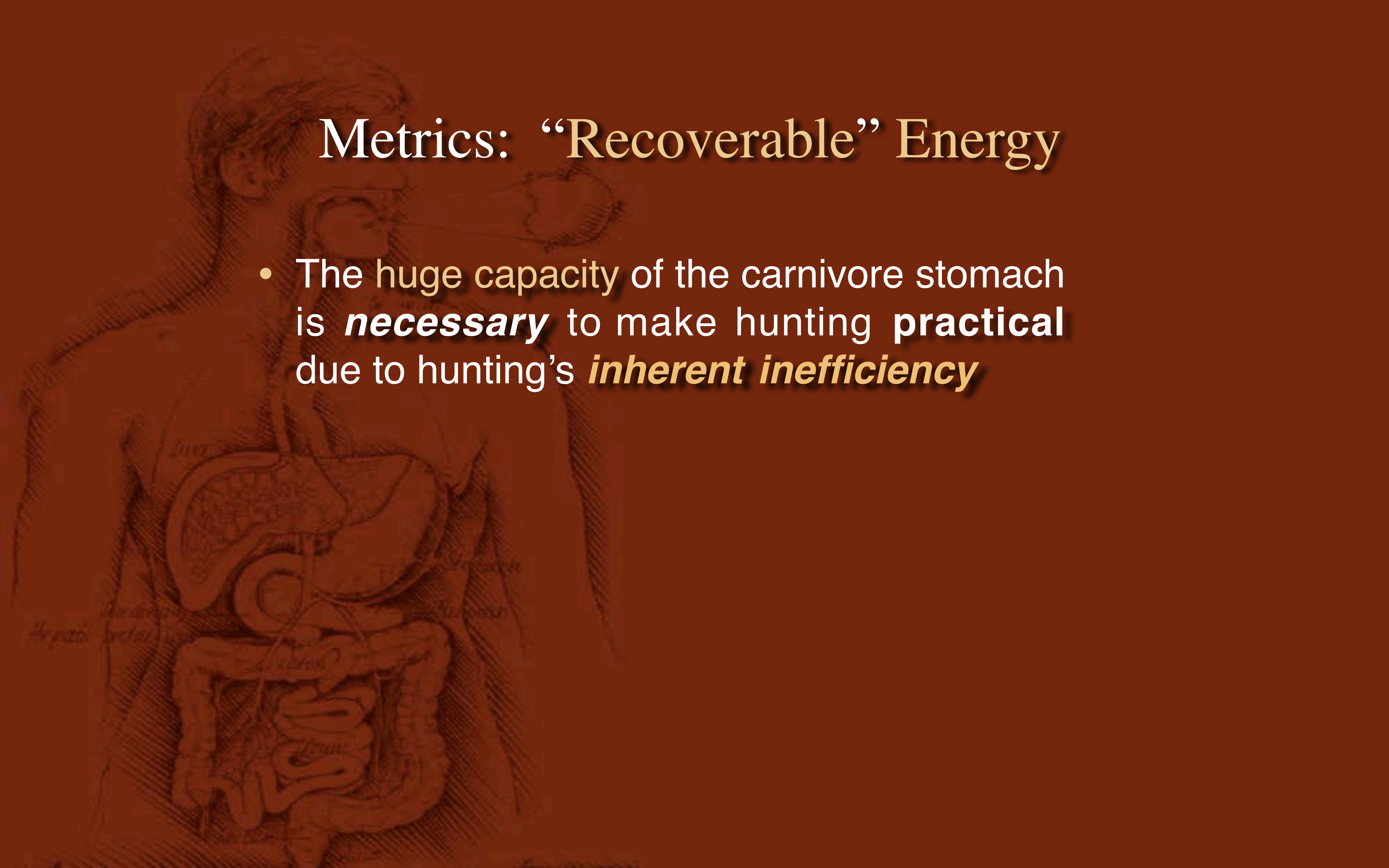
- Extremely acidic with food: $\text{pH} \leq 1$
- **Powerful acid** dissolves bones, hooves and tough connective tissue
- **Extremely LARGE!**
- Holds 60 - 70% of total gut capacity
- Enables animal to consume $\approx$ **20 - 30% of body weight** at one meal
- Designed for intermittent feeding
- Can digest **carrion** and **neutralize & destroy** potentially **lethal pathogens**

Metrics: “Recoverable” Energy



Metrics: “Recoverable” Energy

- The huge capacity of the carnivore stomach is *necessary* to make hunting **practical** due to hunting’s *inherent inefficiency*



Metrics: “Recoverable” Energy

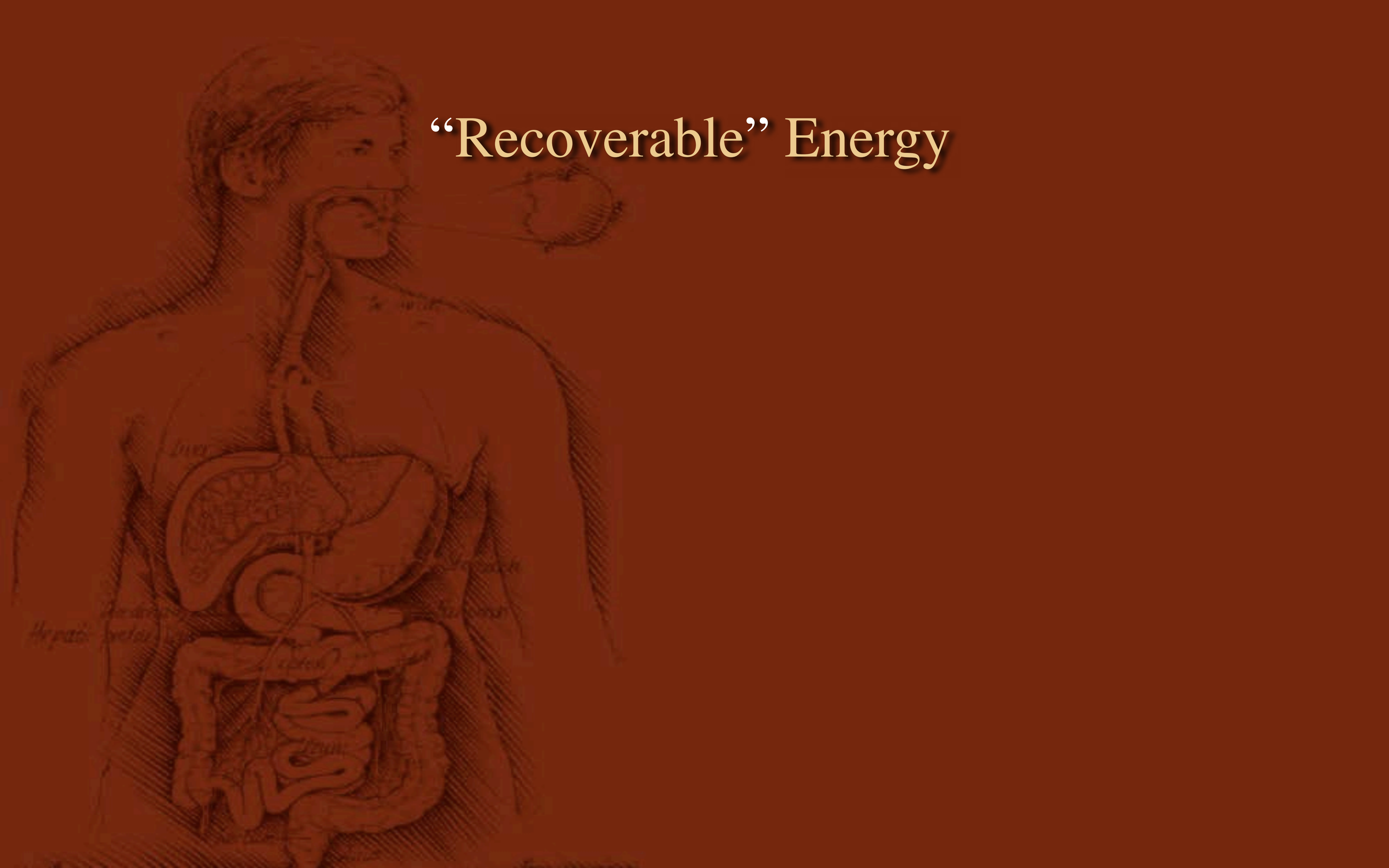
- The huge capacity of the carnivore stomach is *necessary* to make hunting practical due to hunting’s *inherent inefficiency*
- A stomach that can hold 20-30% of an animal’s body weight means that *at a single meal* a 50kg (110 lb) wolf can consume up to 15kg (34 lbs!) of meat which @ 1.41 cal/g =

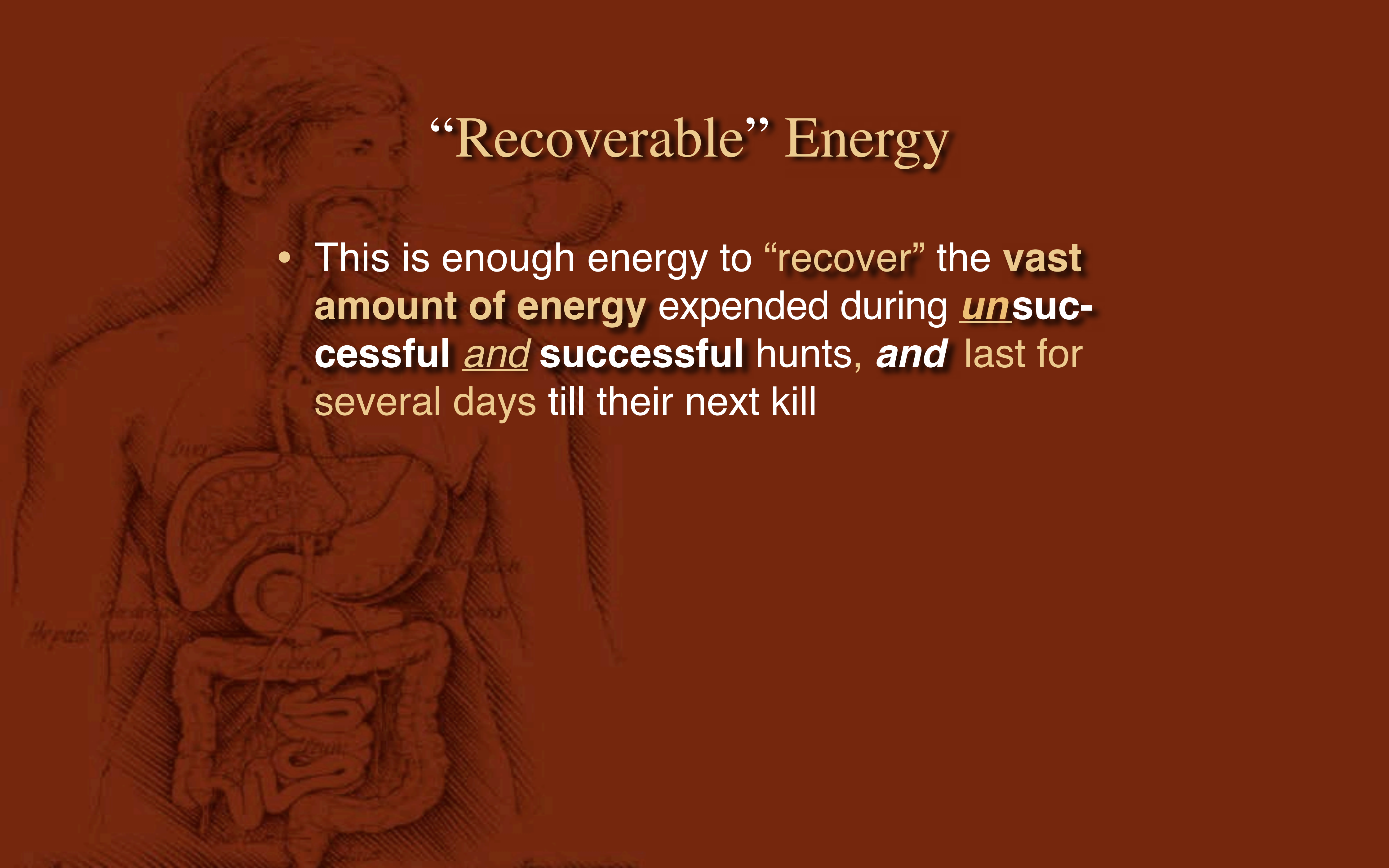
Metrics: “Recoverable” Energy

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21,500 calories!

“Recoverable” Energy





“Recoverable” Energy

- This is enough energy to “recover” the **vast amount of energy** expended during **unsuccessful and successful** hunts, ***and*** last for several days till their next kill

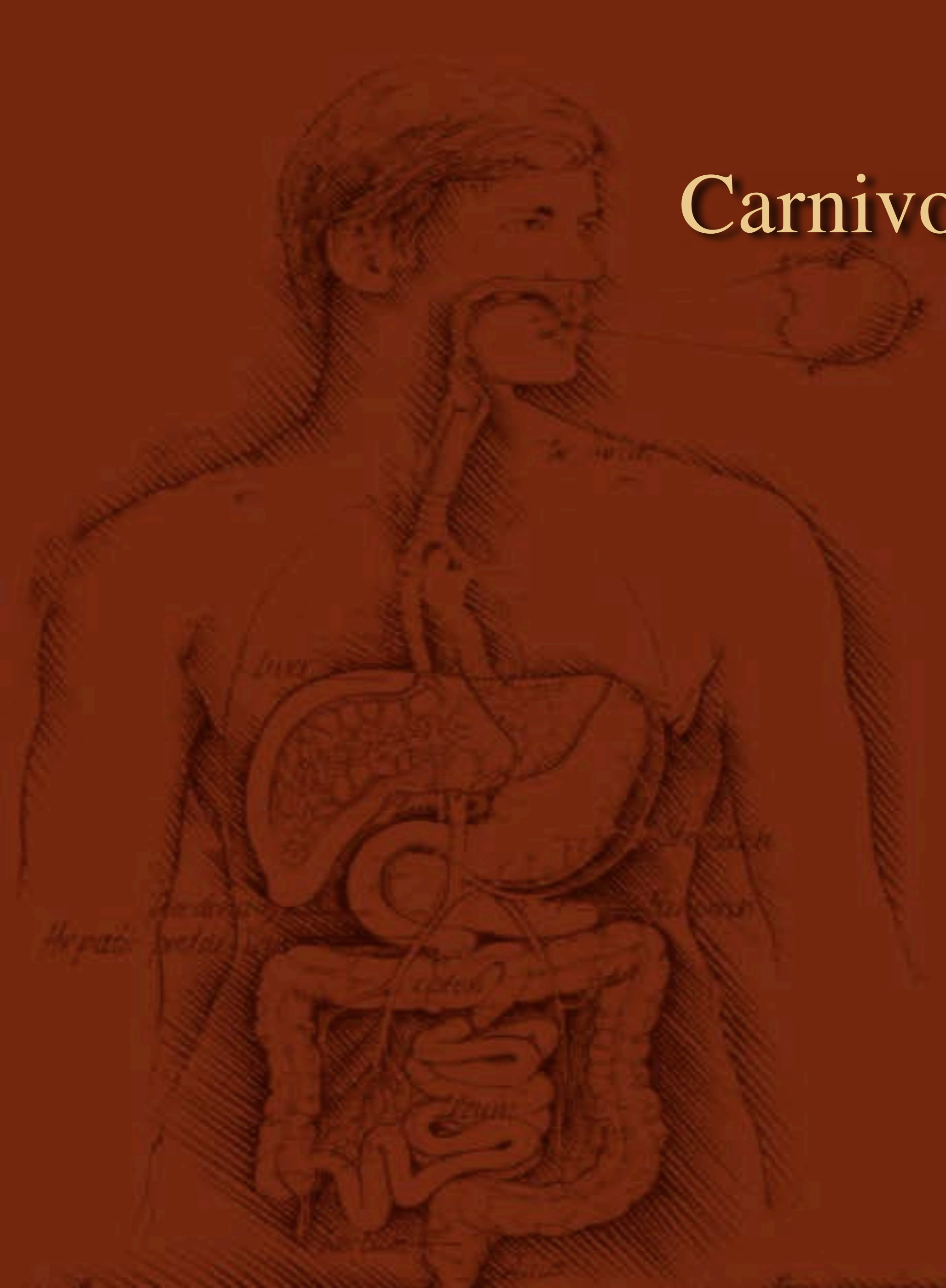
“Recoverable” Energy

- This is enough energy to “recover” the **vast amount of energy** expended during **unsuccessful and successful** hunts, **and** last for several days till their next kill
- Moreover, because of their ability to eat “**carrion**” (*putrefying, bacteria/toxin-laden flesh*), carnivores **can recover additional energy** from a **single** successful hunt over the course of several days **if** they can fend off other predators off their cached prey

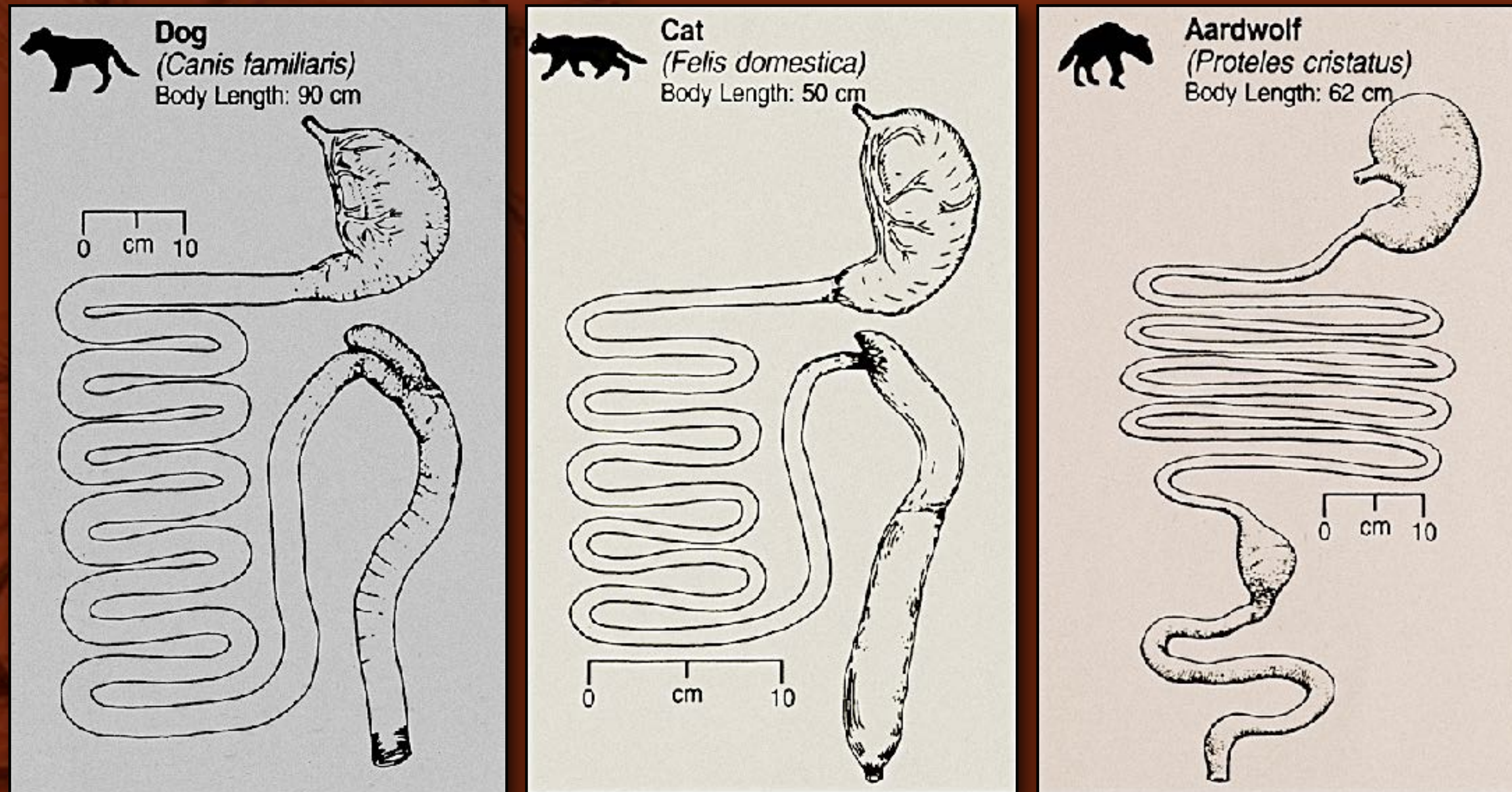
Carnivore Small Intestine

- Very **short**, usually only $\approx 3 - 4$ times body length
- **Protein** and **fat** digesting enzymes predominate
- Able to go for **long periods** *between meals* **without** mucosa **involuting** and becoming **non-absorptive**
- Poor capacity to digest and absorb a **moderate to large** carbohydrate load/meal

Carnivore GI Tract

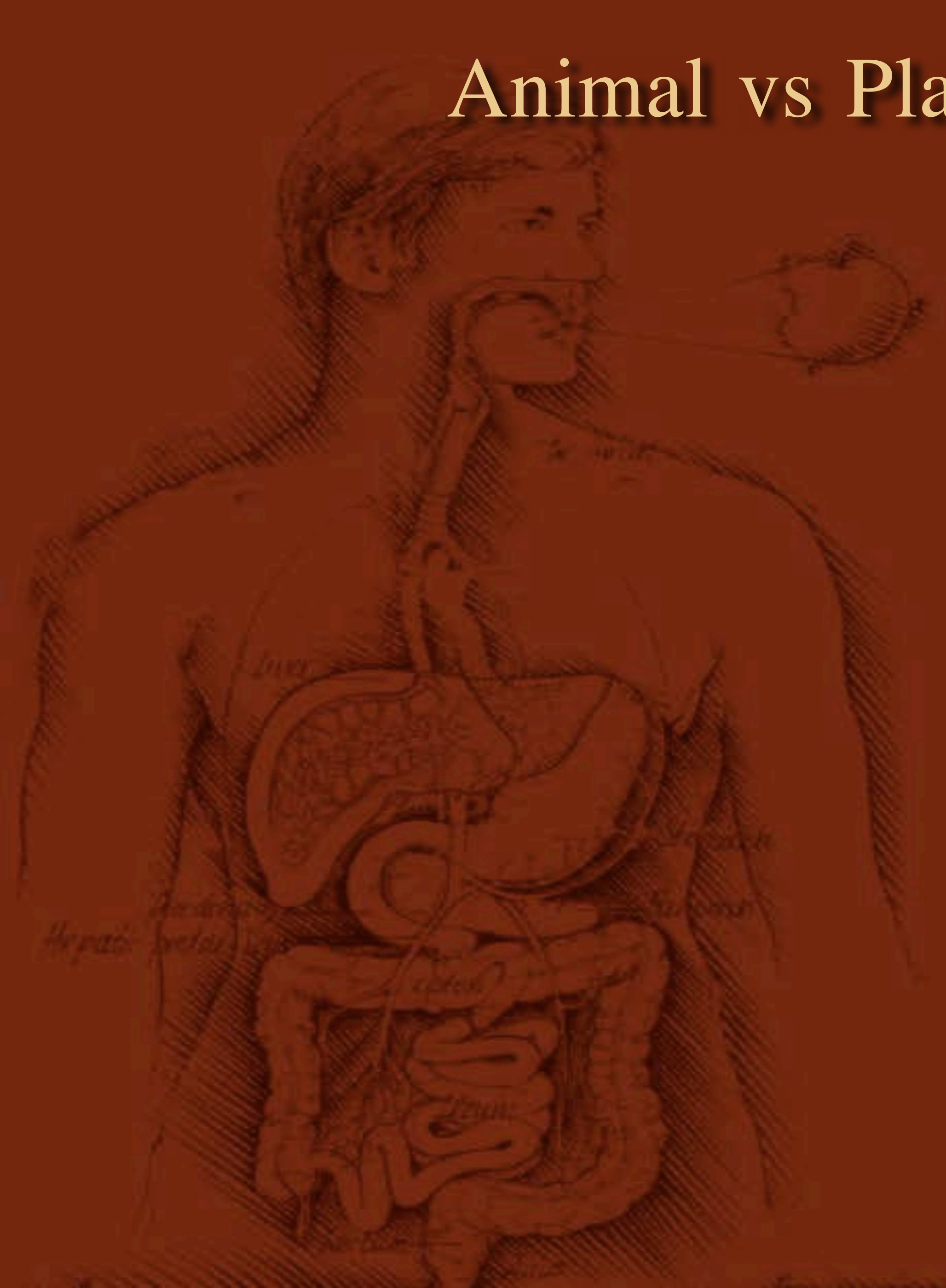


Carnivore GI Tract



Carnivore's have **simple, short** “**uncomplicated**” GI tracts

Animal vs Plant Food Digestion



Animal vs Plant Food Digestion

*Plants have no bones, therefore, they use **insoluble fibers** to stiffen and protect their tissues*

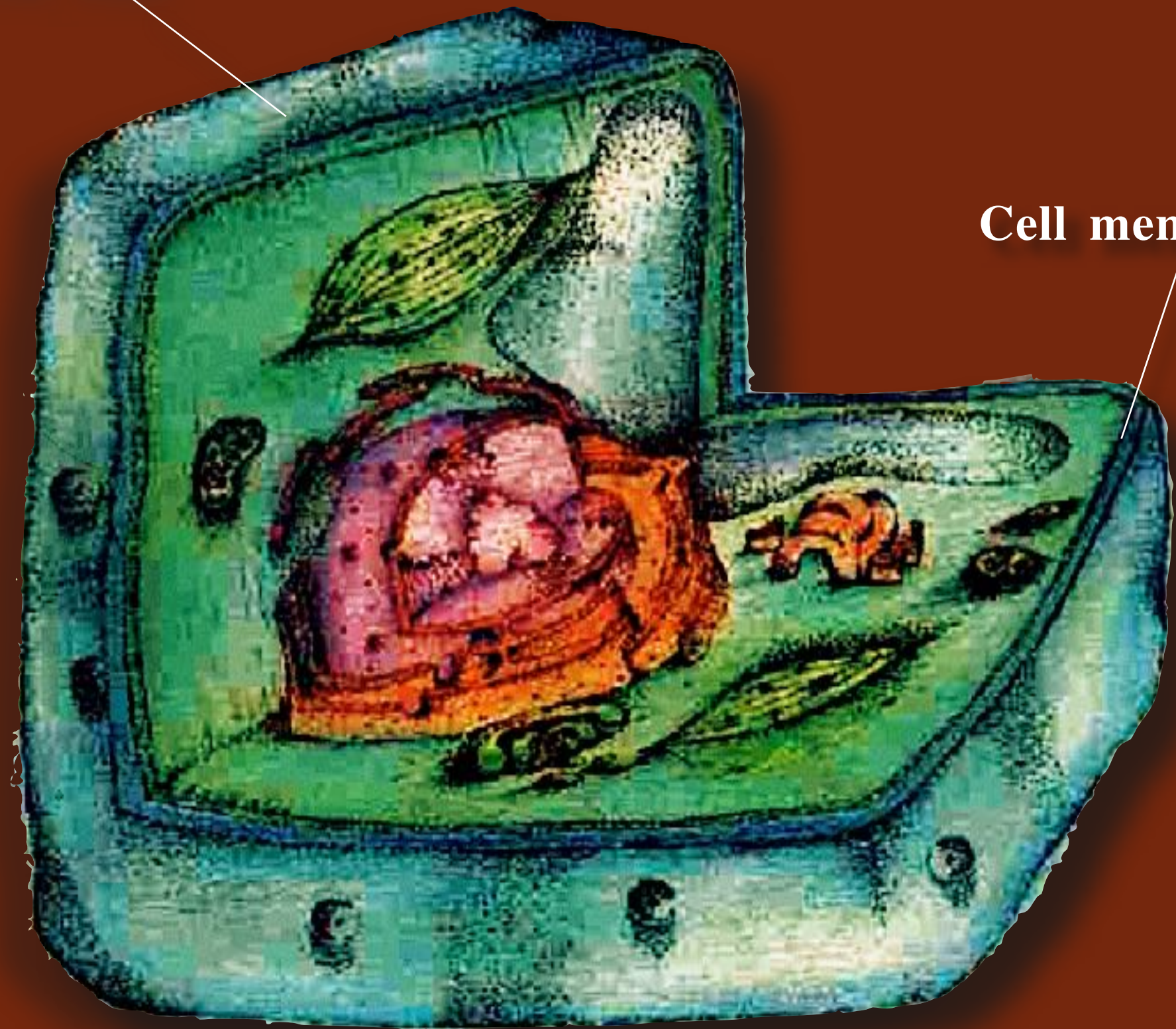
Animal vs Plant Food Digestion

Plant tissues:

- Composed of **protein, fat, carbohydrates** and ***fibrous cell wall***
- Require ***prolonged* digestion** due to presence of **cellulose**
- Therefore, herbivores ***do*** need **much longer** and **more elaborate** GI tracts

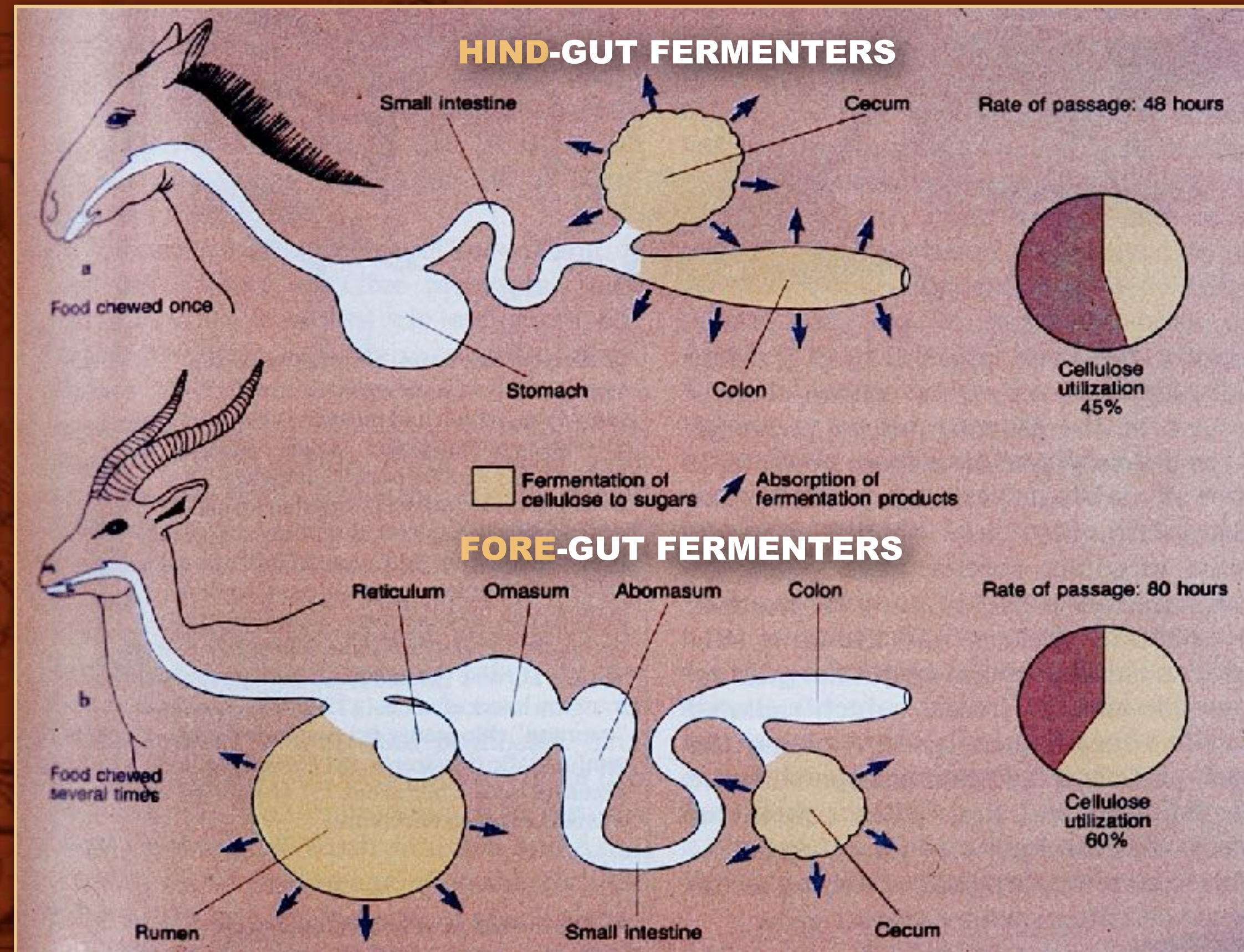
Cell wall

Cell membrane

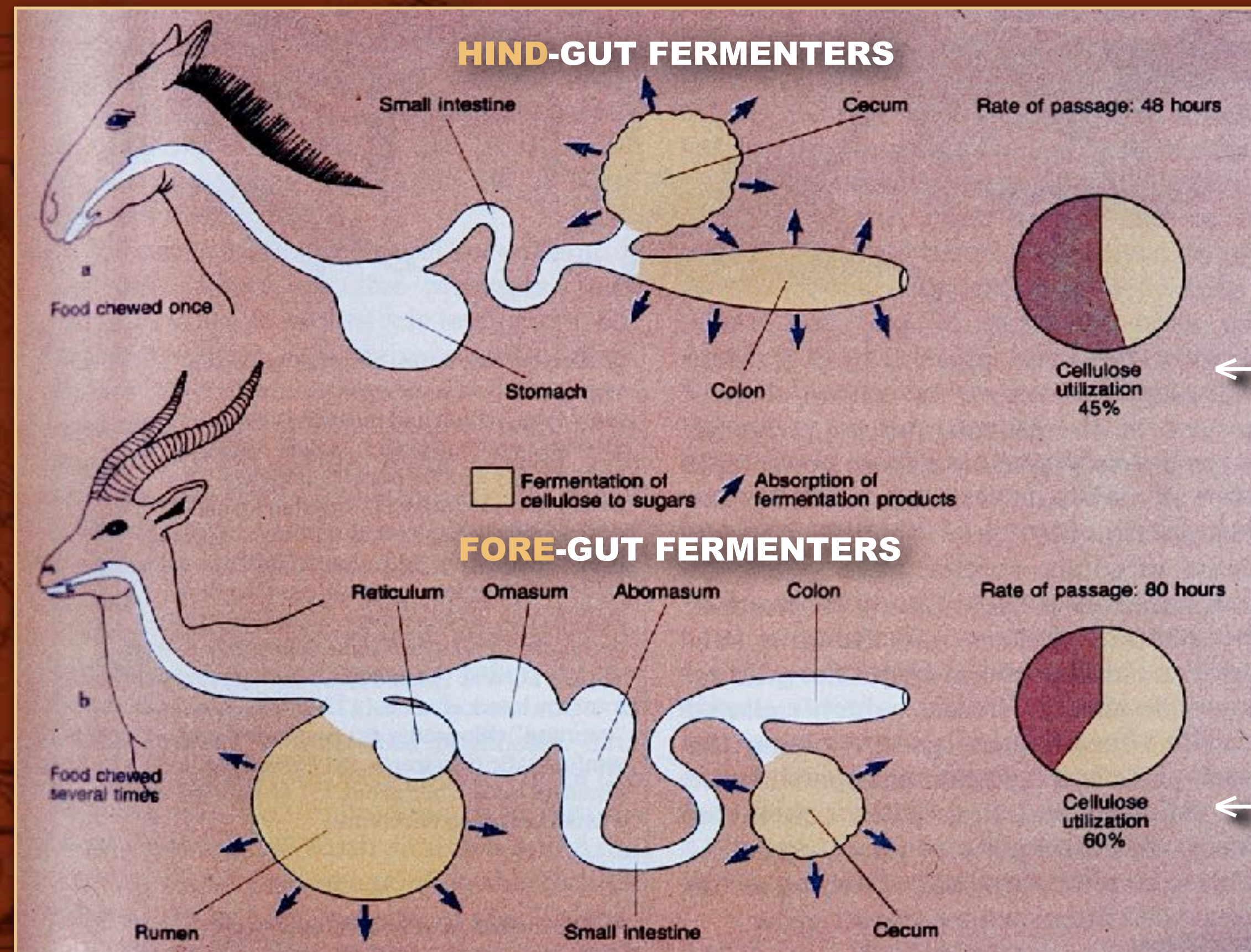


Plant cell

Two Ways of Fermenting Fiber



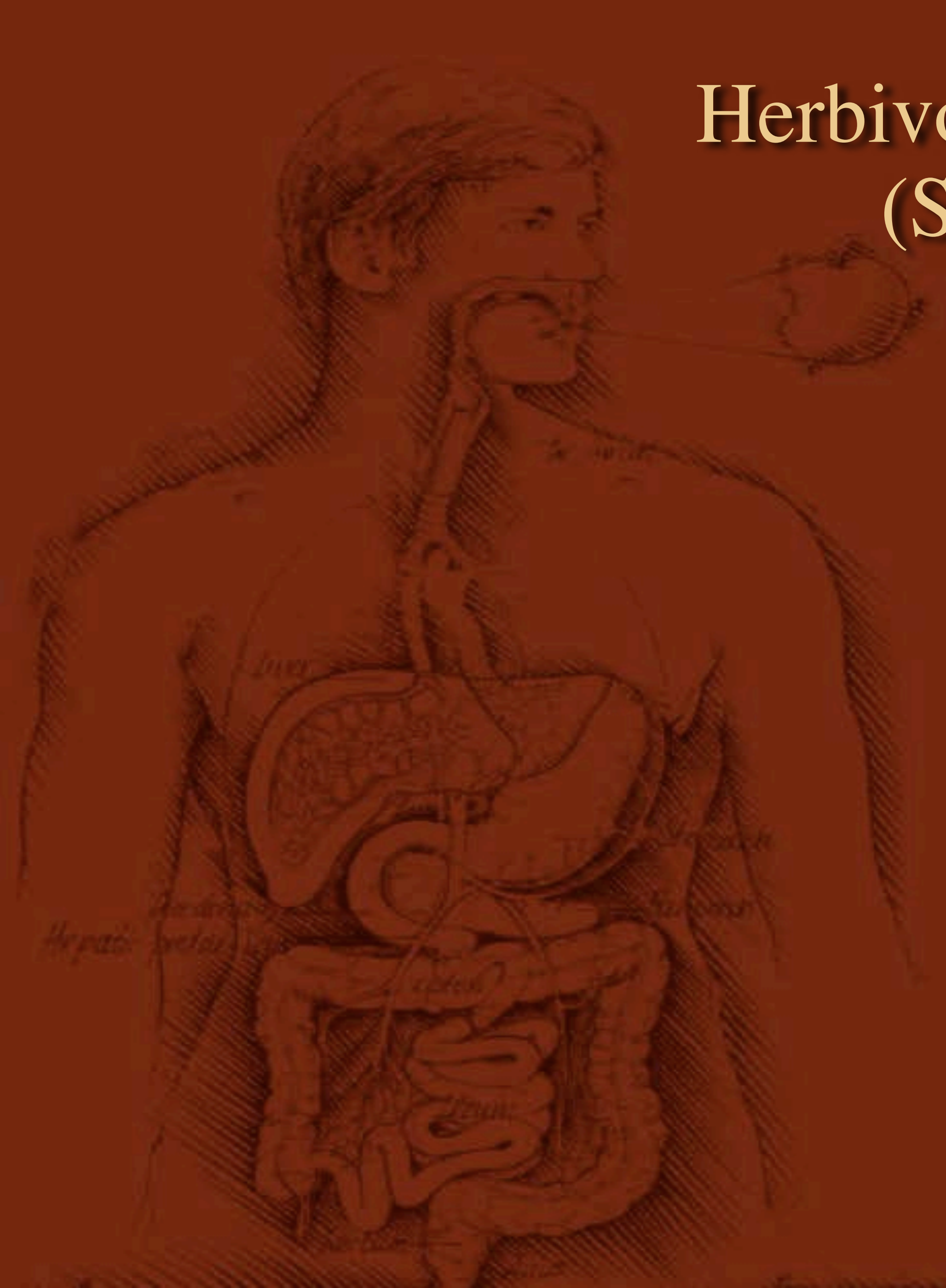
Two Ways of Fermenting Fiber



**Percent
Cellulose
Utilization**

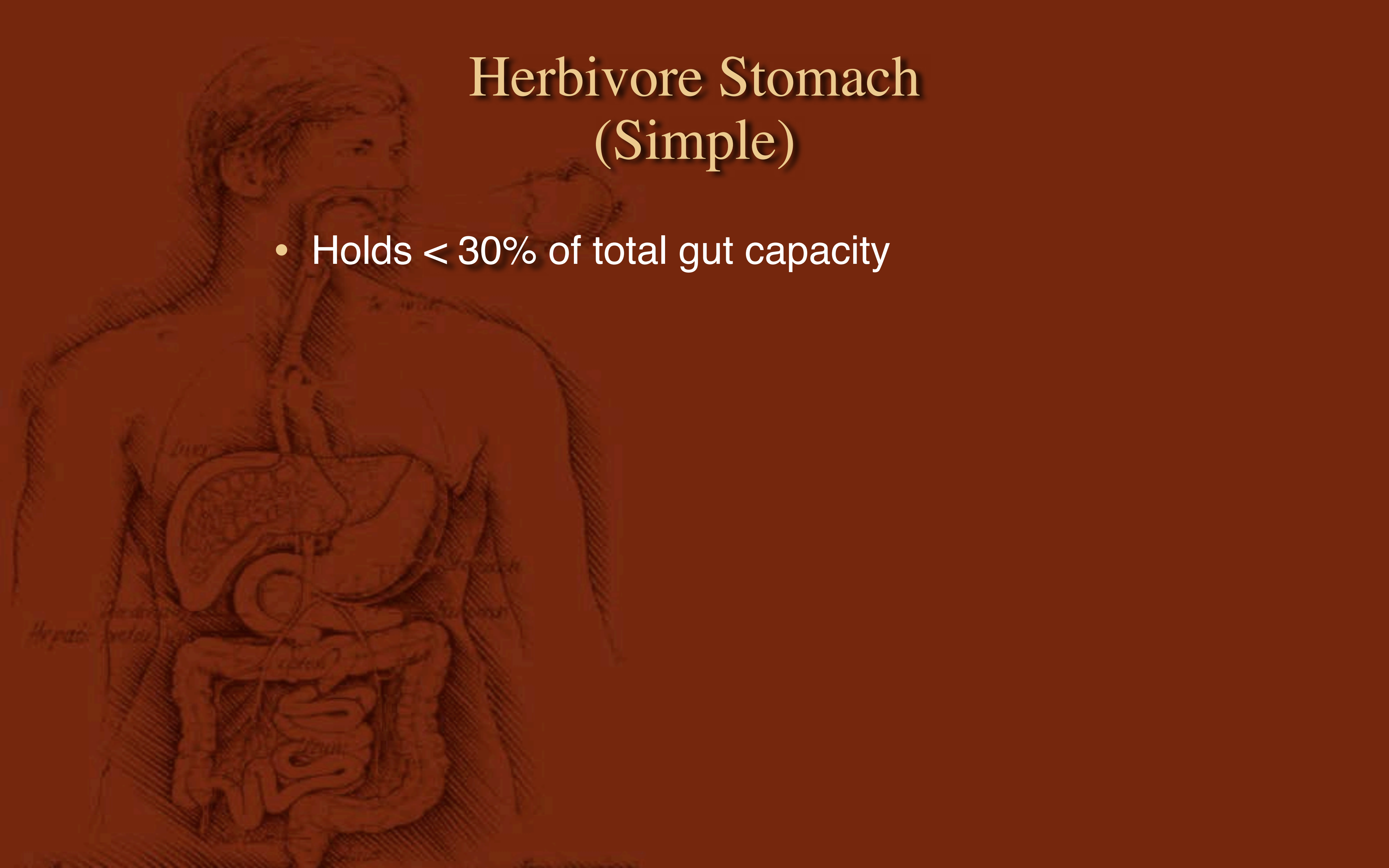
Not *all* herbivores have—or *need*—multiple stomachs!

Herbivore Stomach (Simple)



Herbivore Stomach (Simple)

- Holds < 30% of total gut capacity



Herbivore Stomach (Simple)

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- Herbivores eat on average 3.33% of body wt/day*

***For a 5 ton Elephant that works out to 330lbs of food per day**

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Herbivore Stomach (Simple)

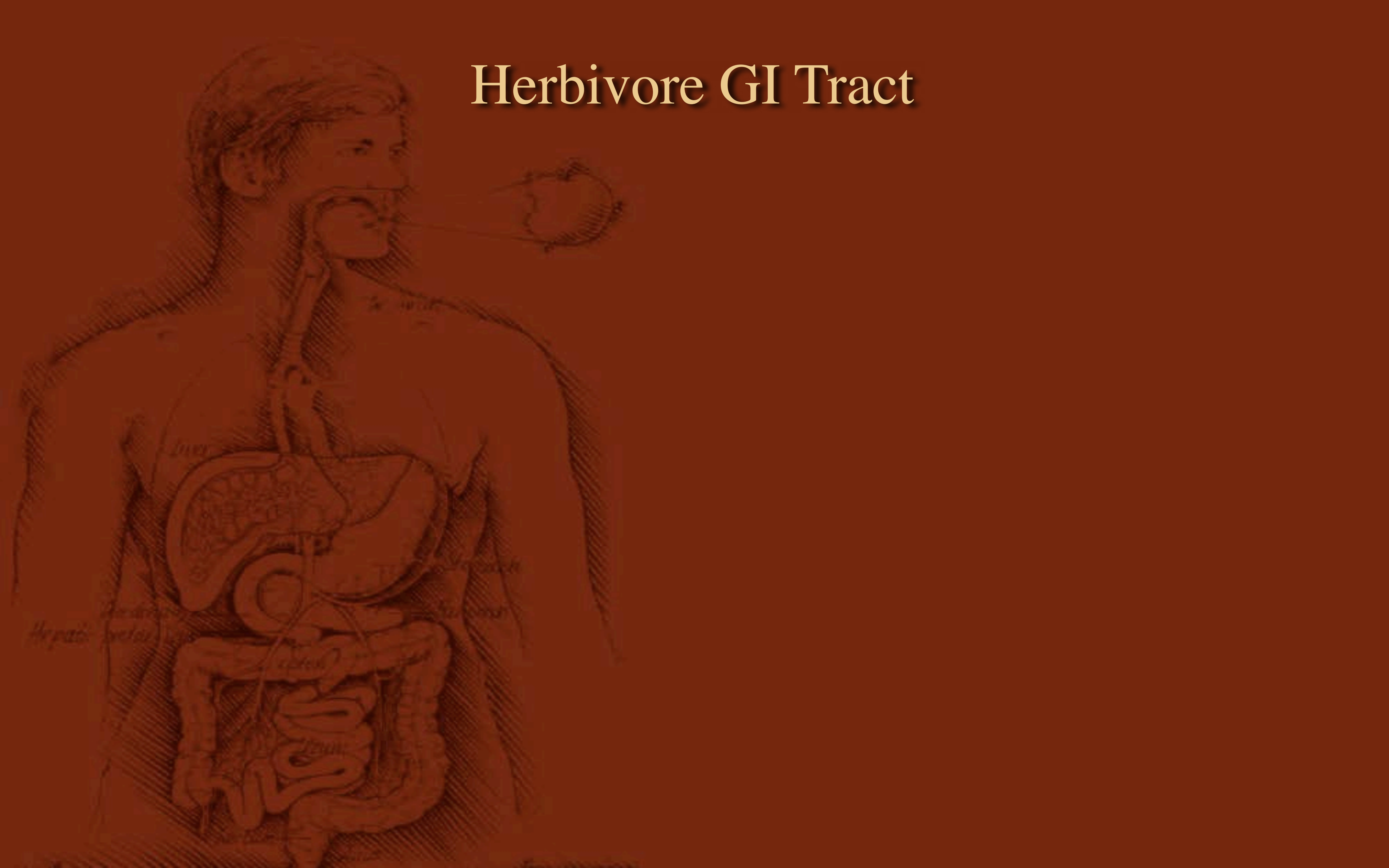
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- Mild to moderate acidity: pH = 4-5 with food
- Designed for ***batch feeding***
- **Cannot** hold enough calories to last ***even ONE day***
- Therefore, herbivores ***must eat several times EVERY day*** to meet caloric needs

*For a 5 ton Elephant that works out to 330lbs of food per day

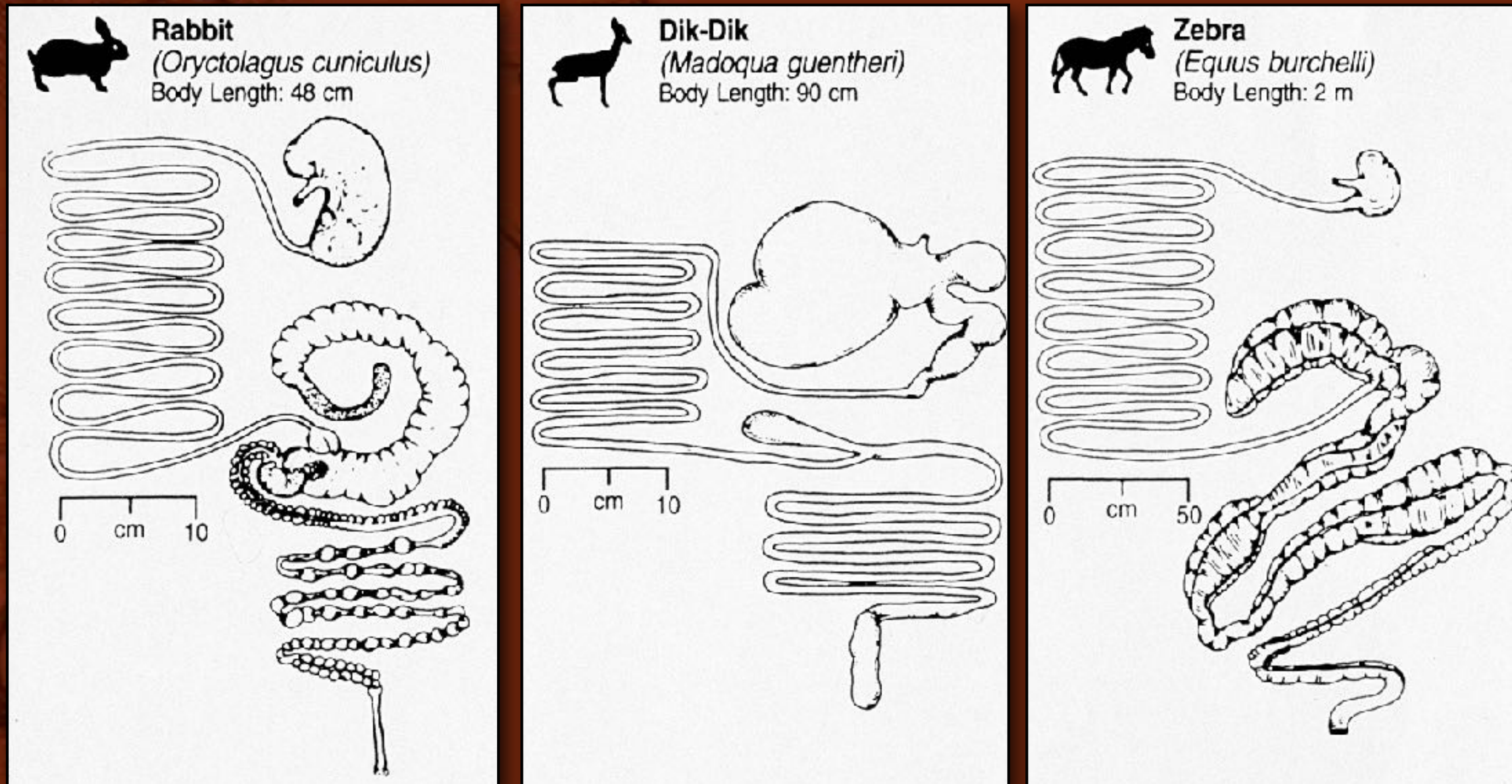
Herbivore Small Intestine

- **Extremely long: 10 – 12 times** body length or more
- Because fiber slows down digestion, the **extended length** allows **sufficient time** and **surface area** to extract absorbable nutrients from **fibrous** plant tissues
- Adjustable mix of carbohydrate, fat and protein digesting enzymes
- **Unlimited capacity** for carbohydrate digestion and absorption

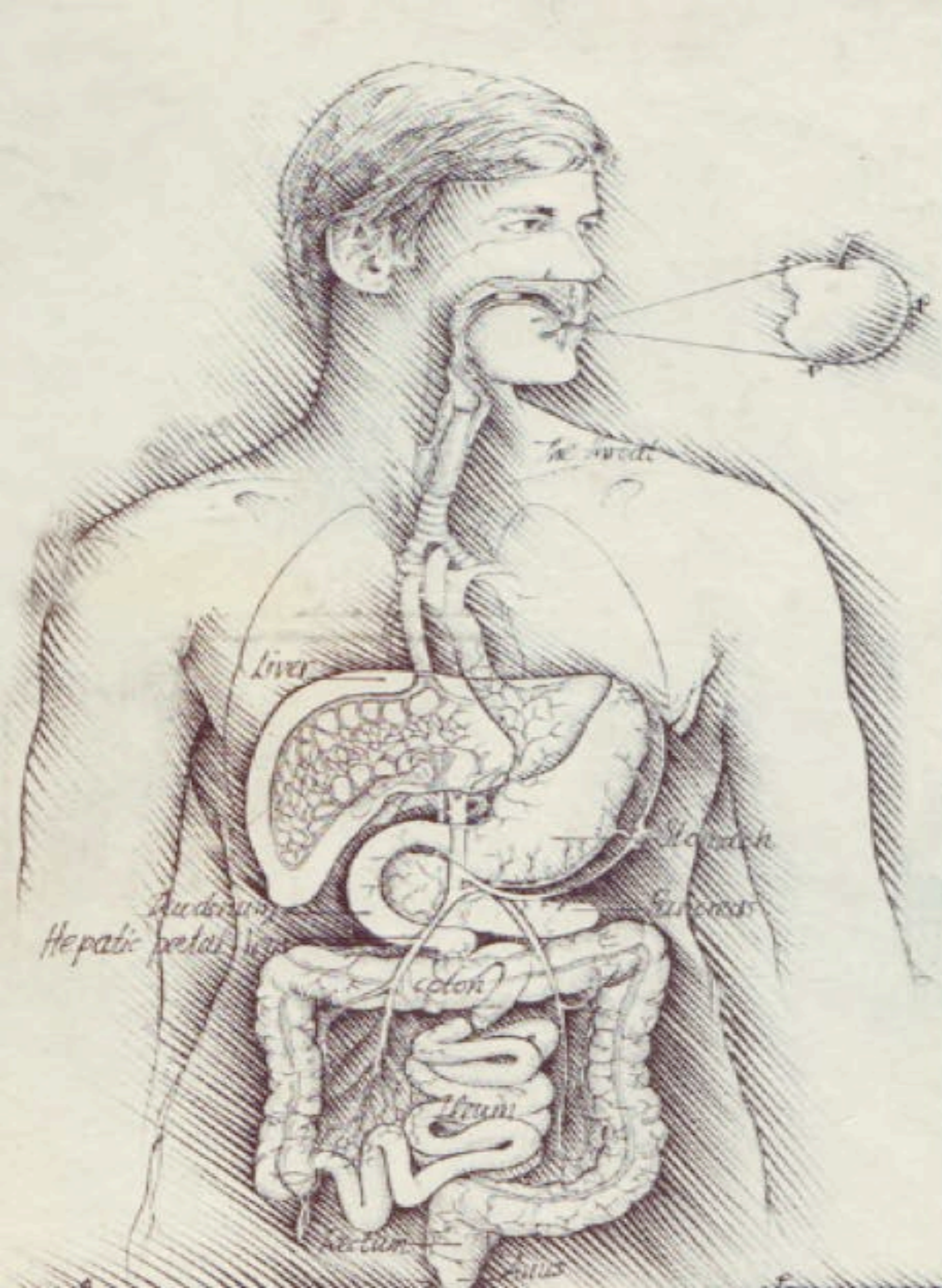
Herbivore GI Tract



Herbivore GI Tract

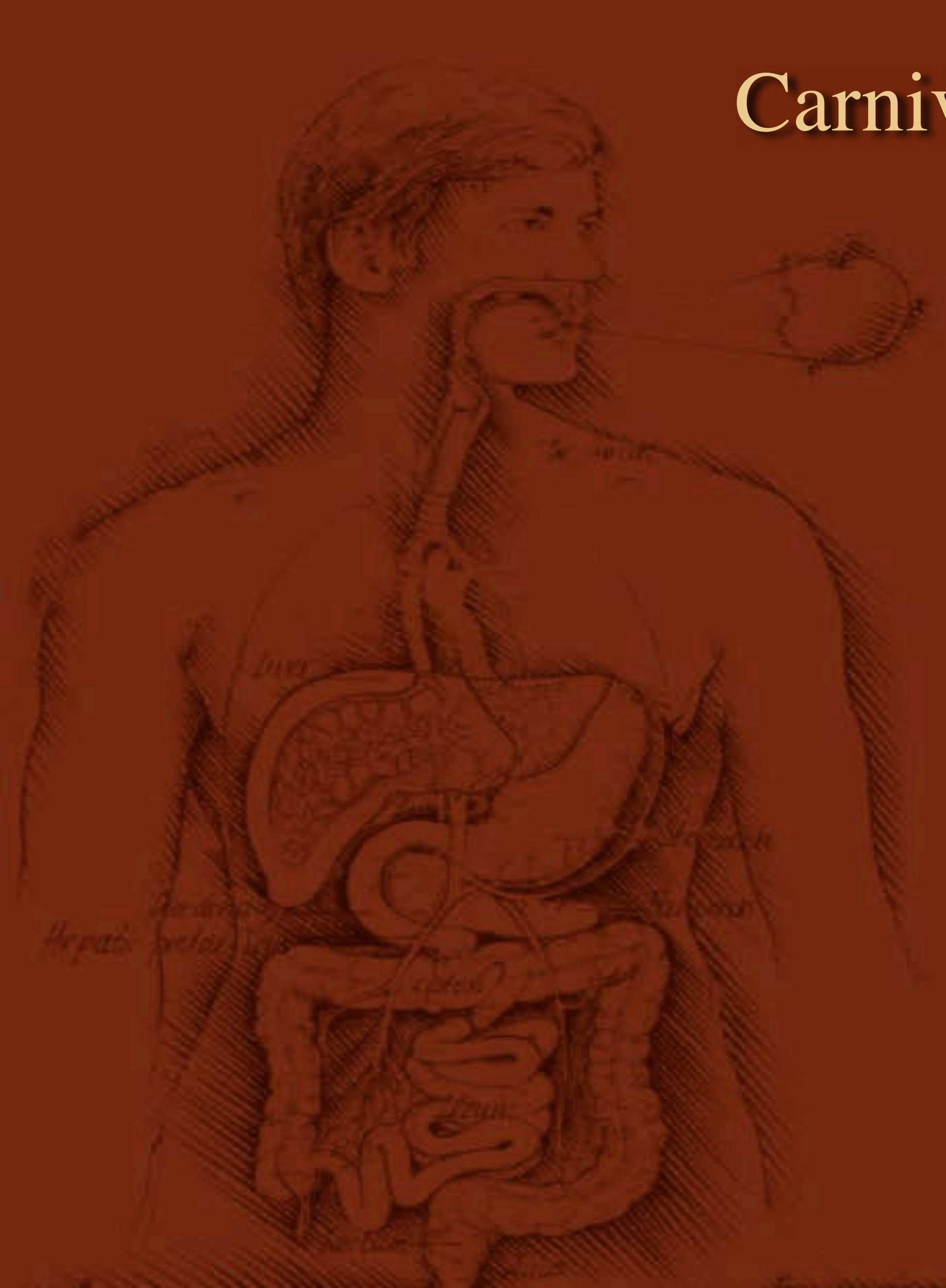


Herbivores have long, “elaborate” GI tracts designed to process fibrous plant foods



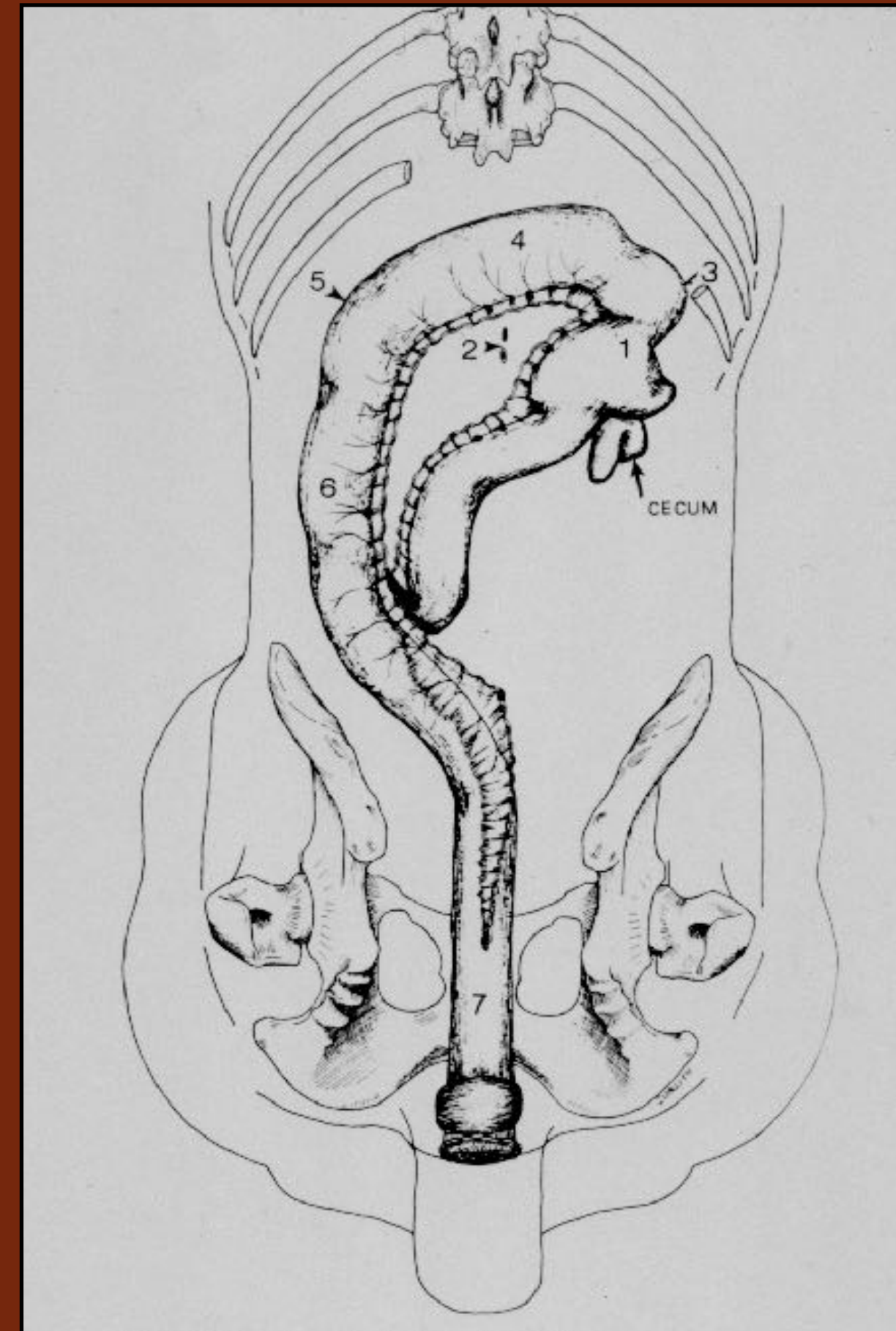
LOWER GASTRO- INTESTINAL TRACT

Carnivore Colon

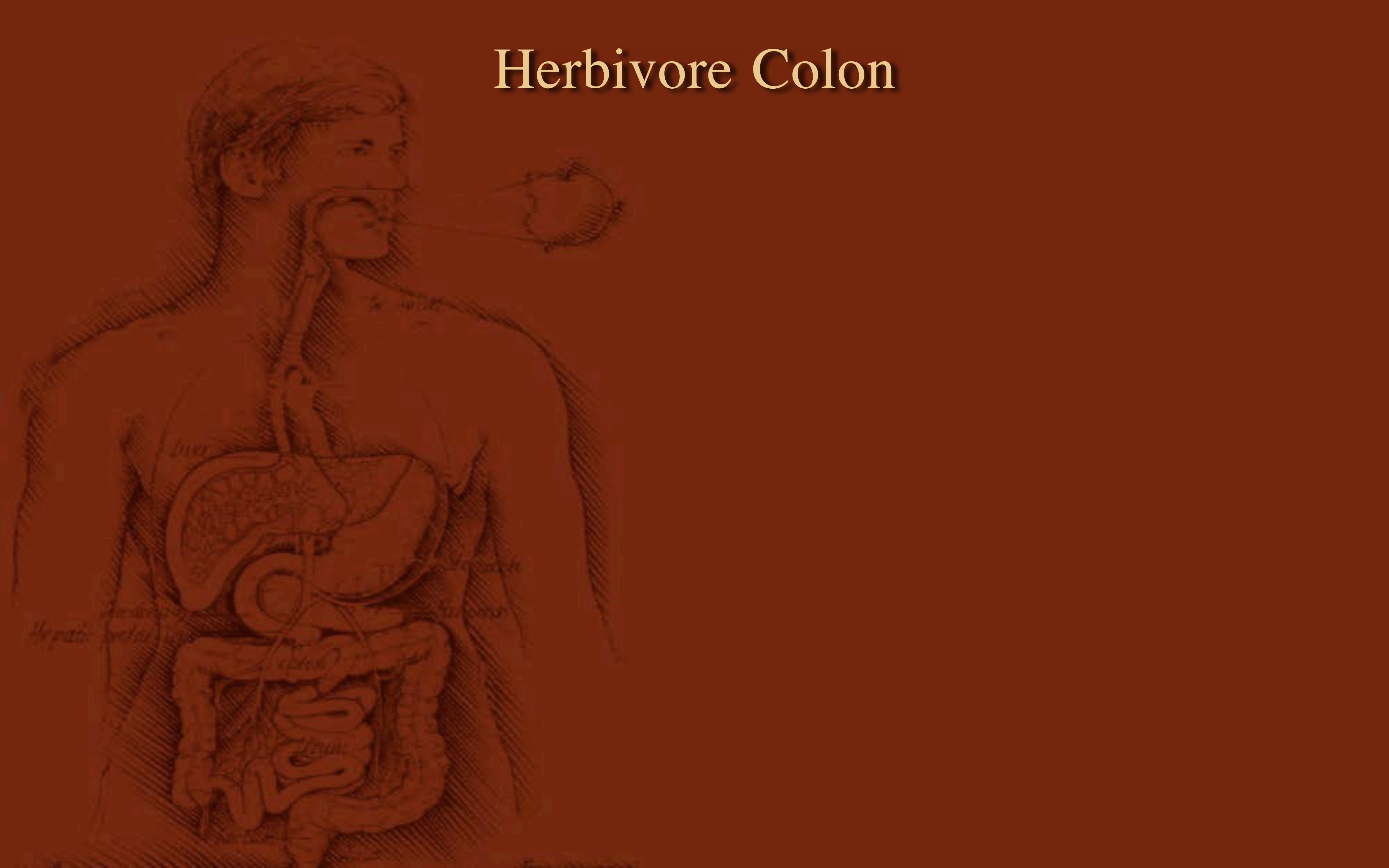


Carnivore Colon

- **Very short**
- Relatively “straight” and **non-pouched**
- Only function is **elimination**
- Lack of **fiber** means bacteria can only use **protein residues** as an **energy** substrate
- Therefore, meat residue will **putrefy releasing toxic metabolites** if **not rapidly** eliminated



Herbivore Colon



Herbivore Colon

- **Extremely long**; often has *pouched* **structure** with an “annular” **configuration**
- Functions:
 - Accessory fermentation of fiber
 - Water absorption
 - Vitamin production by bacteria
 - Enhancing immune function
 - Elimination

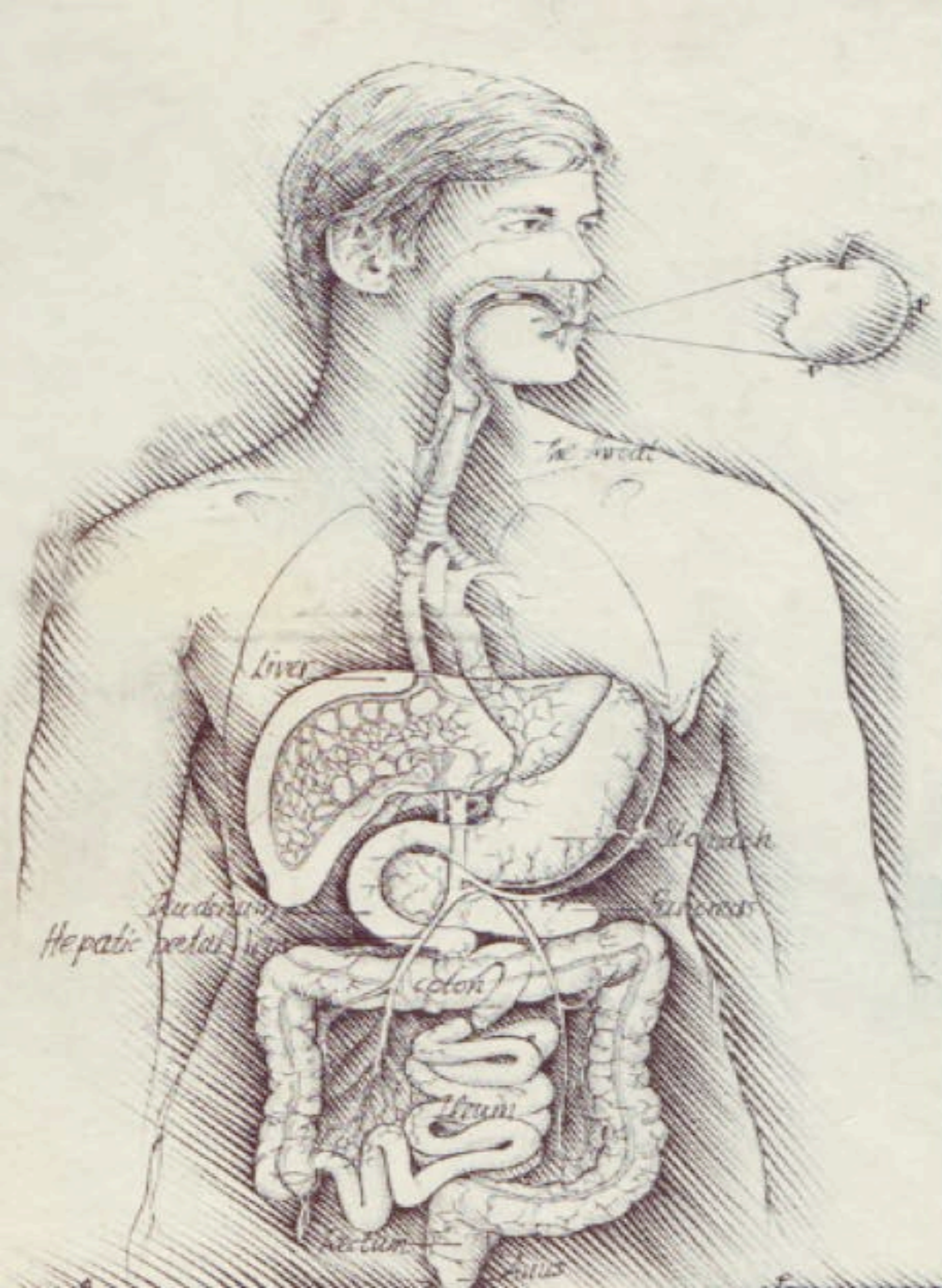


Horse



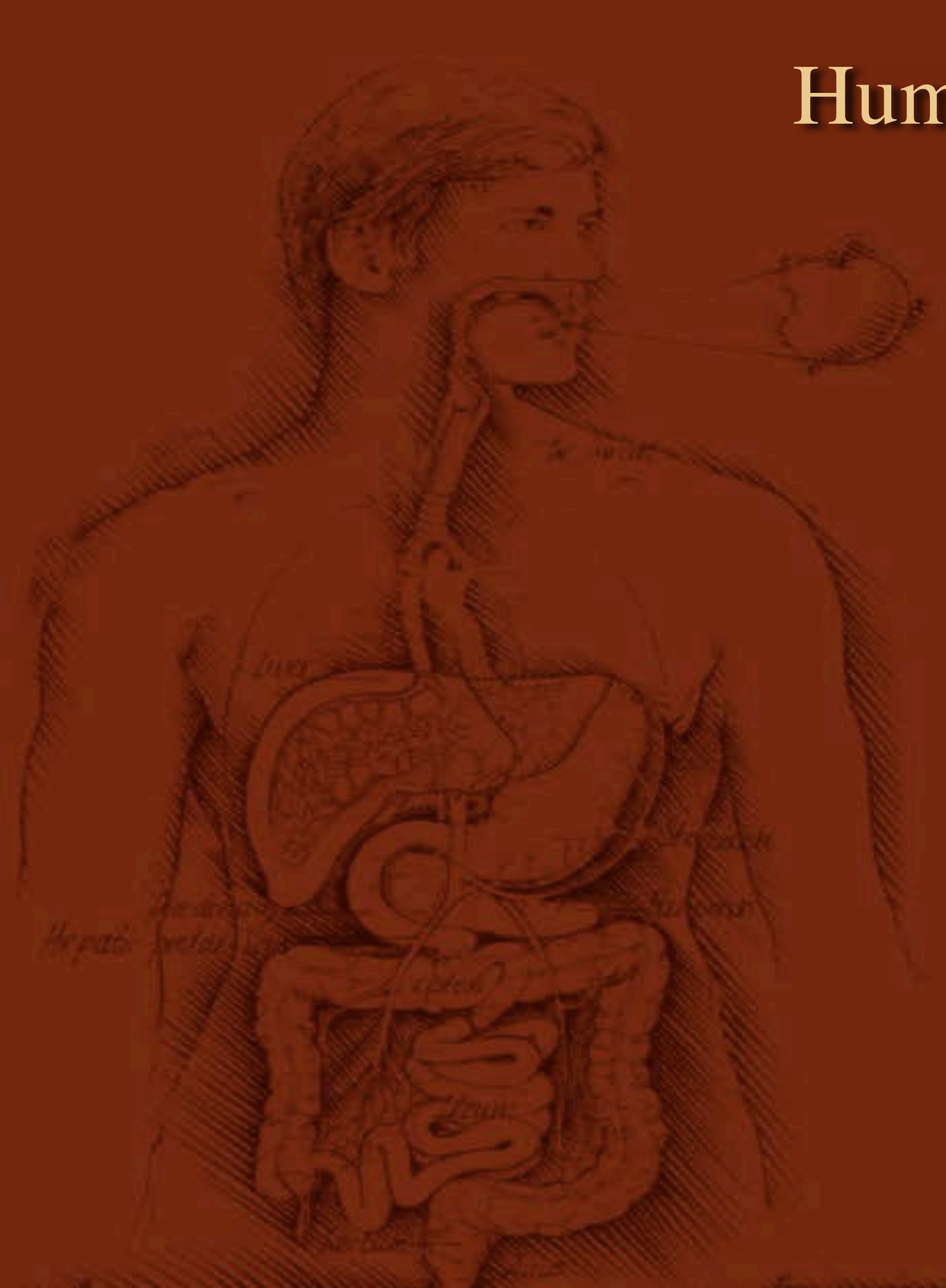
Rhesus Monkey

In Hind-gut Fermenters
Cellulose utilization $\approx 45\%$
(= Semi-solid “*fibrous*” stool)



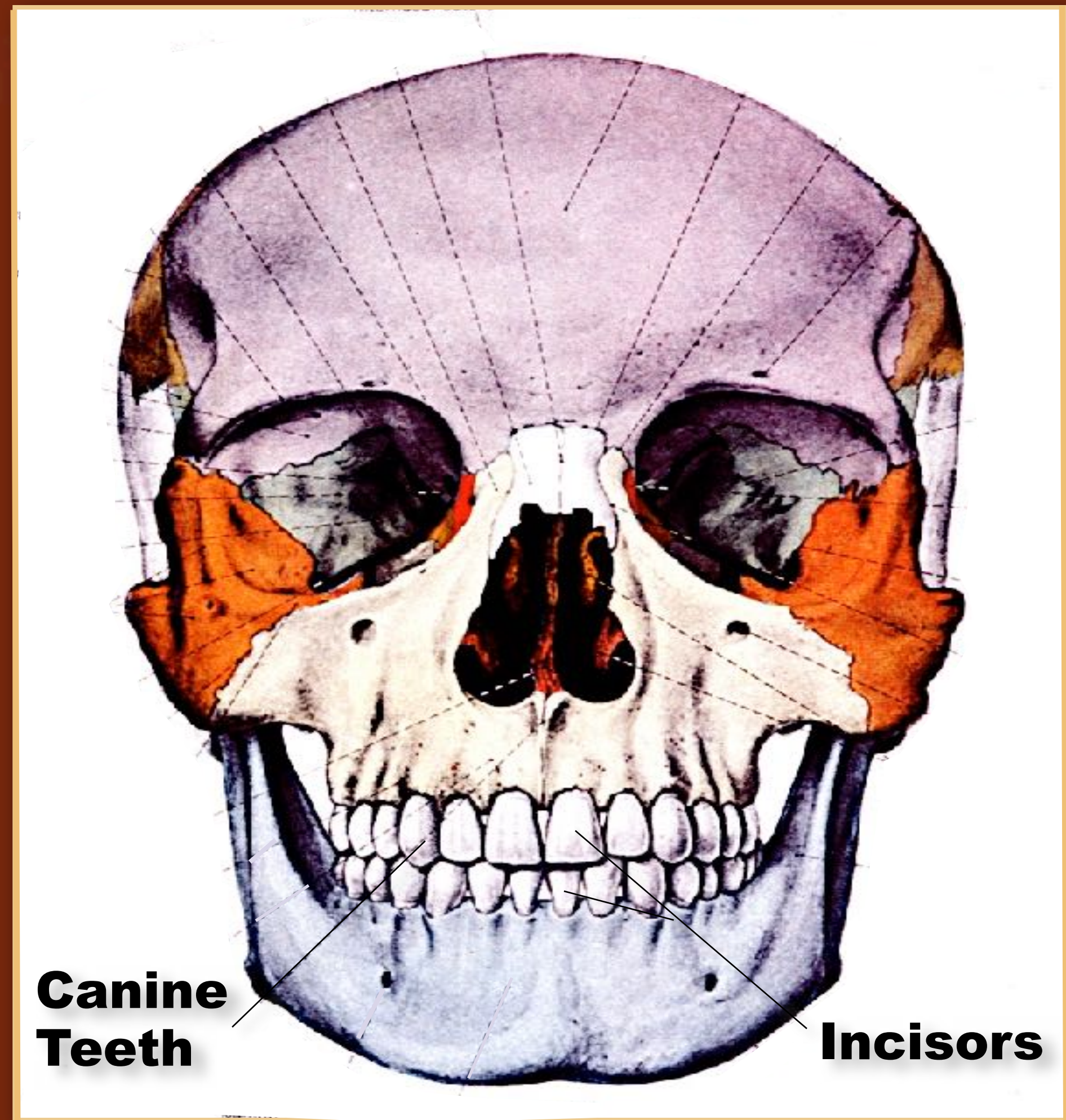
HUMANS

Human Teeth

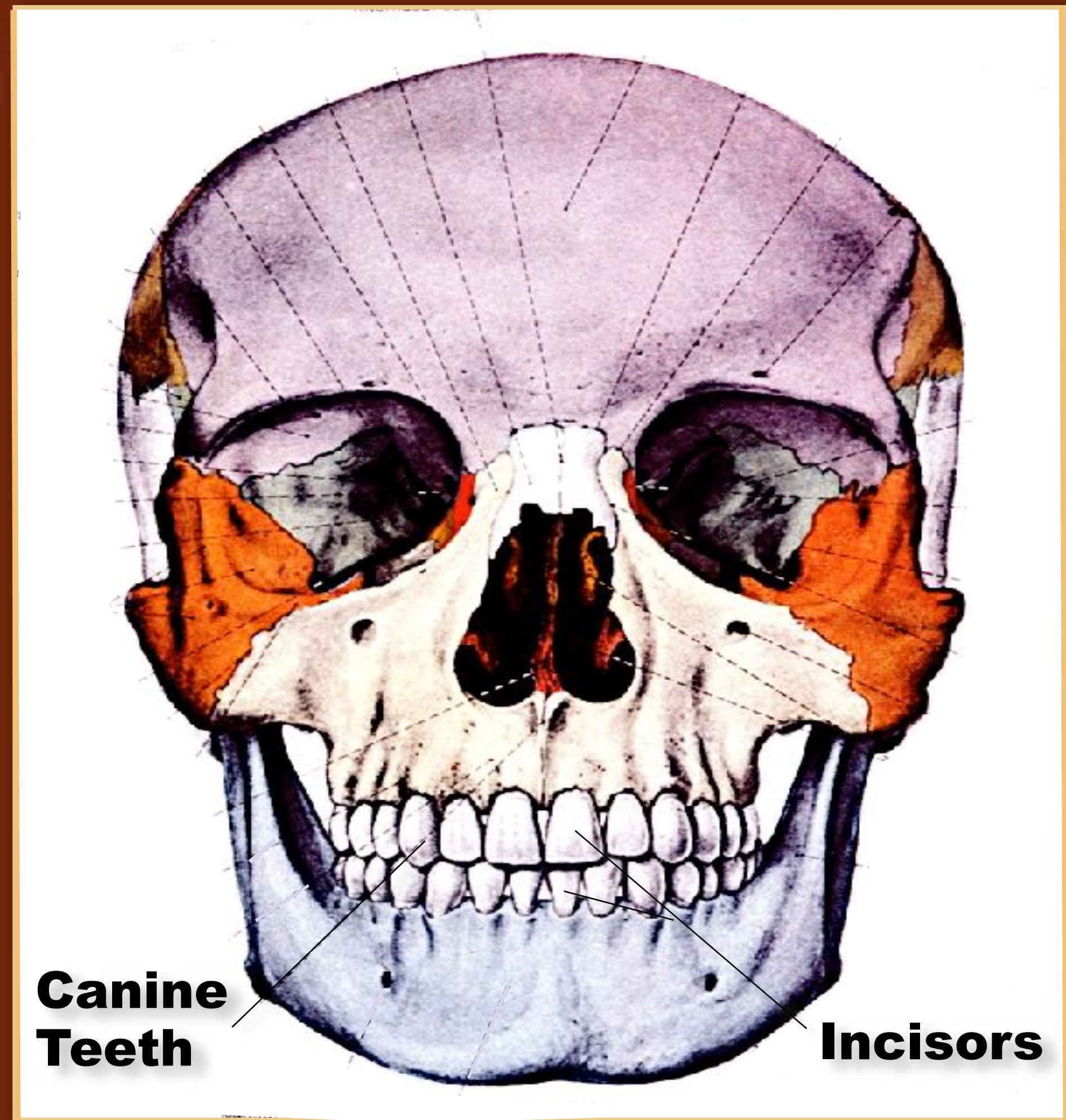


Human Teeth

- Spade-like **incisors** designed for cropping and peeling
- Canine teeth are **reduced in size** and have a “**flattened**” *form*; and function like *accessory incisors*
- Molars slide **across** each other **horizontally**

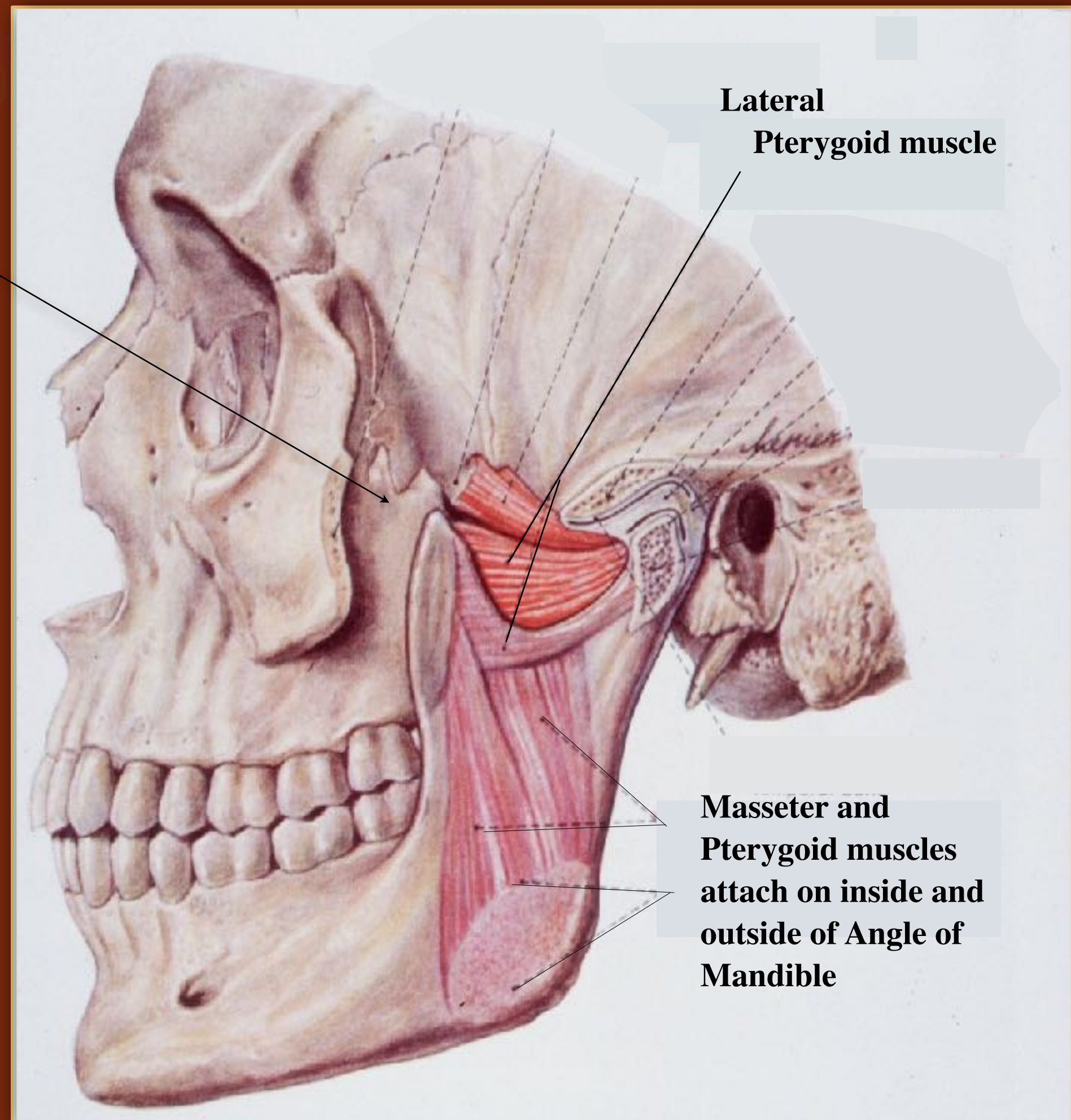


Human Jaw

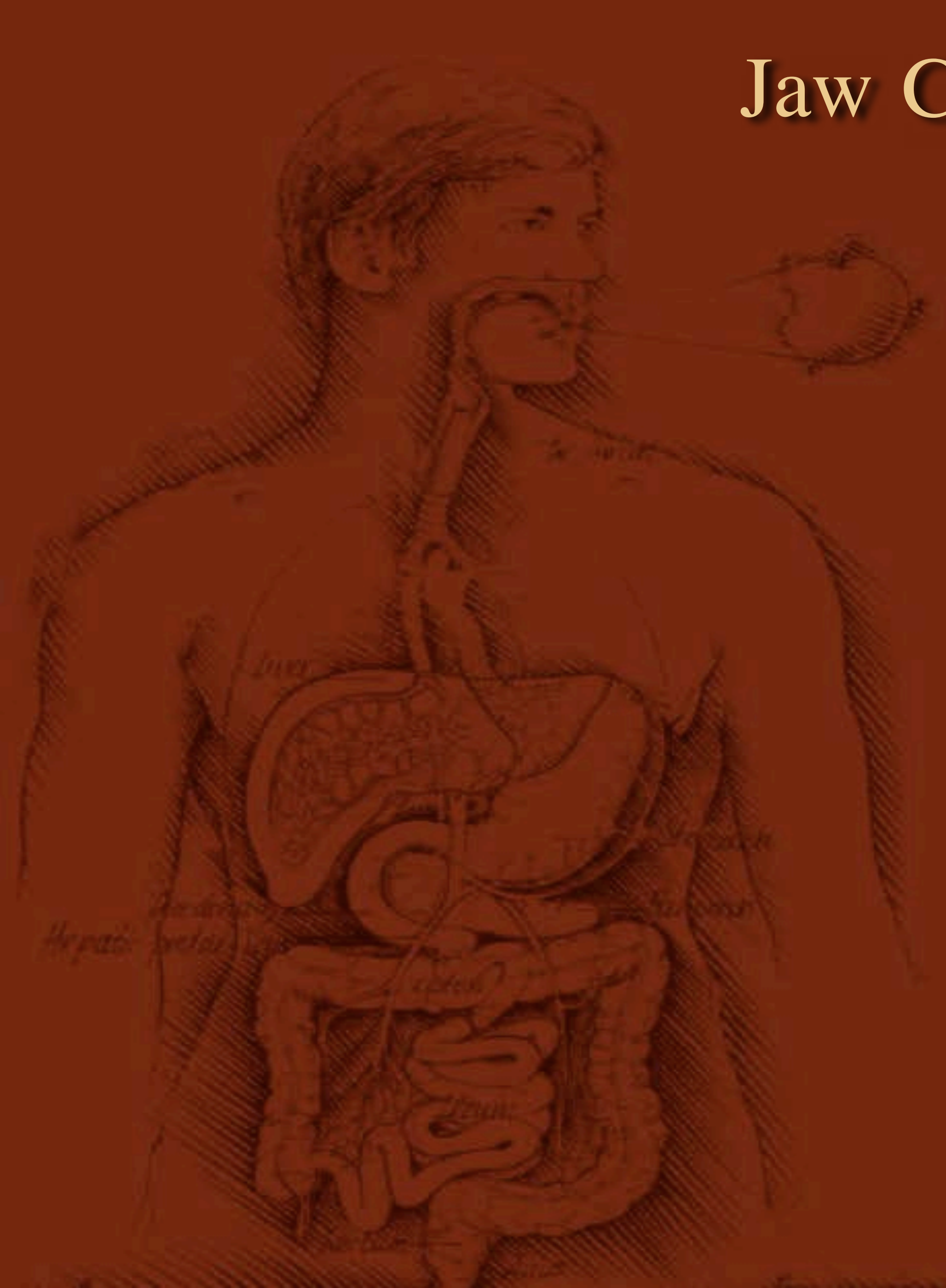


Human Jaw

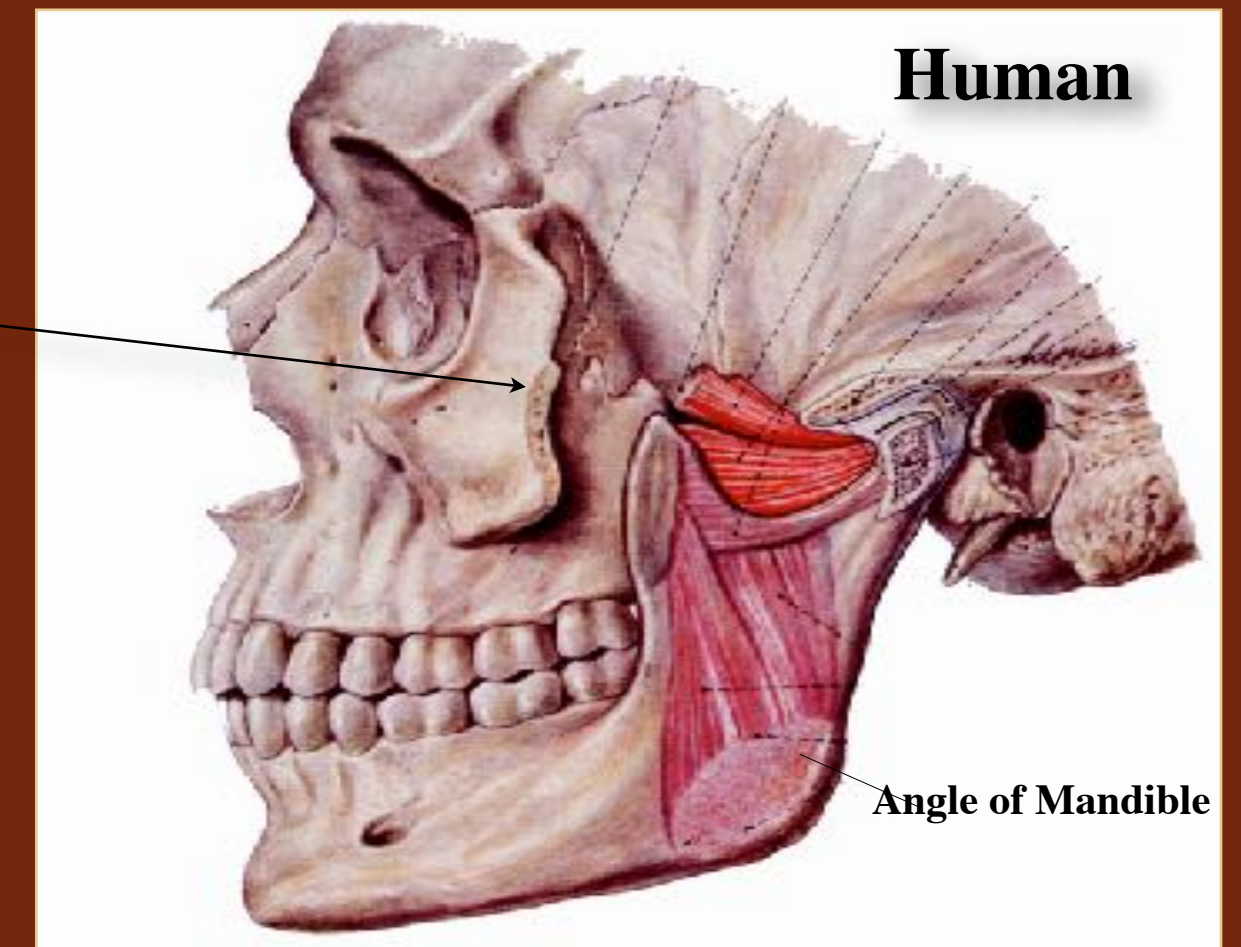
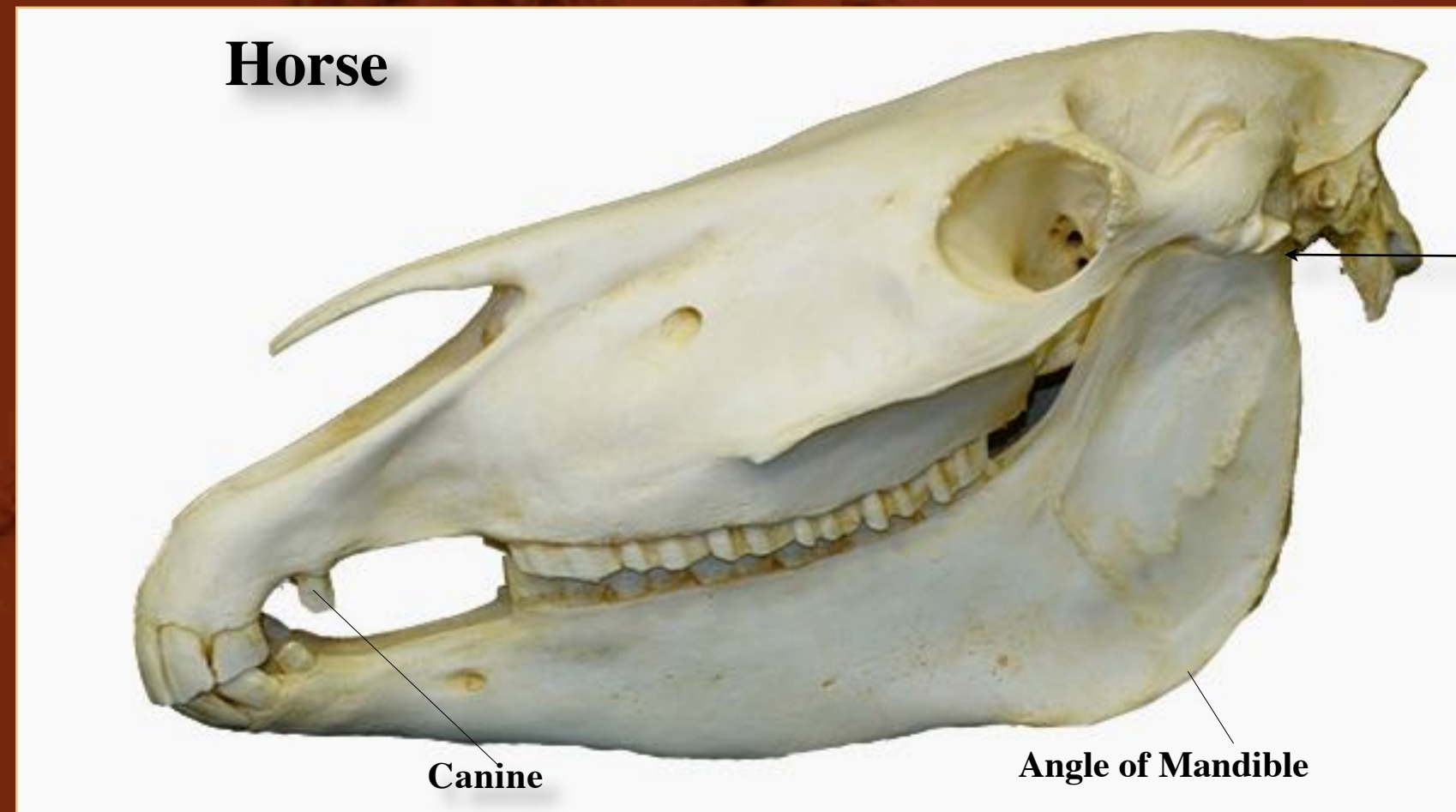
- Jaw joint is **above** the plane of cheek teeth
- Angle of mandible is **expanded**
- Molars **flattened** and **nodular** for **grinding**
- Lower jaw moves **forward** and **side-to-side** allowing the “**rotary**” actions of **chewing**



Jaw Comparison



Jaw Comparison



Whose teeth are *most* like ours?



In **herbivores/humans** the jaw joint is **above** the plane of the teeth

Angle of mandible **is expanded**

Primary jaw muscles are the **Masseters** and **Pterygoids**

Horses **also** have **modified canines**

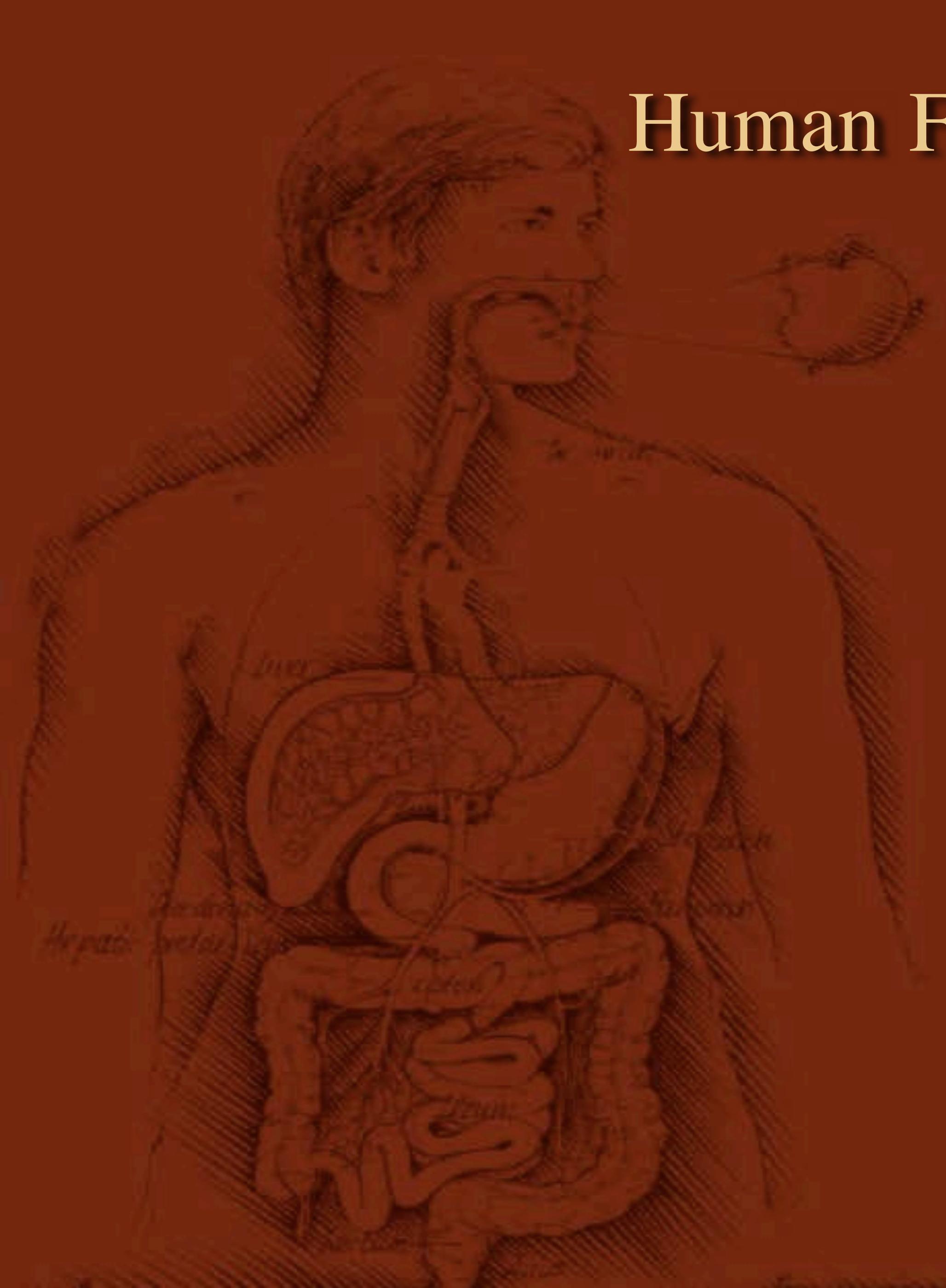
Carnivores and **by-design omnivores** have their **jaw joint** on the **same plane** as the cheek teeth

Temporalis is the **primary** jaw muscle

Angle of mandible is **NOT** expanded

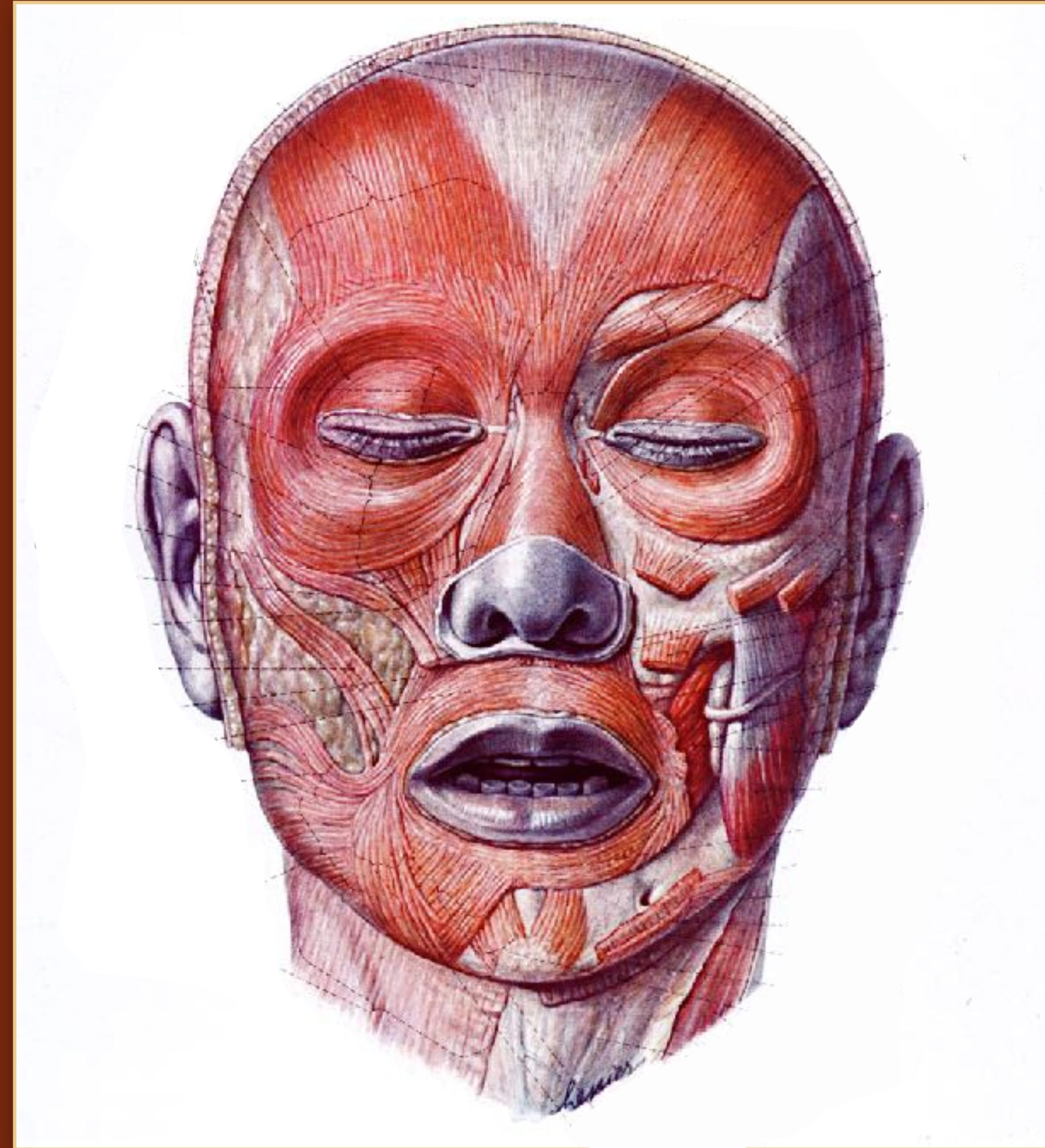
Canines are **elongated** and **dagger-like**

Human Facial Muscles

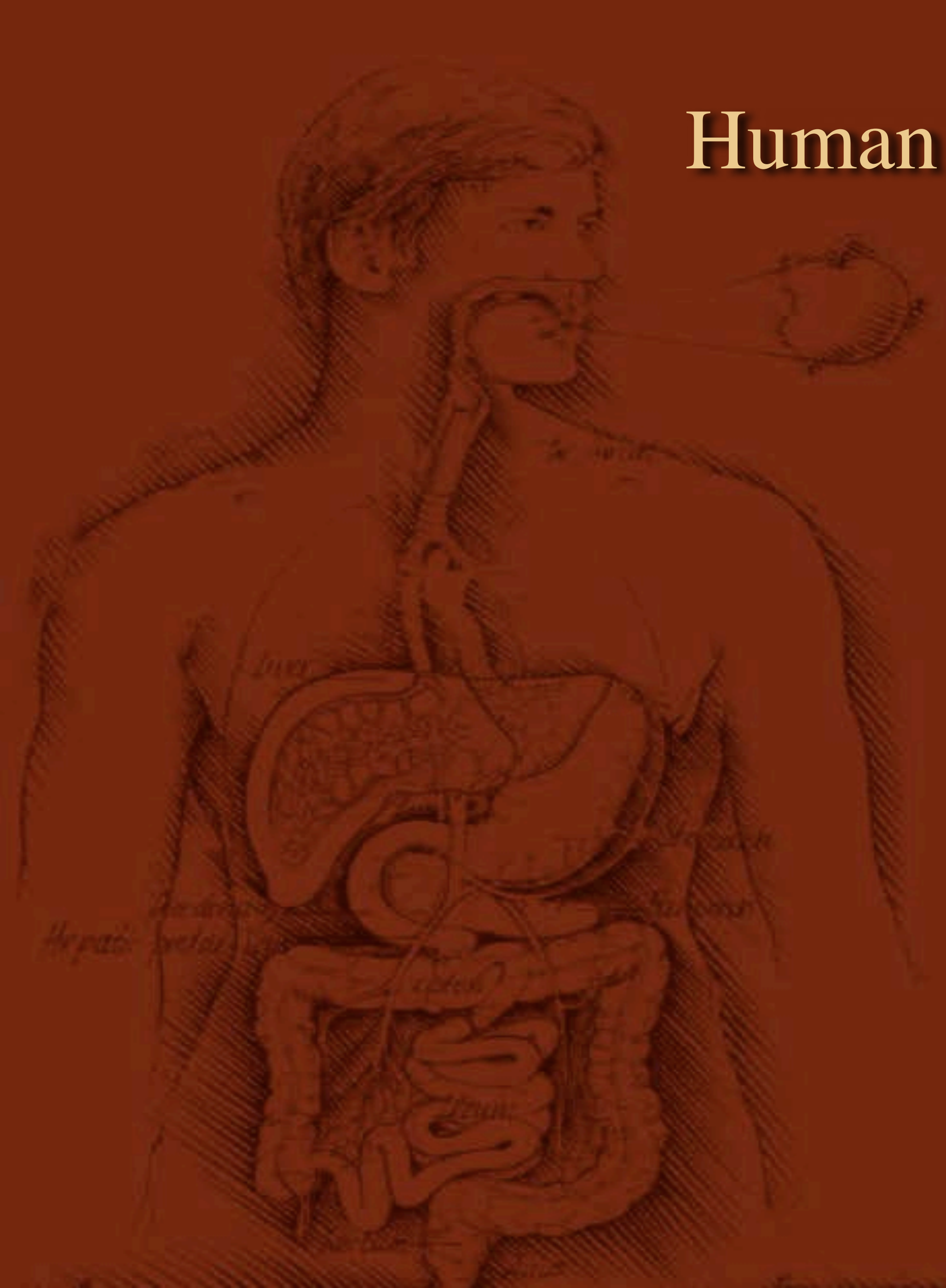


Human Facial Muscles

- Well-developed **facial muscles**
- Small **mouth** opening
- **Walled-in** oral cavity
- **Fleshy, muscular lips**
- **Cheek muscles** aid in chewing
- **Temporalis** muscle is **reduced** in size

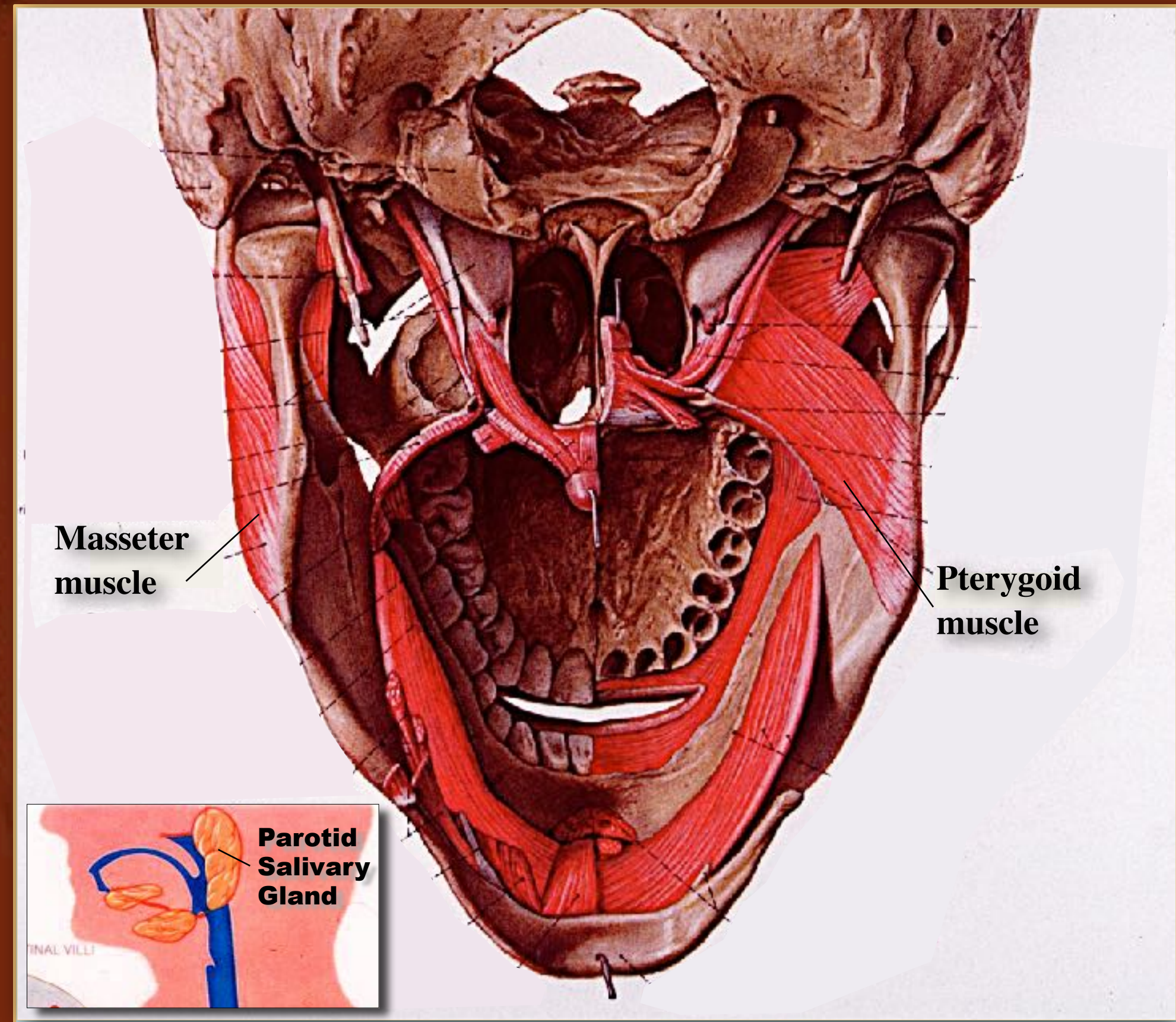


Human Oral Cavity

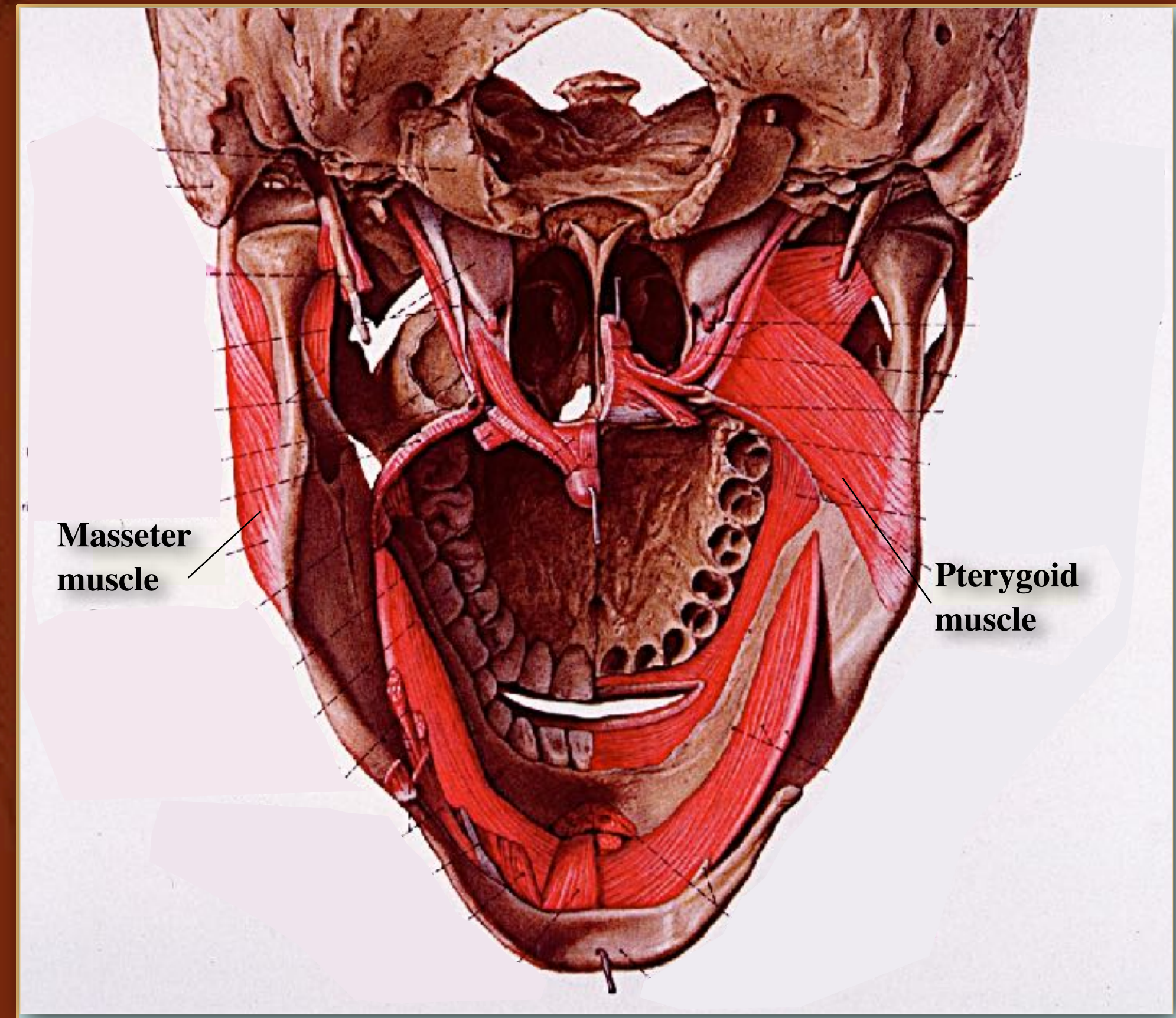


Human Oral Cavity

- **Walled-in** oral cavity (inside view)
- **Masseter** and **Pterygoid** muscles are primary muscles of mastication
- Saliva contains the enzyme **Salivary amylase** produced by the **Parotid** salivary gland

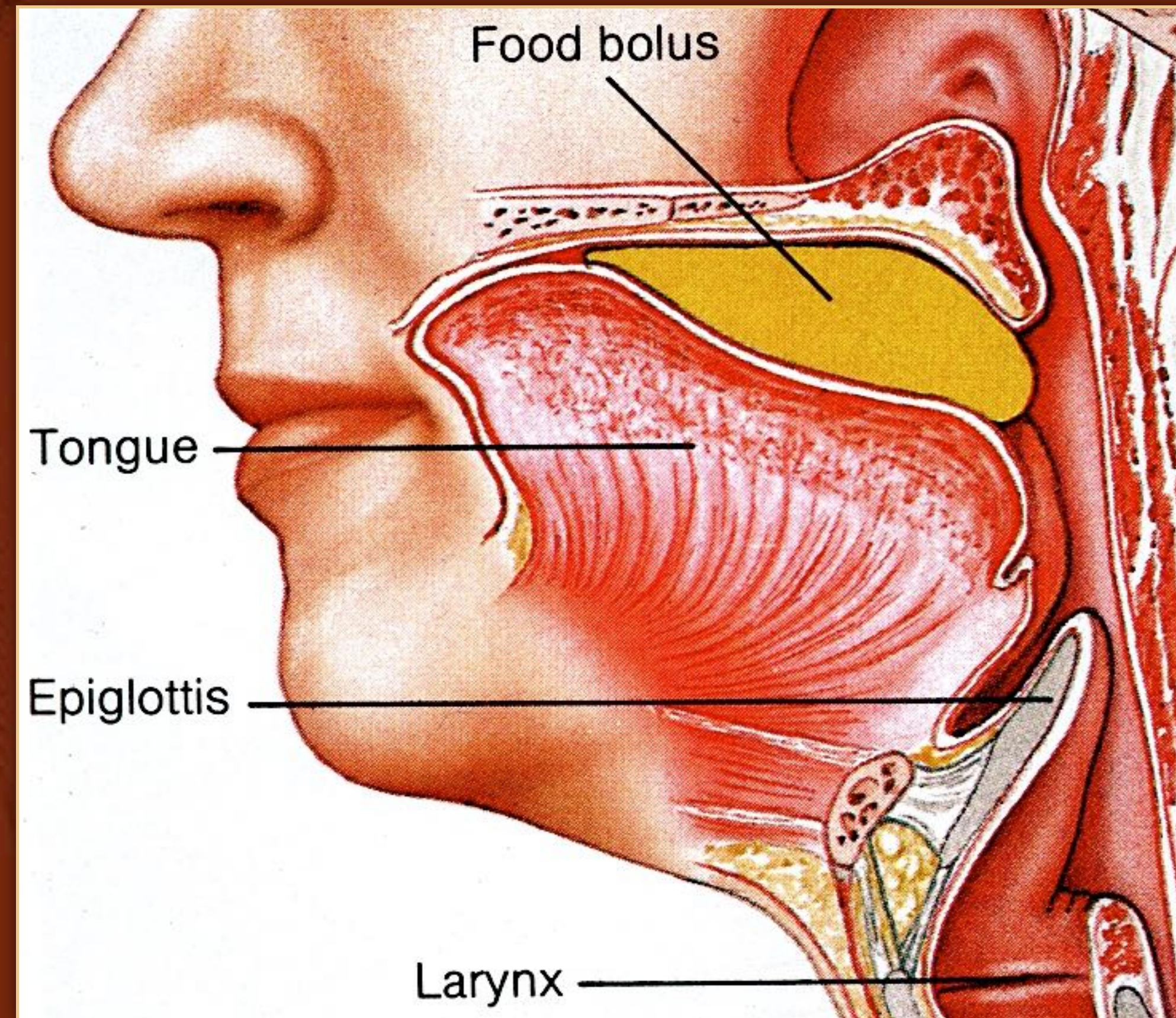


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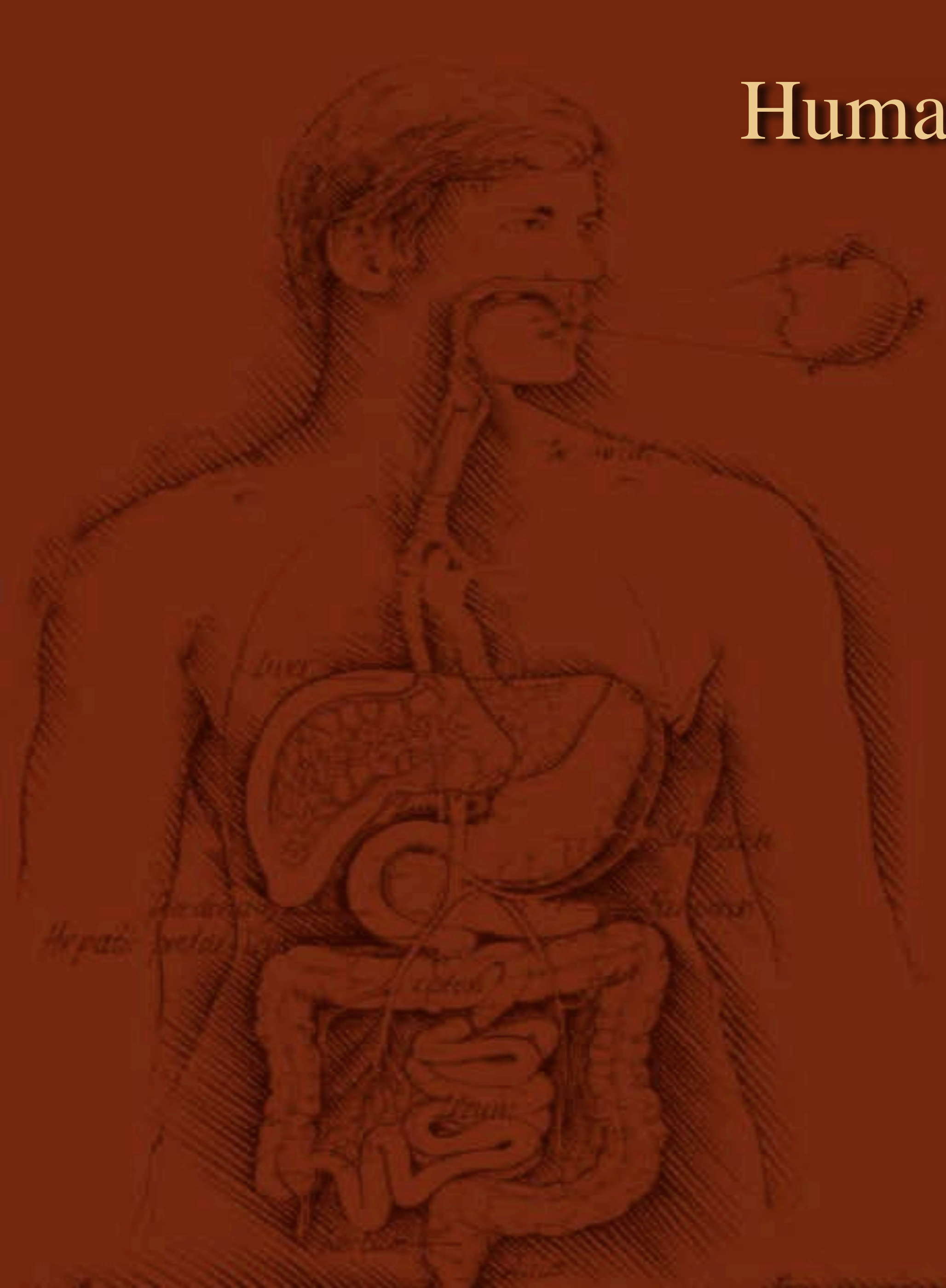


Human Oral Cavity

- Tongue is thick and muscular to aid in **chewing** and **speech**
- Structure of human pharynx allows our **olfactory mucosa** to broaden sense of “**taste**”
- Pharynx structure also facilitates **speech**

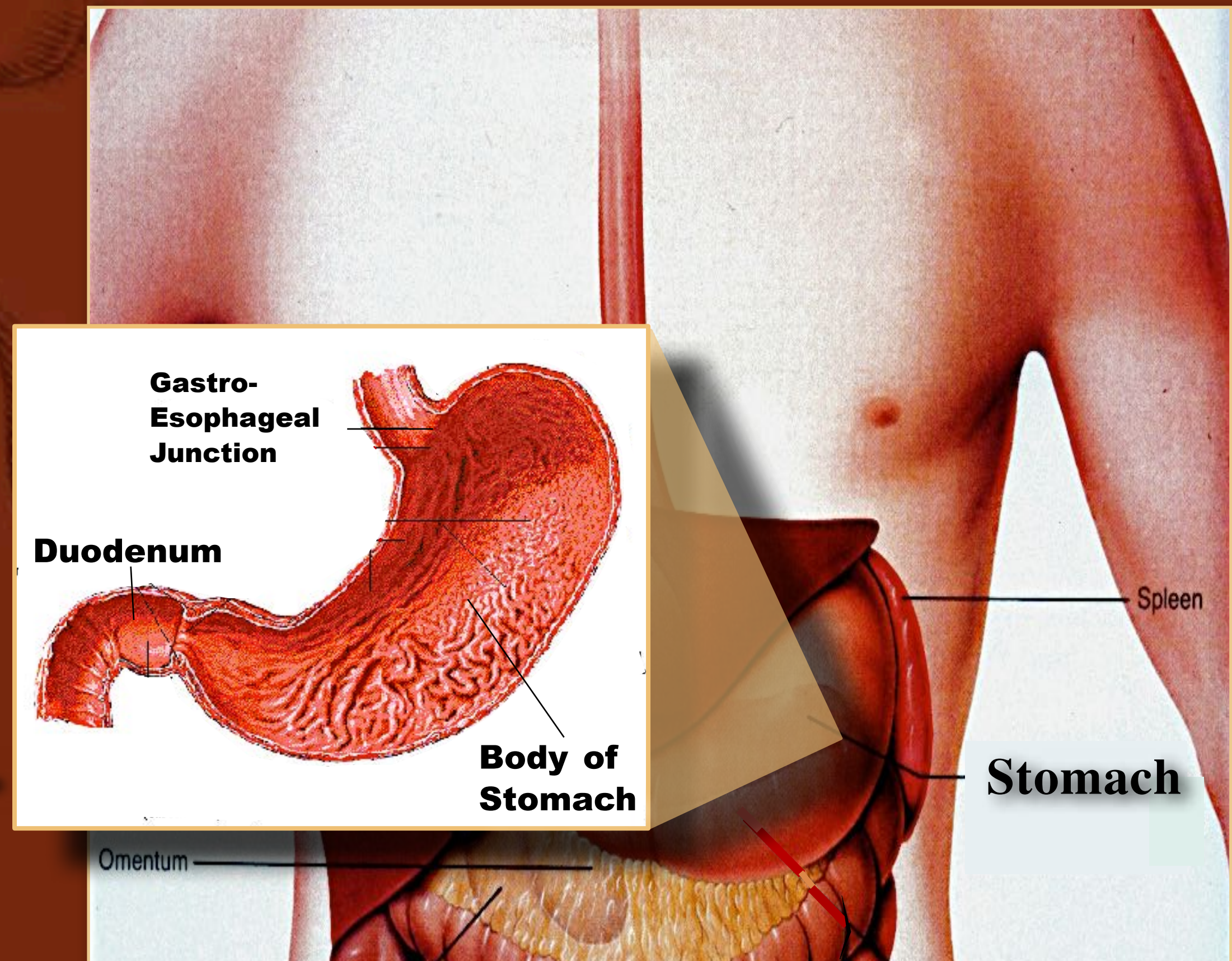


Human Stomach



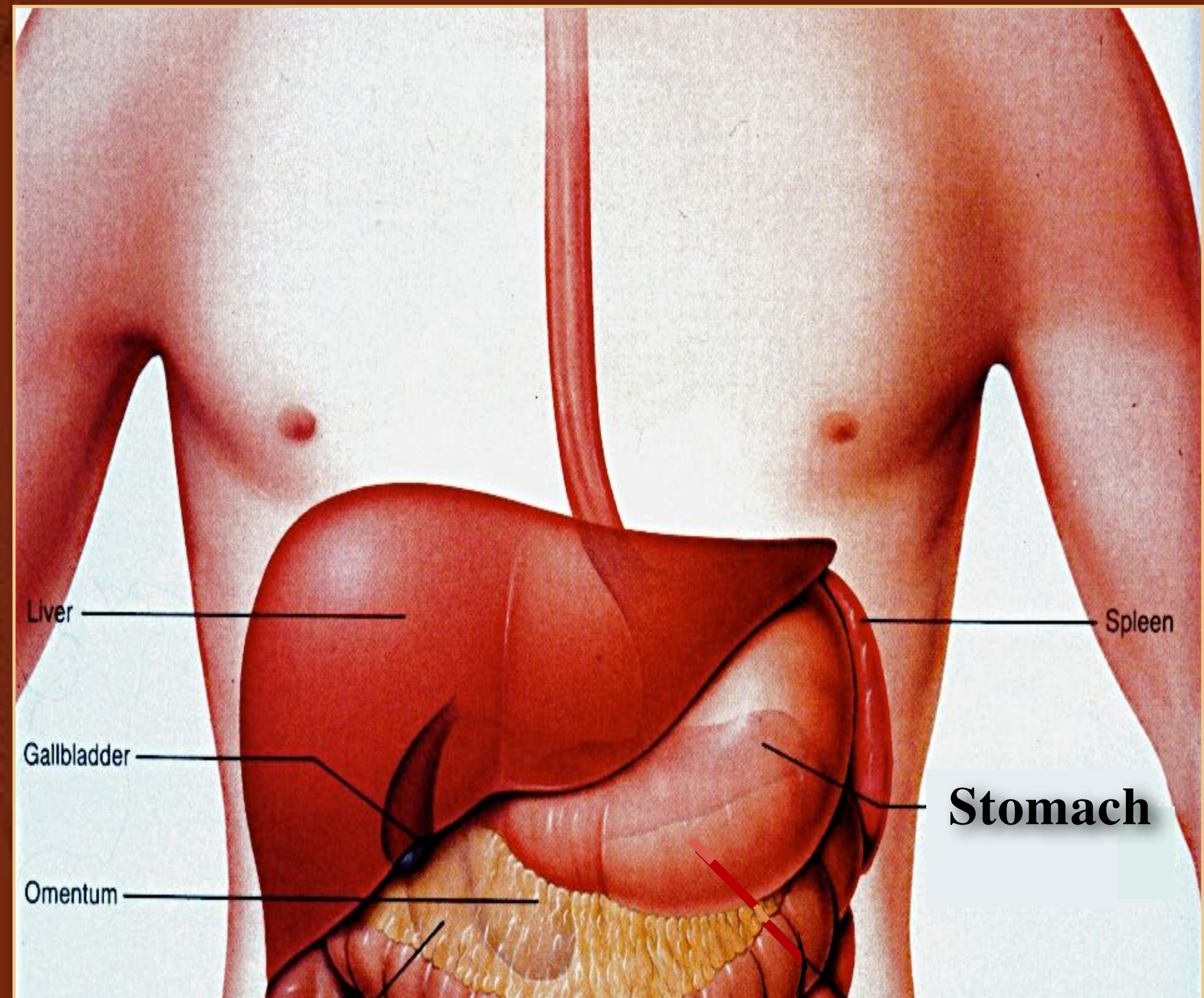
Human Stomach

- Moderately acidic with food: pH $\approx$ 4-5
- Holds $< 25\%$ of capacity of GI tract $\leq$ **.94 Liter**
- Designed for **batch feeding**
- Based on the energy content of **wild foods**, humans can consume $\leq$ **800 - 1270** calories at a single meal (**less than our daily caloric needs**)
- Therefore, we **must** eat **multiple meals** each day
- Average adult human consumes about **2700 kcal/day** = **5.46lbs** of food = **3.33%** of body weight

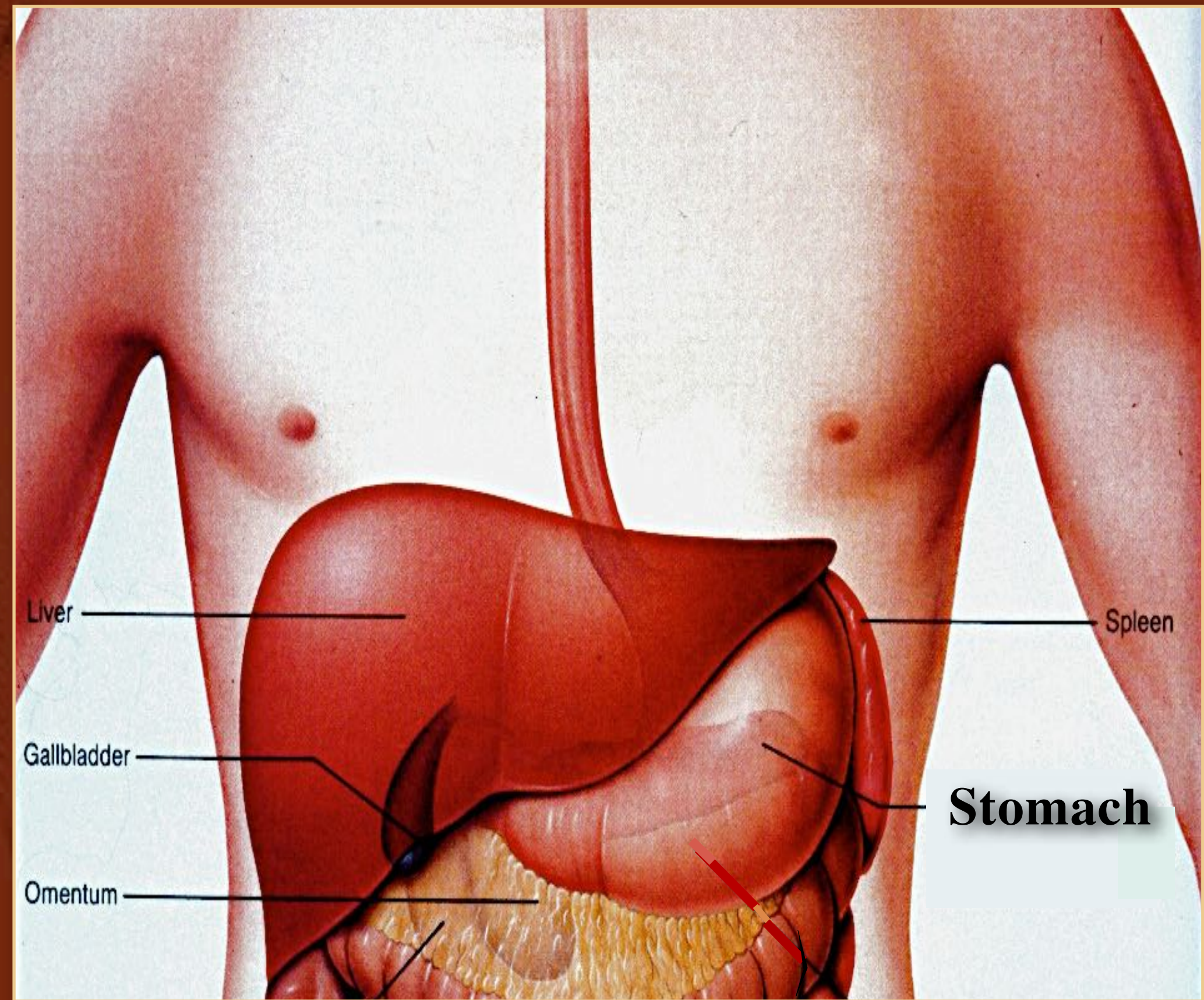


Gastric emptying time = 2- 4 hours

Human Stomach

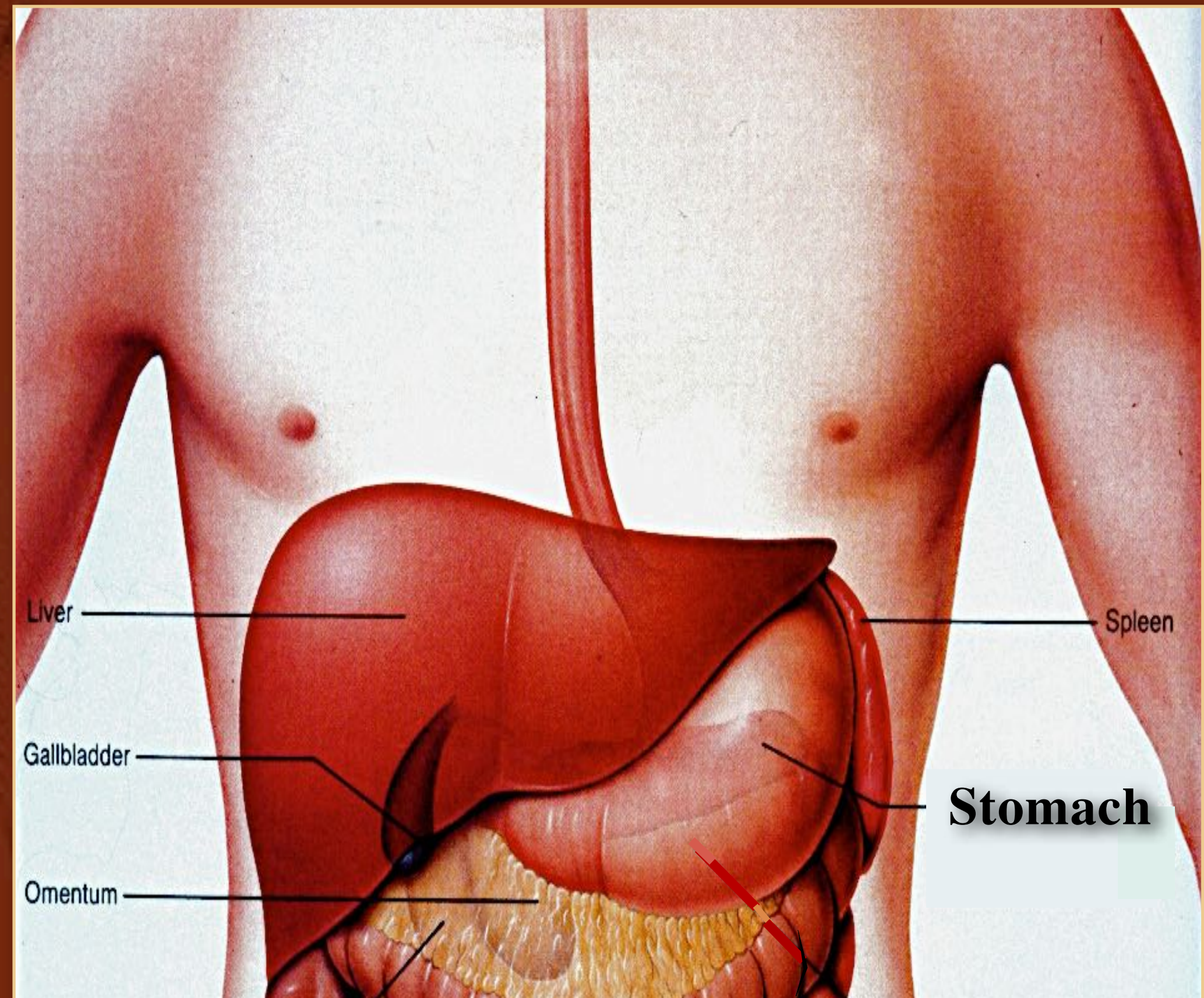


Human Stomach



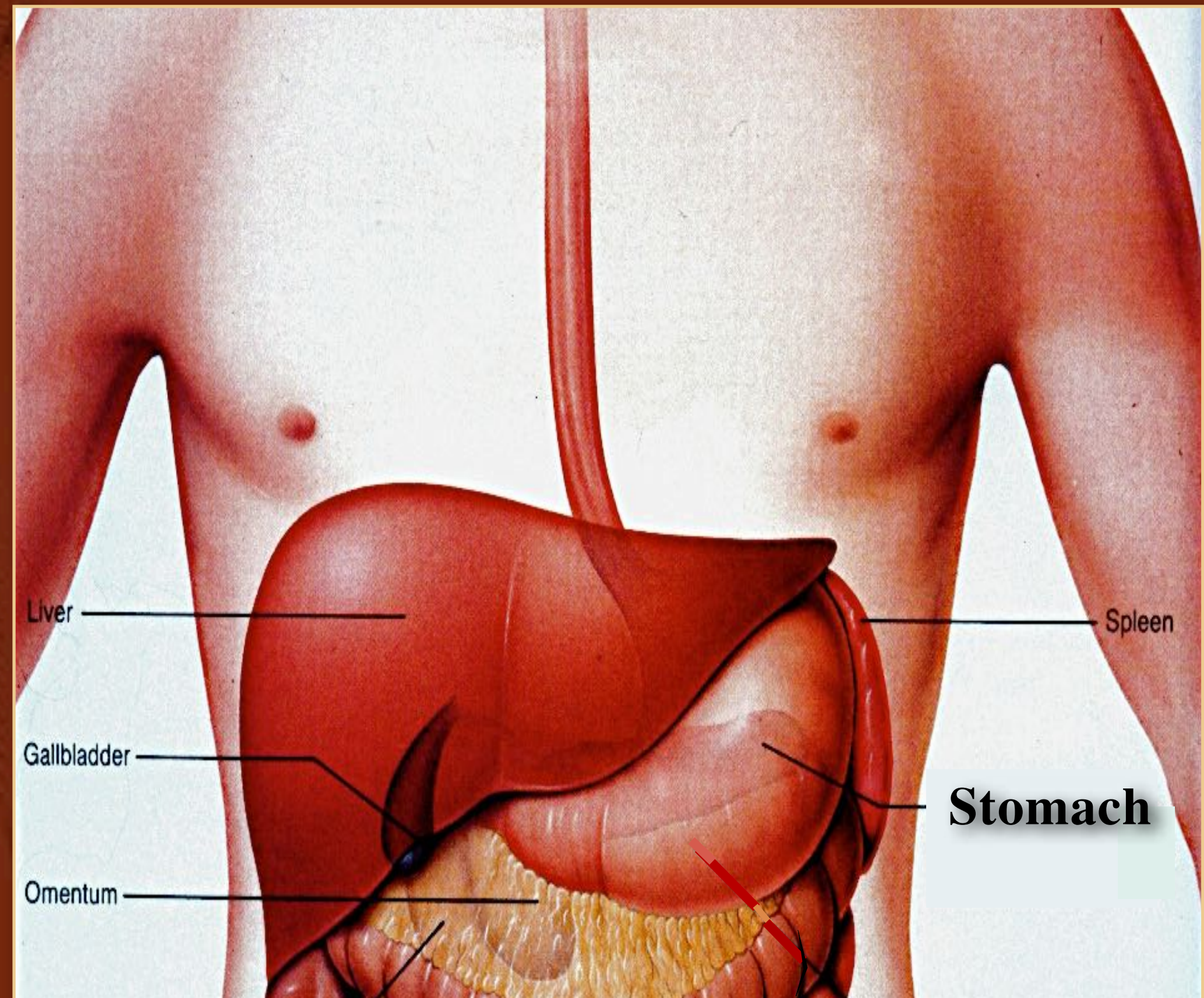
Human Stomach

- Because of the **small capacity** of the human stomach, and **our inability to eat carrion**, humans **cannot** recover large amounts of energy from a single carcass the way carnivores can



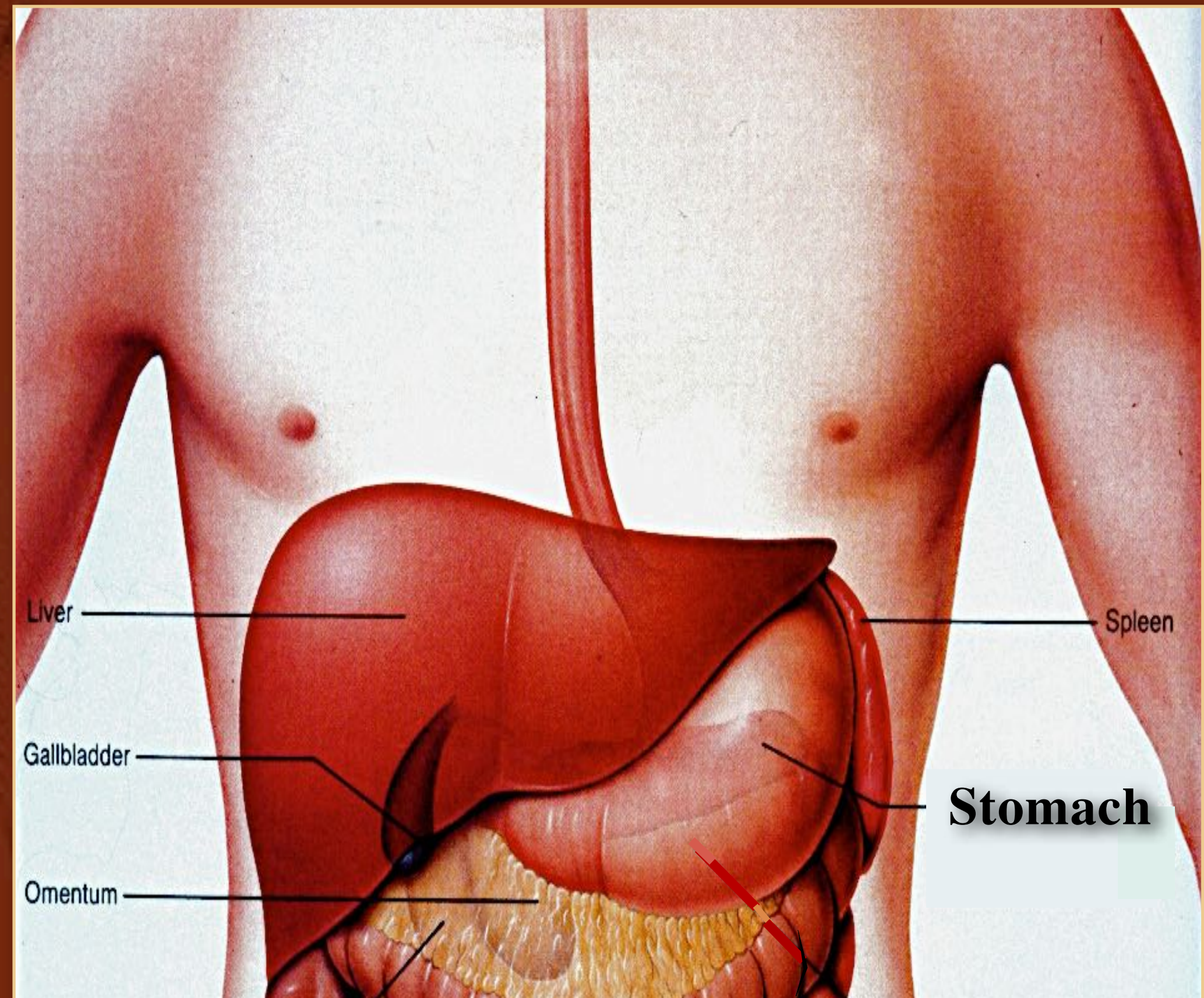
Human Stomach

- Because of the **small capacity** of the human stomach, and **our inability to eat carrion**, humans **cannot** recover large amounts of energy from a single carcass the way carnivores can
- This is why ***hunting is much less beneficial for us***

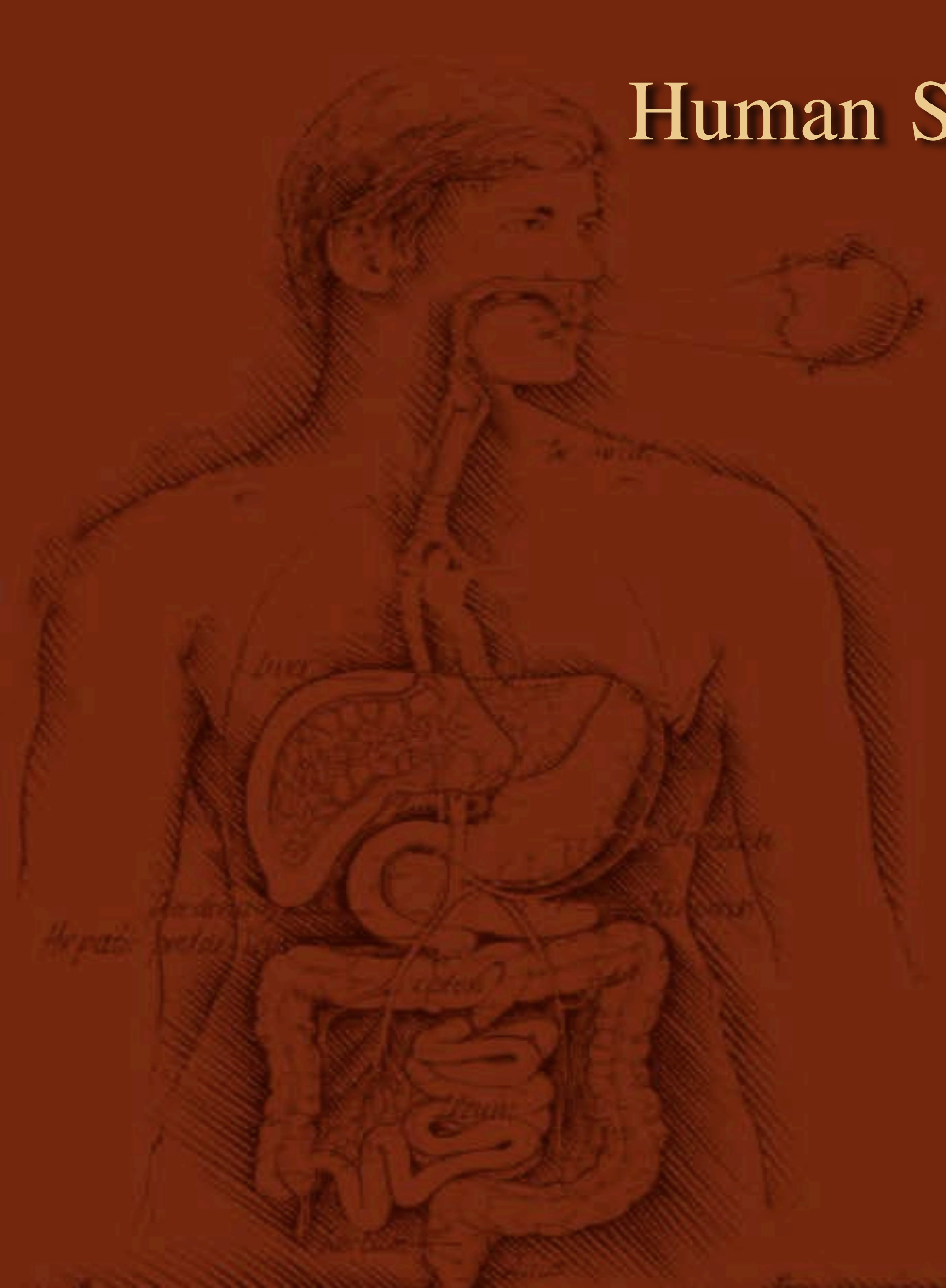


Human Stomach

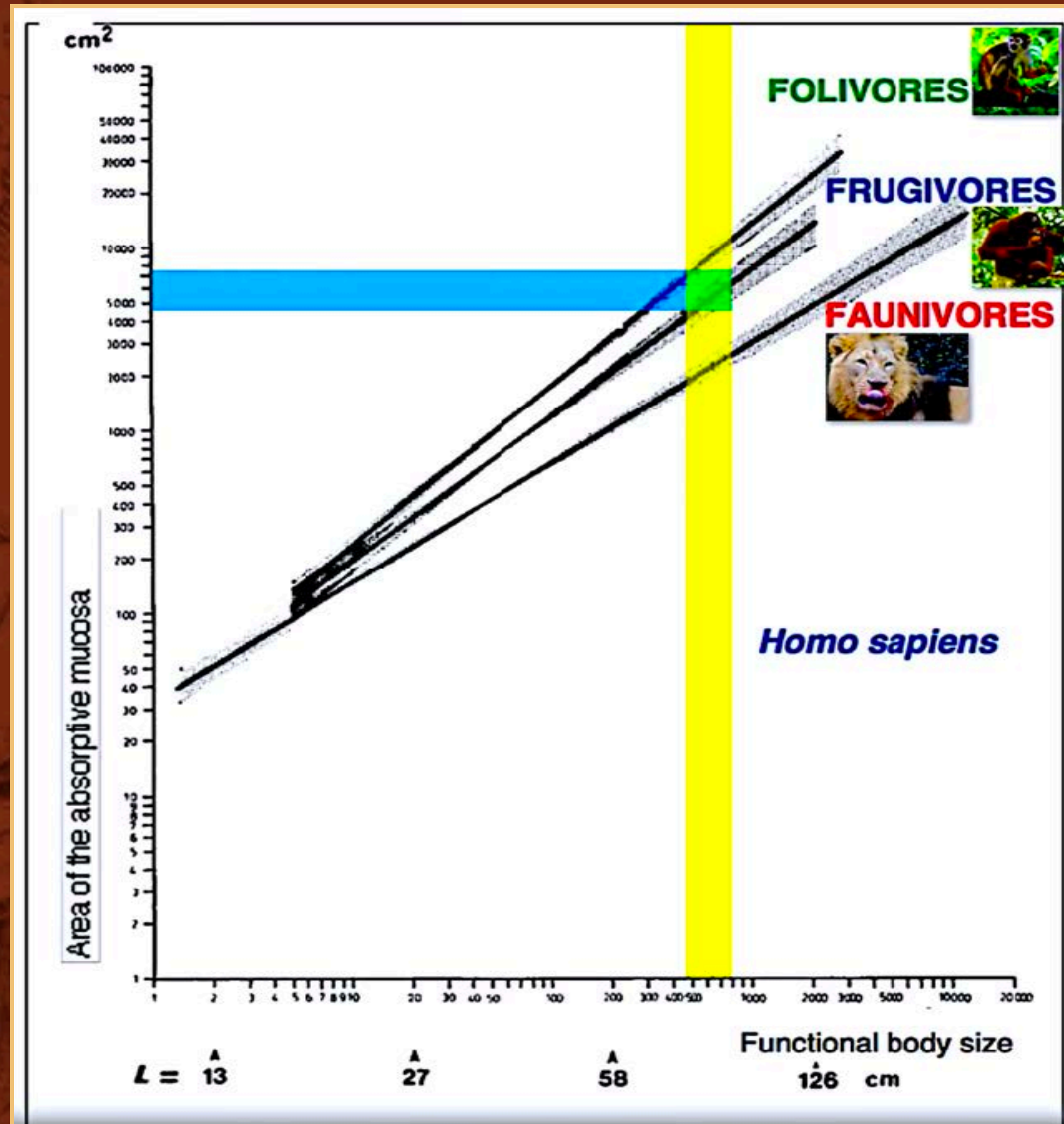
- Thus, in the **absence** of reliable, large scale **preservation methods**, **hunting** is **NOT** an **efficient way** of obtaining energy for “**Stone Age**” humans
- This is why throughout **history** “**crop failures**” have resulted in **famine**, **starvation** and **death** for human populations
- And why “**plant-eating**” **Locusts** are considered a “**plague**” and **not** a *food bonanza!*



Human Small Intestine

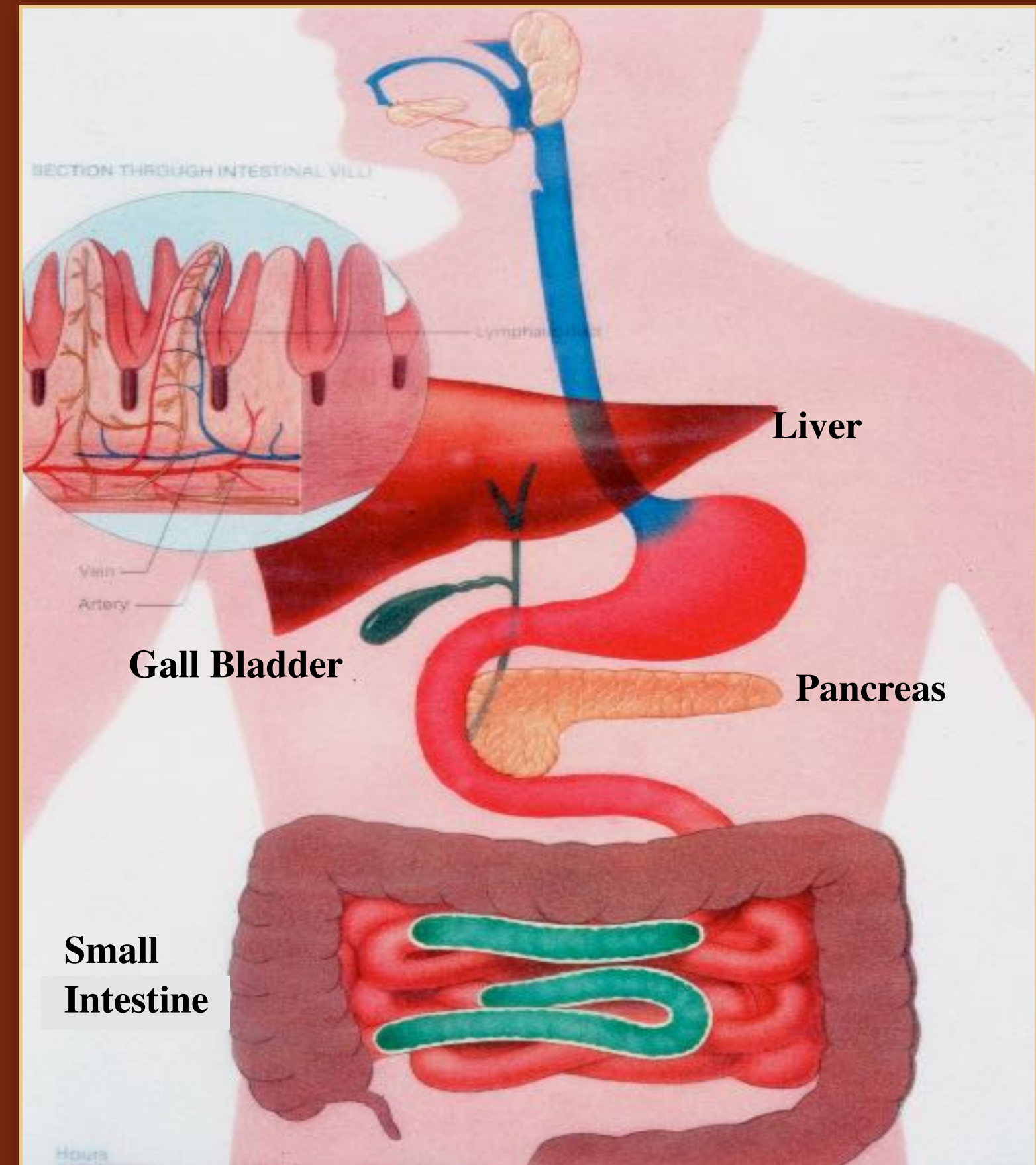


Human Small Intestine



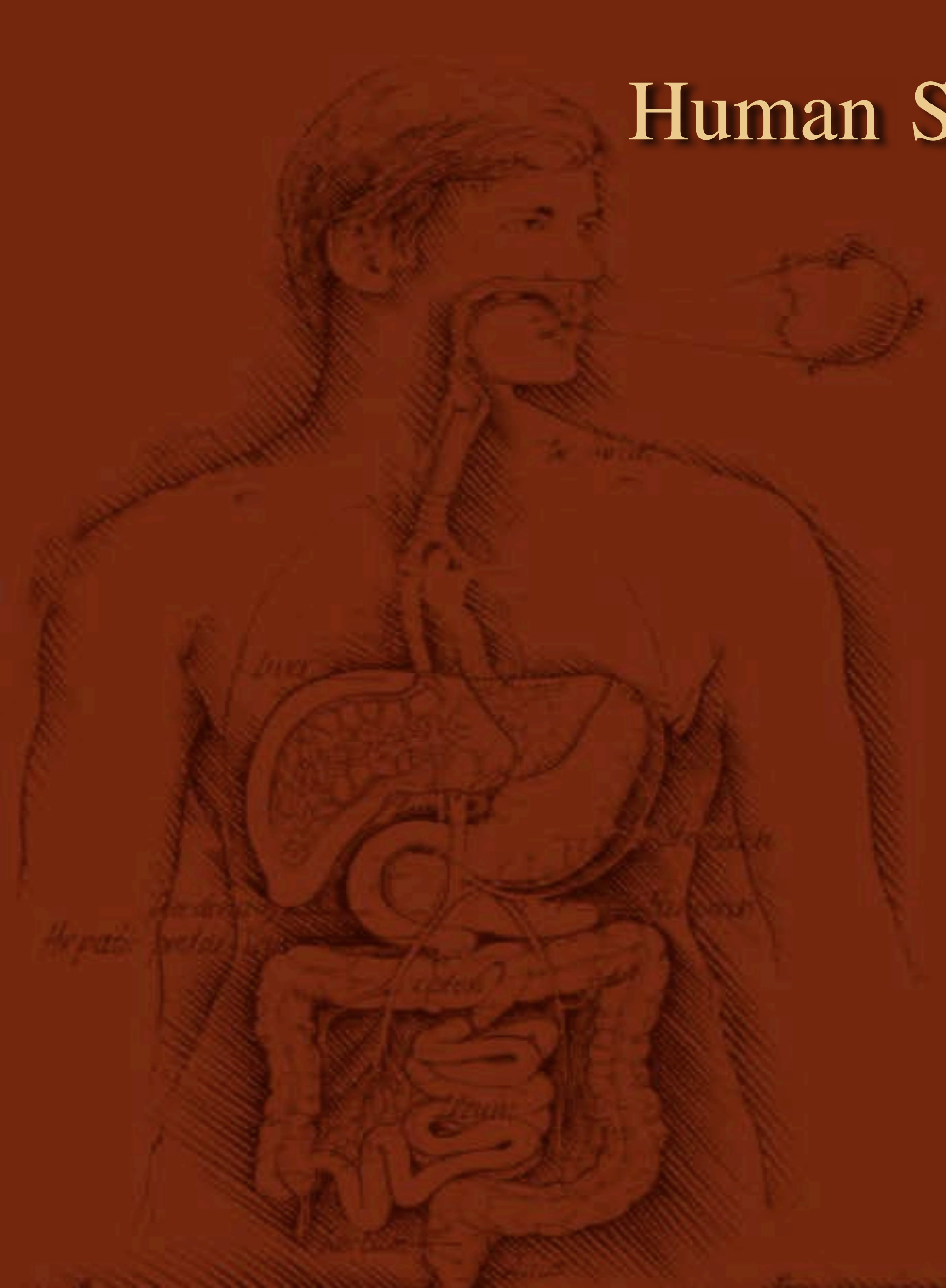
Human Small Intestine

- **Extremely long** averaging 25 - 35 feet
- Human **body length** averages 2.5 to 3 feet (measured **head to tail bone**)
- Human **small intestine** is, therefore, **≥ 10 -11 times body length**
- Thus, the **human small intestine** has the characteristic proportions of a typical **herbivore**



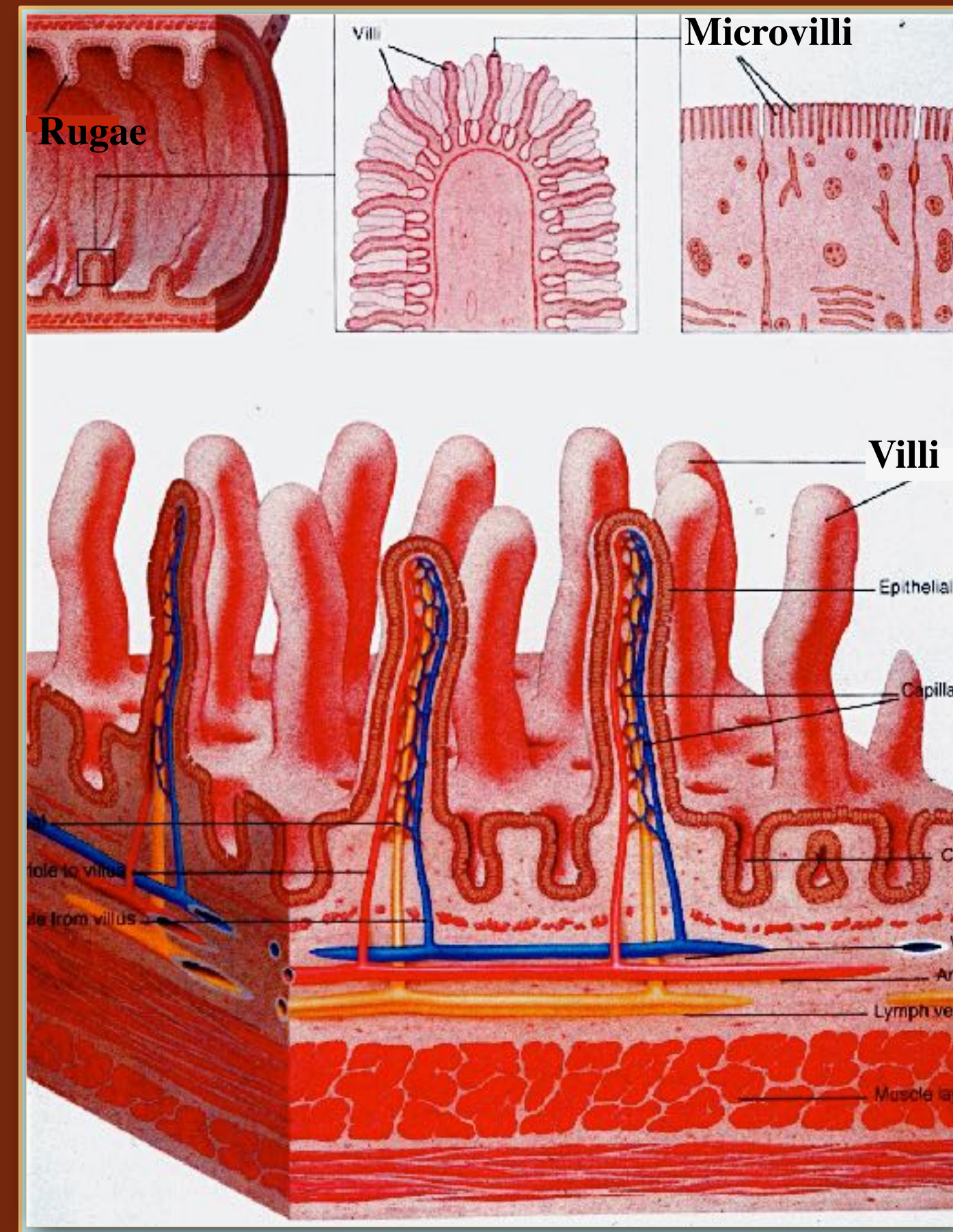
*Food transits **entire length** of Small Intestine in ≈ 2 hours*

Human Small Intestine

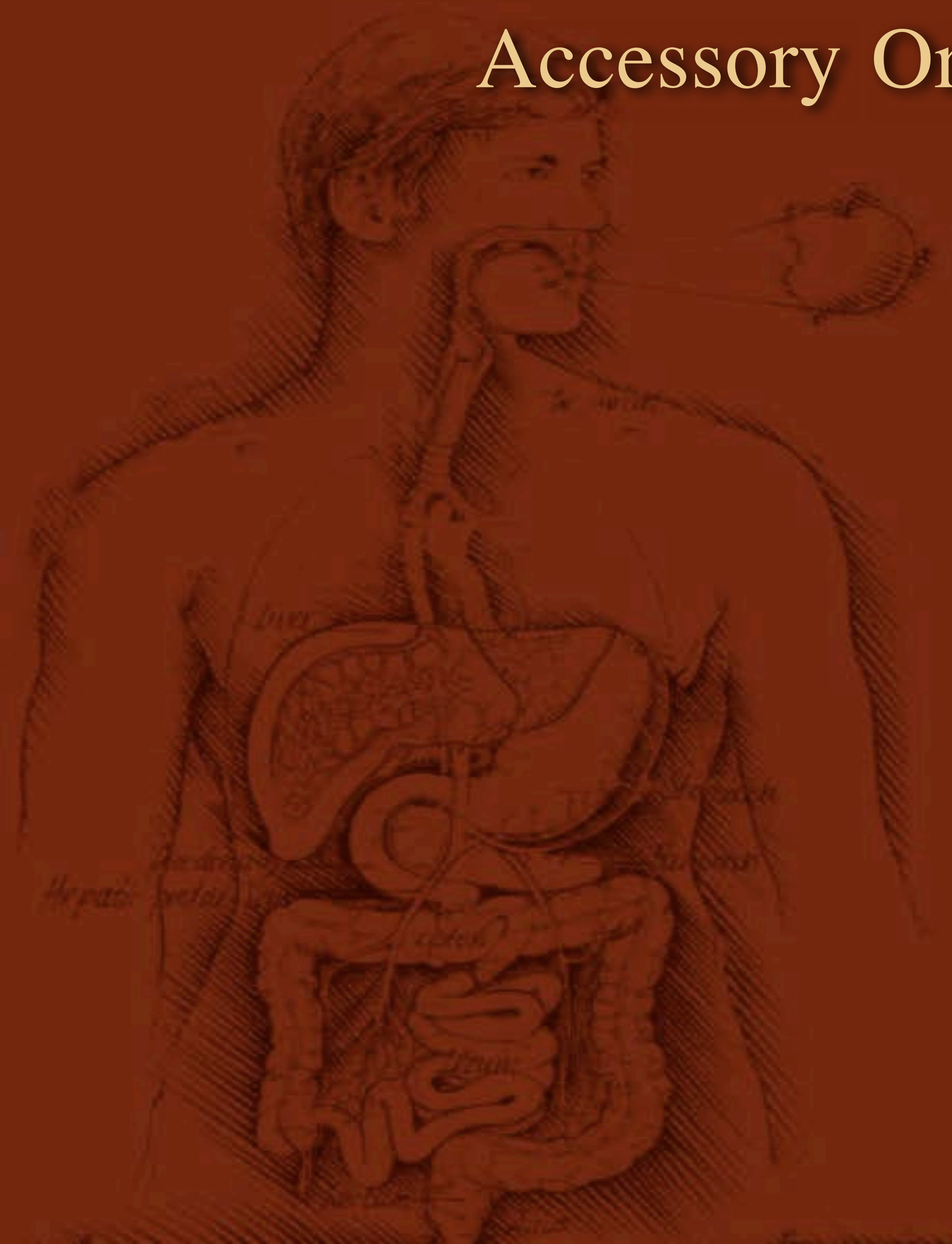


Human Small Intestine

- Mucosa compressed like an accordion
- Surface area further increased by villi and microvilli
- Total surface area equal in size to a singles' tennis court
- Enzymes are a mixture of carbohydrate, protein, and fat digesting enzymes



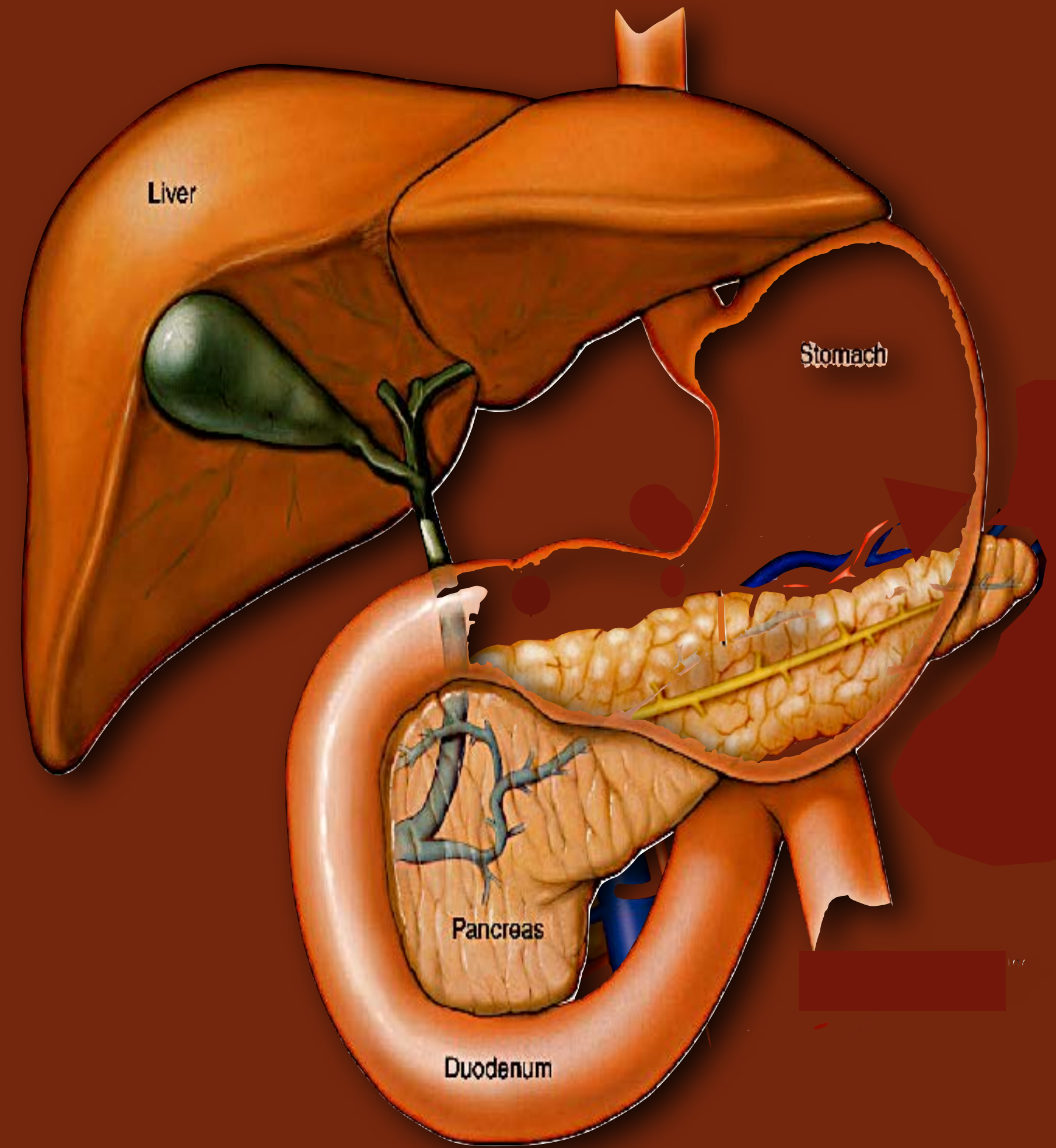
Accessory Organs of Digestion



Accessory Organs of Digestion

Liver

- manufactures **Bile**
- **bile** is stored in the **Gall Bladder**
- receives **absorbed nutrients** via **portal vein** for **processing, storage** and **detoxification** *before* release into **systemic circulation**
- excretes **fecal components**



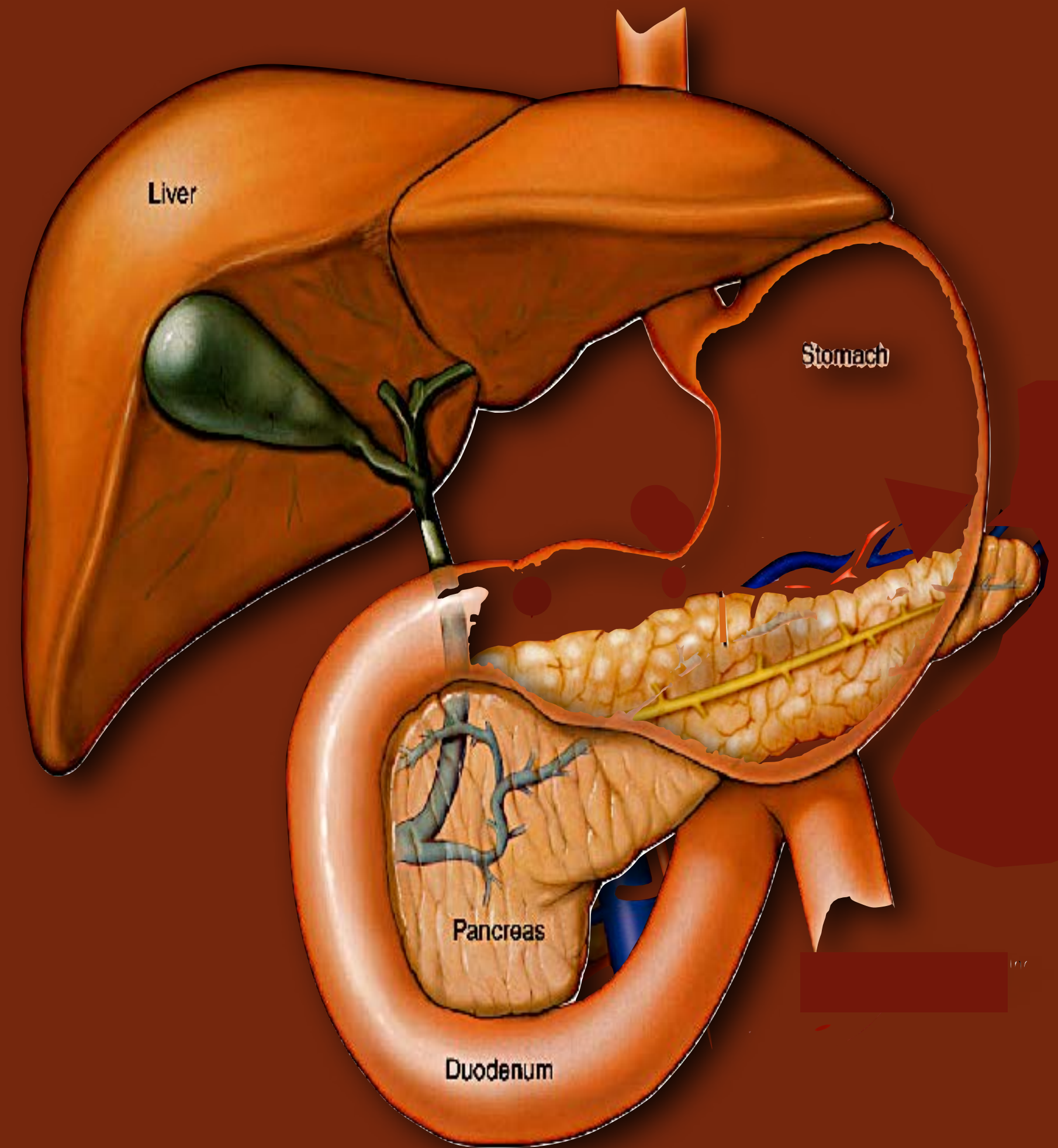
Accessory Organs of Digestion

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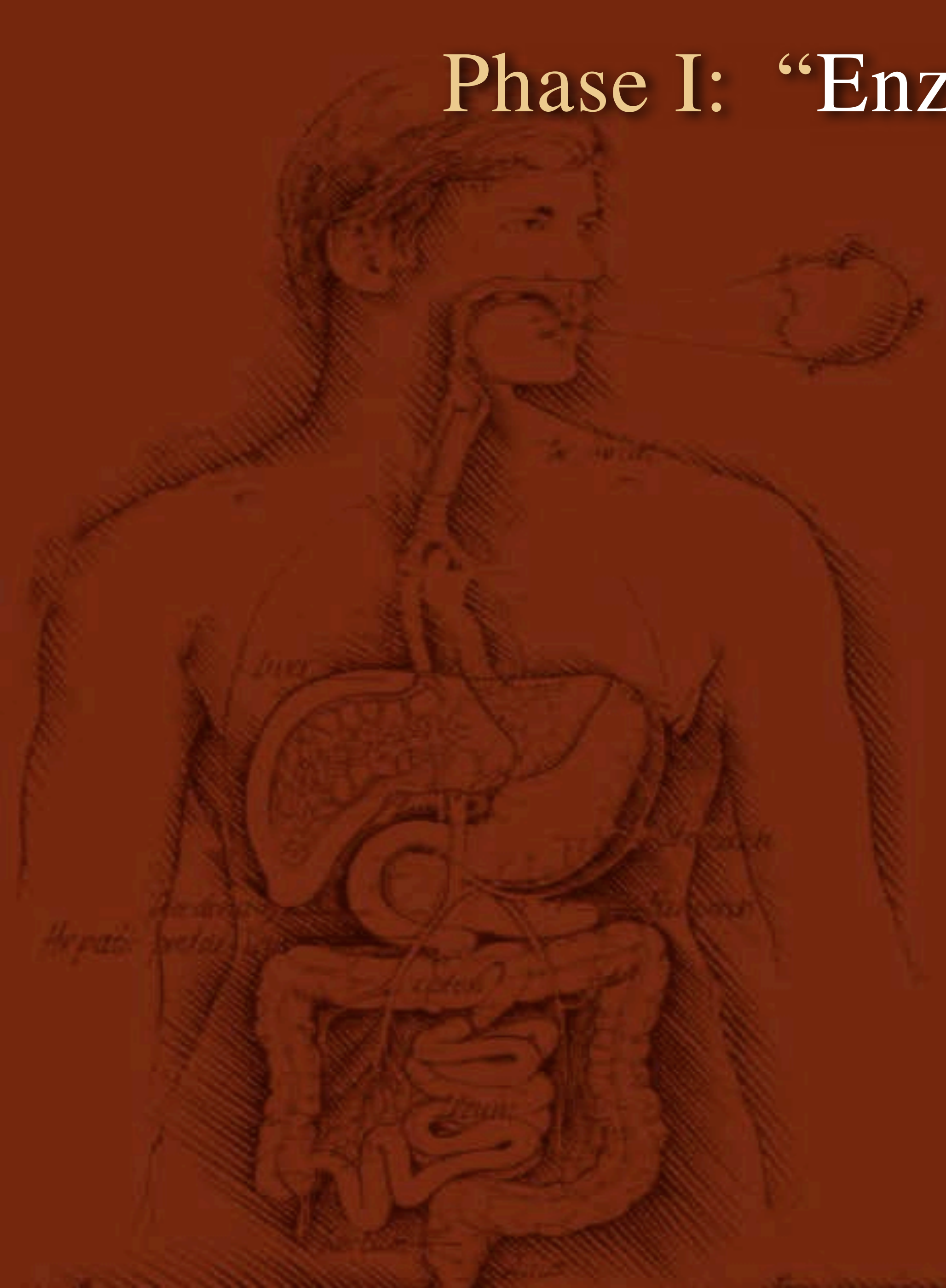
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Pancreas

- manufactures **digestive enzymes**:
 - **Proteases/Lipase/Amylases**
- secretions **neutralize** stomach acid
- **Beta cells** manufacture and release **Insulin** in response to rise in blood sugar



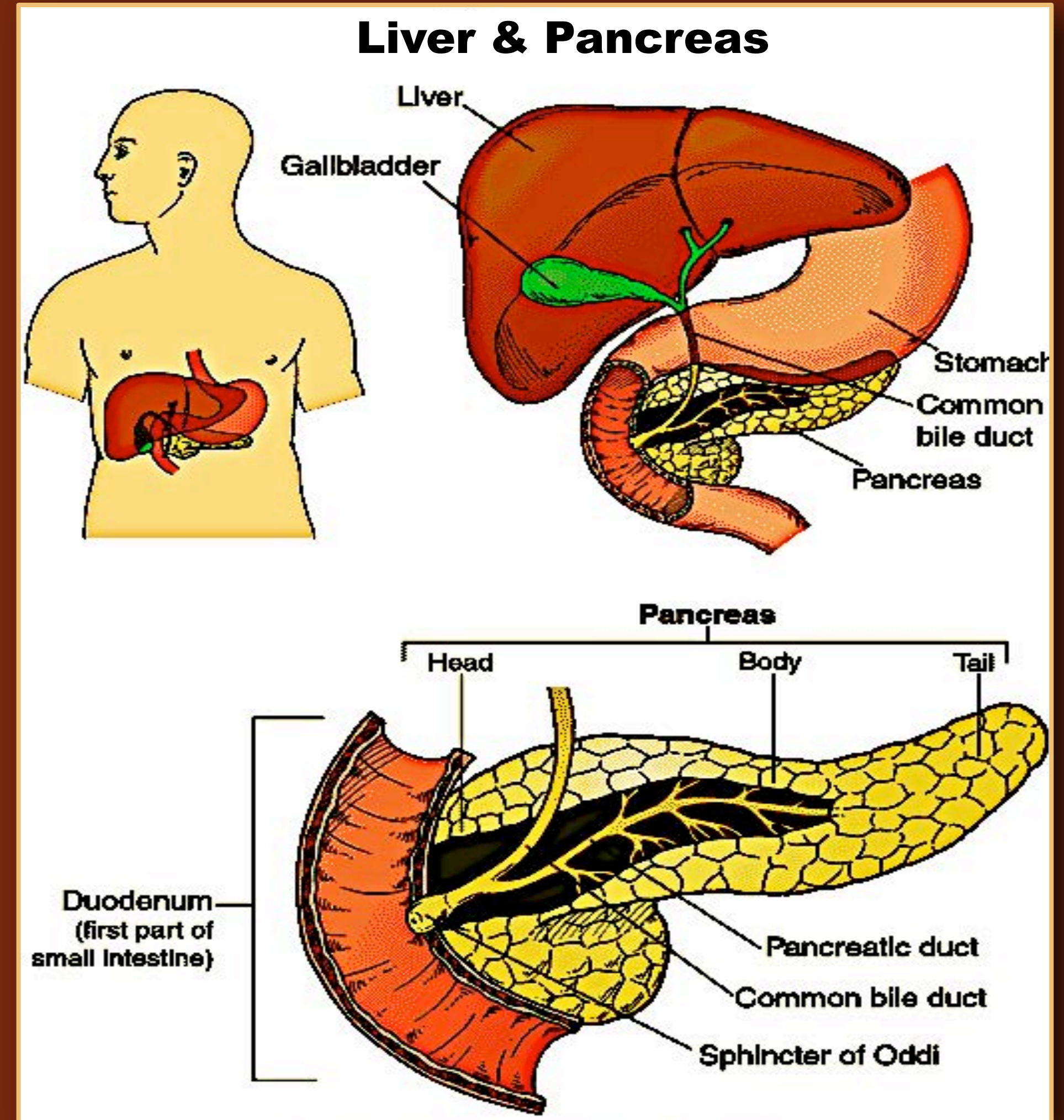
Phase I: “Enzymatic” Digestion



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Bile

- **Emulsifies** fat and **cholesterol** so they can be **absorbed** into bloodstream
- **excretes detoxified compounds** into feces



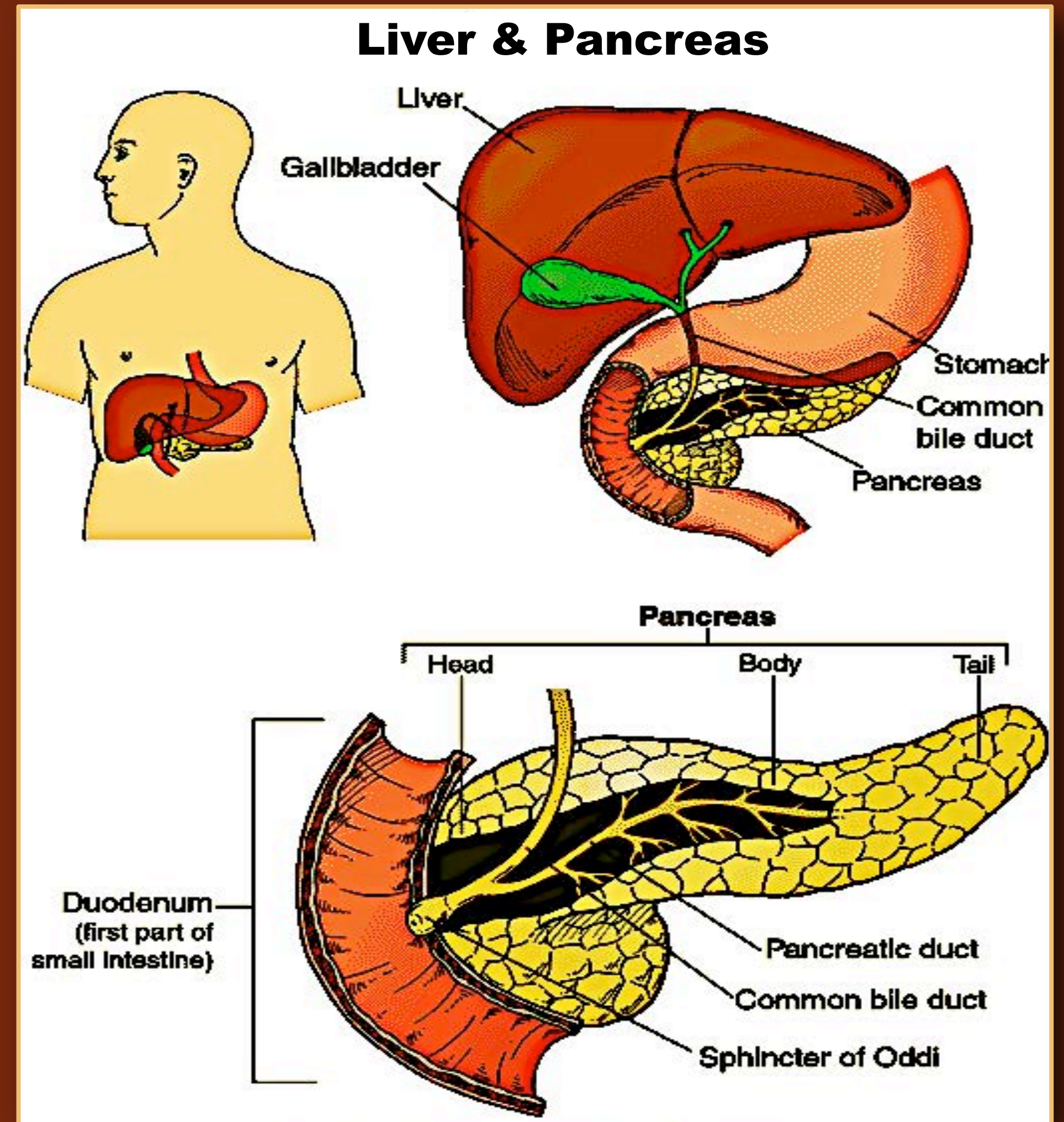
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Pancreatic Enzymes

- **5 different Proteases** completely digest **proteins** to individual **amino acids**



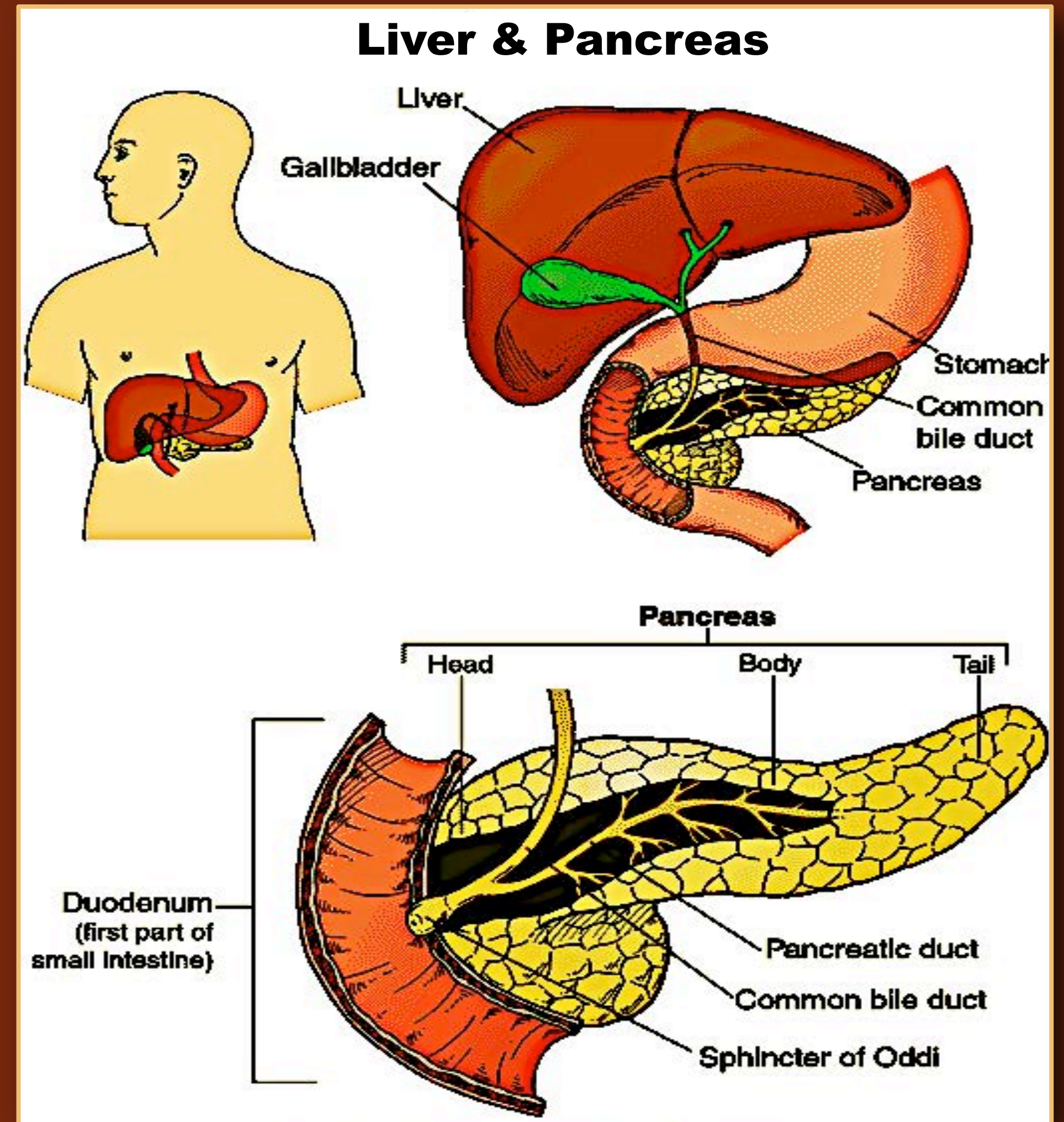
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 - each enzyme **recognizes** and **breaks** a *specific type* of “**peptide bond**”



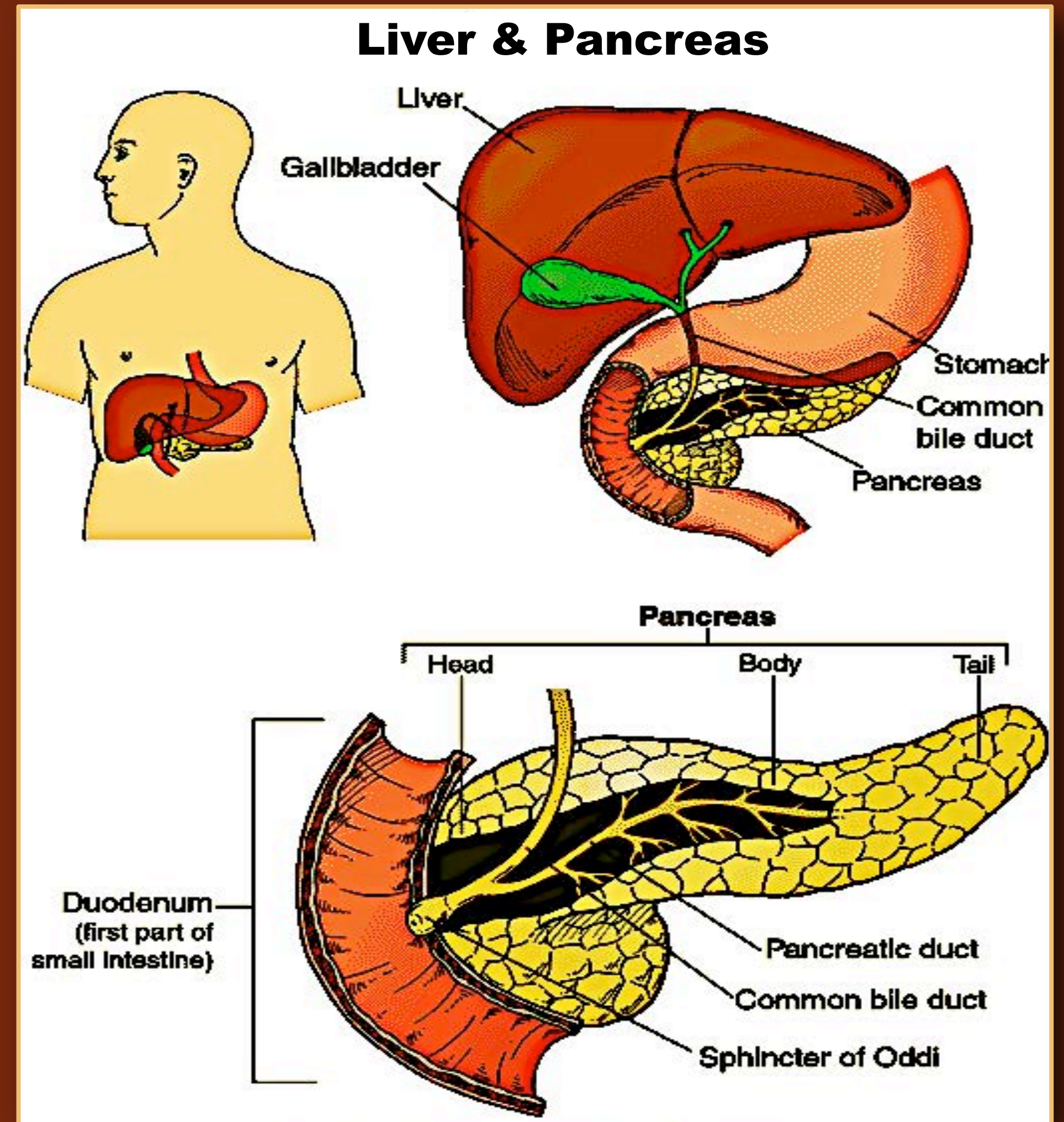
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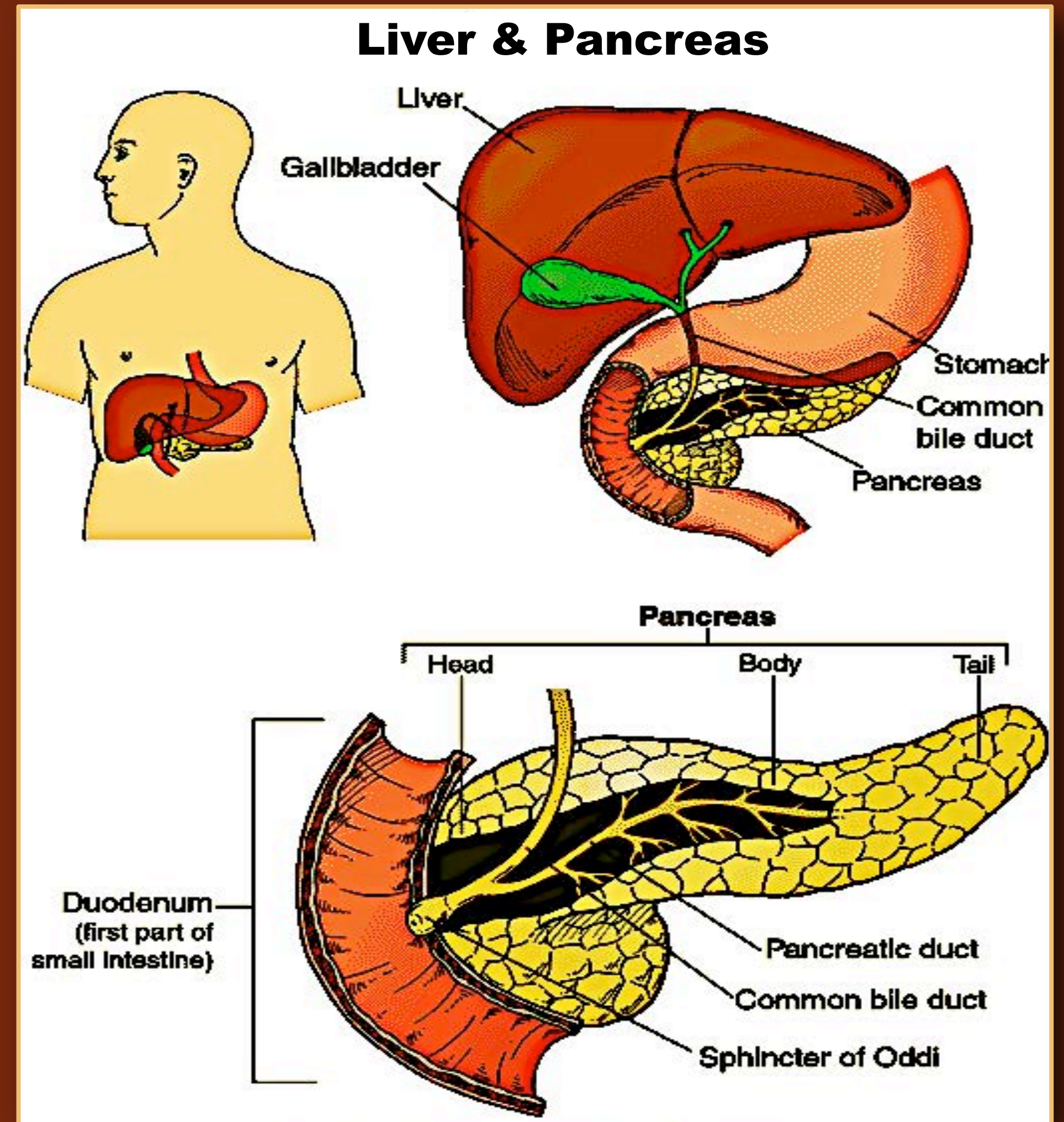
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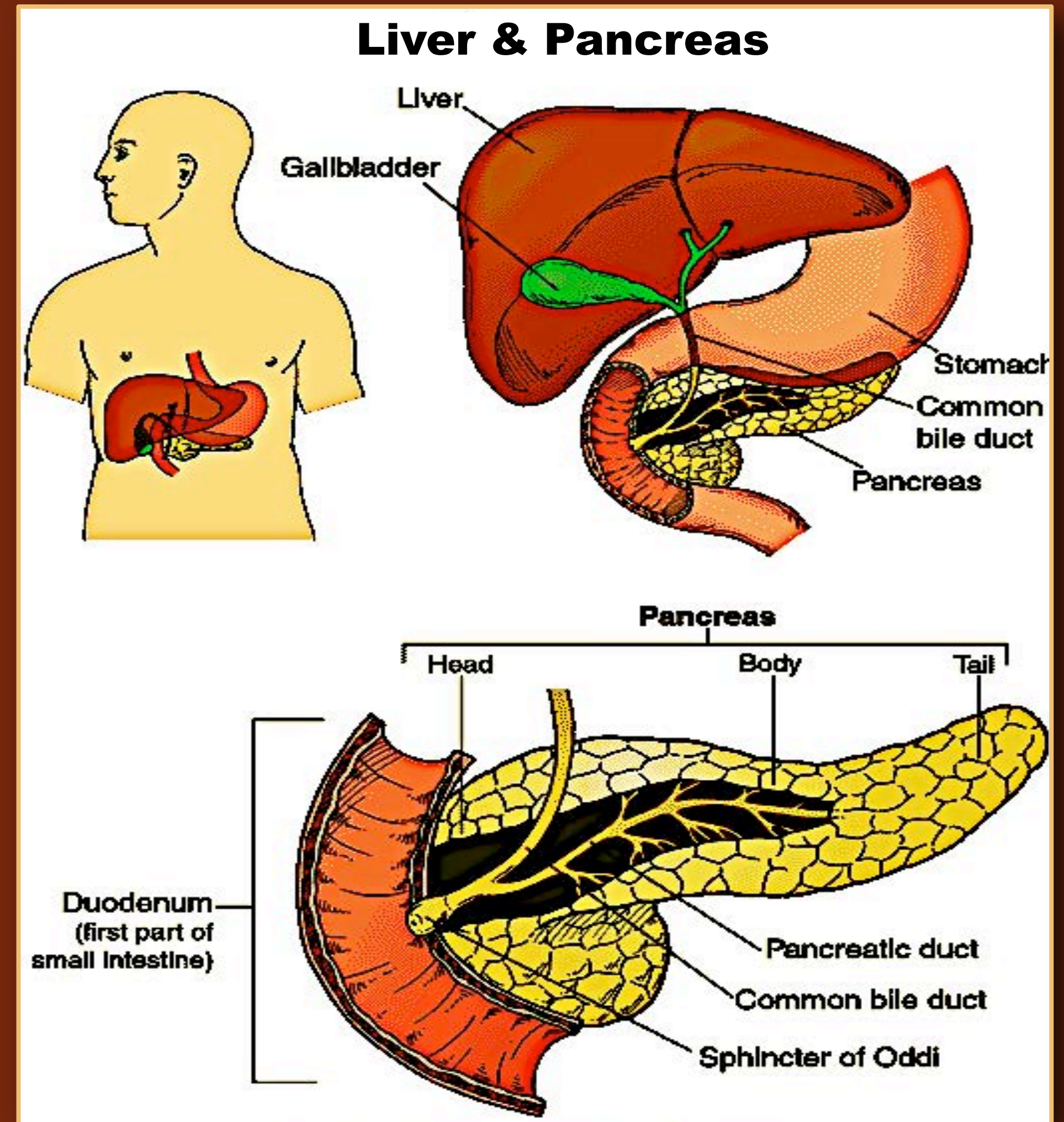
Phase I: “Enzymatic” Digestion

Bile

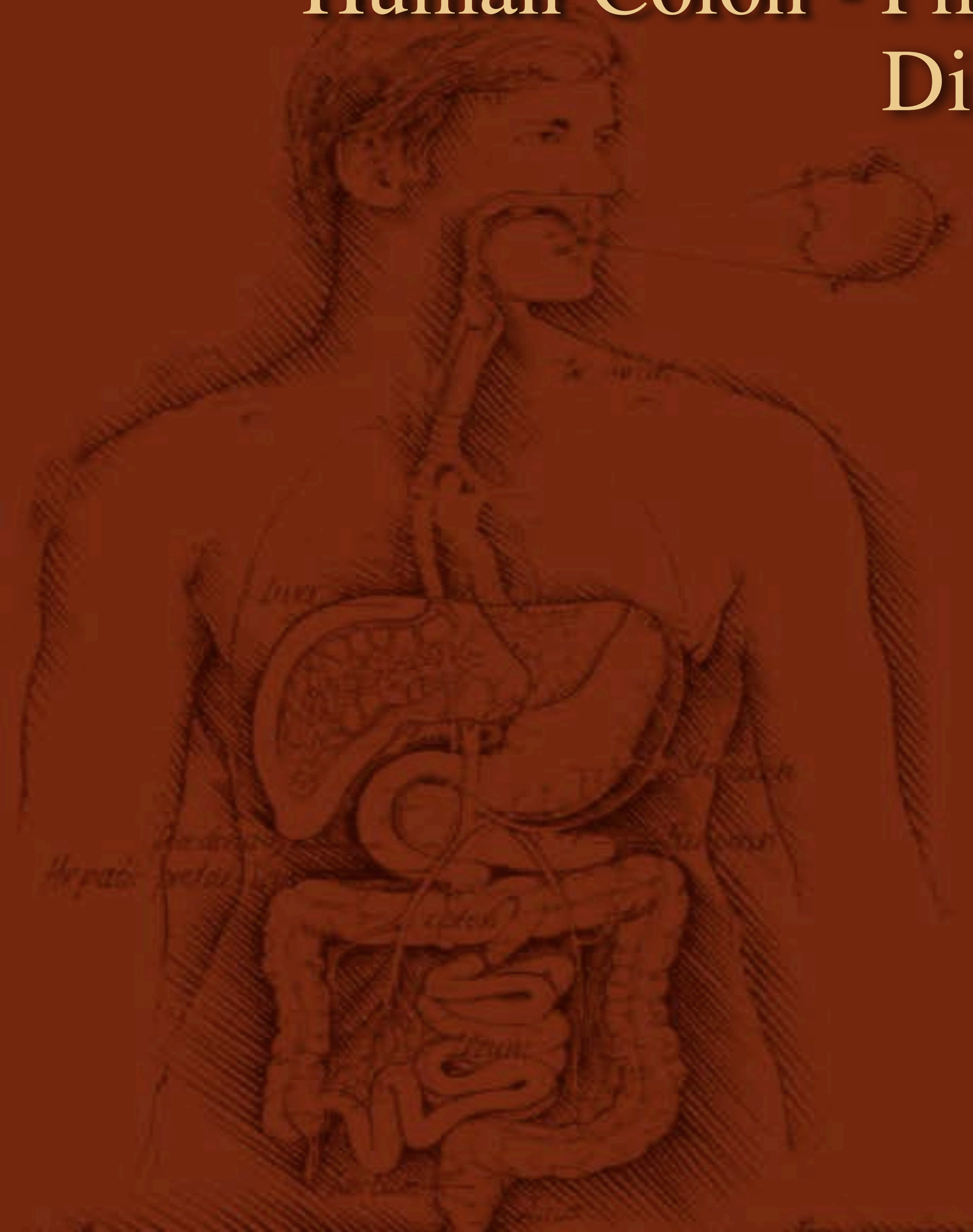
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Pancreatic Enzymes

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 - animal and plant proteins **differ** only in *relative proportions* of AA's and protein *structure* — **NOT** in *types* of bonds
- **Lipase** hydrolyzes TG's into FFA's
- **Amylases** and **Brush border** enzymes break **starchs** down into individual **sugar molecules**



Human Colon - Phase II: “Fermentation” Digestion



Human Colon - Phase II: “Fermentation” Digestion

The True “Paleo” Diet!



Fossilized Coprolites



Human Colon - Phase II: “Fermentation” Digestion



Fossilized Coprolites



The True “Paleo” Diet!

TOPICS IN DIETARY FIBER RESEARCH

CHAPTER 8

PALEODIETETICS: A REVIEW OF THE ROLE OF DIETARY FIBER
IN PREAGRICULTURAL HUMAN DIETS

Michael Kliks

Division of Entomology and Parasitology
University of California

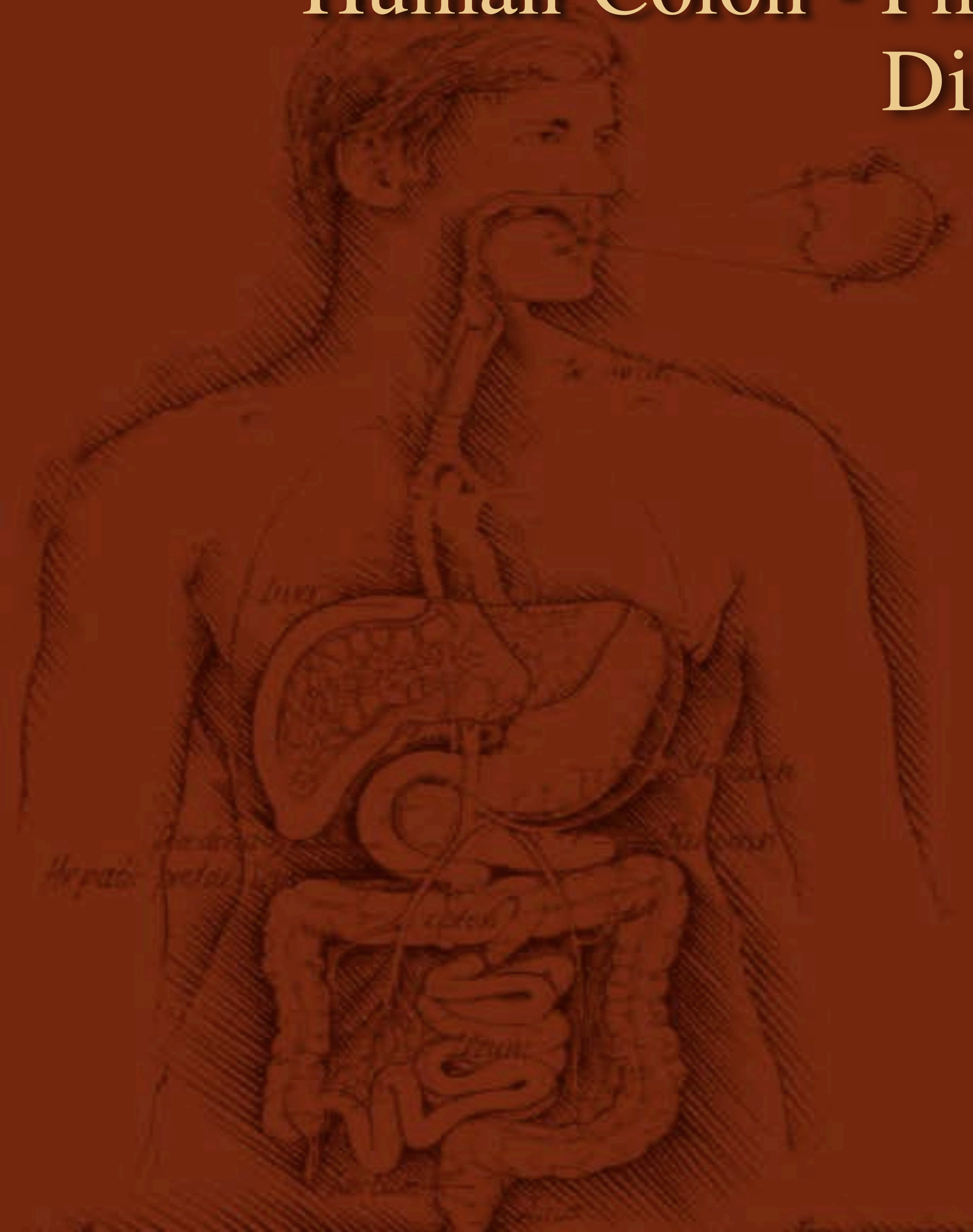
Berkeley, California

The role of dietary fiber in the preagricultural subsistence economy of early human populations strongly suggests that for over 99% of man's existence as a distinct species, his gastrointestinal tract has been exposed to the selective pressures exerted by a coarse, high-residue diet of plant tissues.

Syntex Research
Palo Alto, California

probably evolved over several hundred thousand generations in response to the continuous, selective pressures of a broadly based but consistently phytic diet (17, 19, 39). It is now apparent that during the last 20,000 years, the human diet has undergone a series of far reaching "revolutions," the overall trend of which has been away from a coarse, plant-based regime of foraged leafy greens, seeds, stalks, roots, flowers, and other tissues, to a more limited, often monotypic, diet based primarily on a few cereal grains, tubers, and legumes (Figure 1). The importance of the for-

Human Colon - Phase II: “Fermentation” Digestion



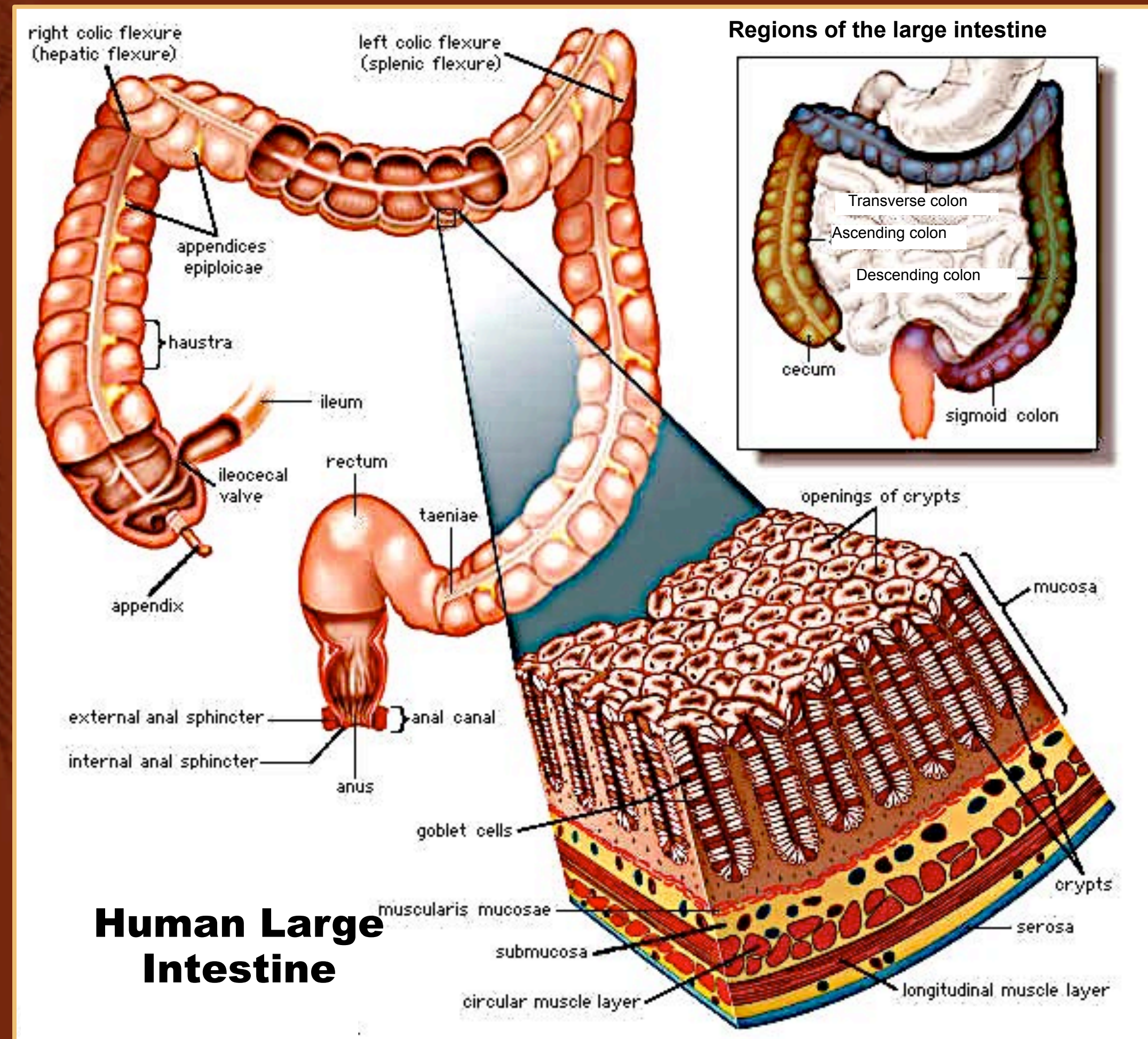
Human Colon - Phase II: “Fermentation” Digestion

- Extremely **long**
- **Pouched** structure
- Has an **Appendix**
- Primary functions:
 - **Ferment fiber** (Hind-gut fermentation)
 - Produce **Short Chain Fatty Acids** (SCFA's)
 - **Vitamin** production
 - Water absorption
 - Elimination



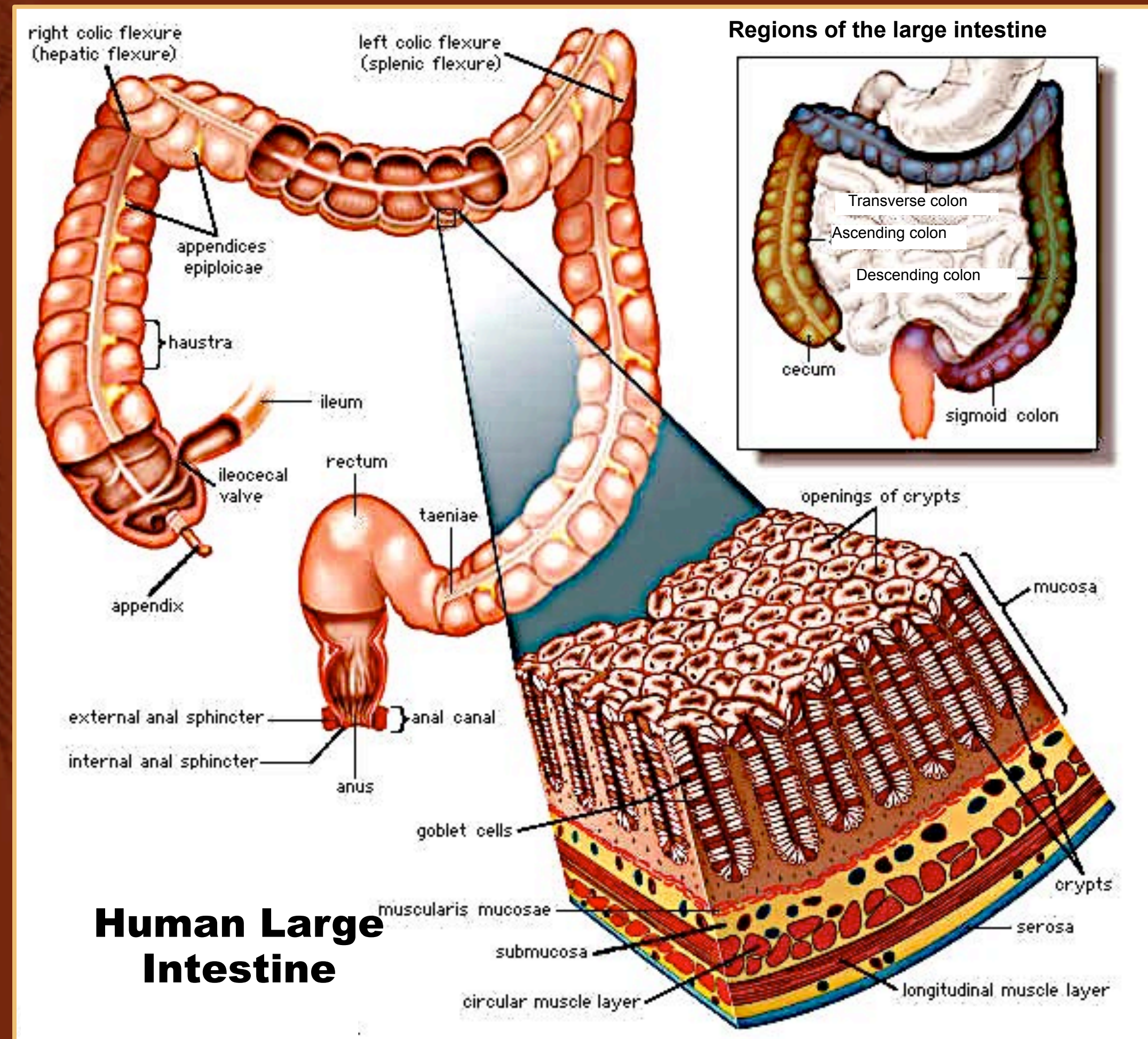
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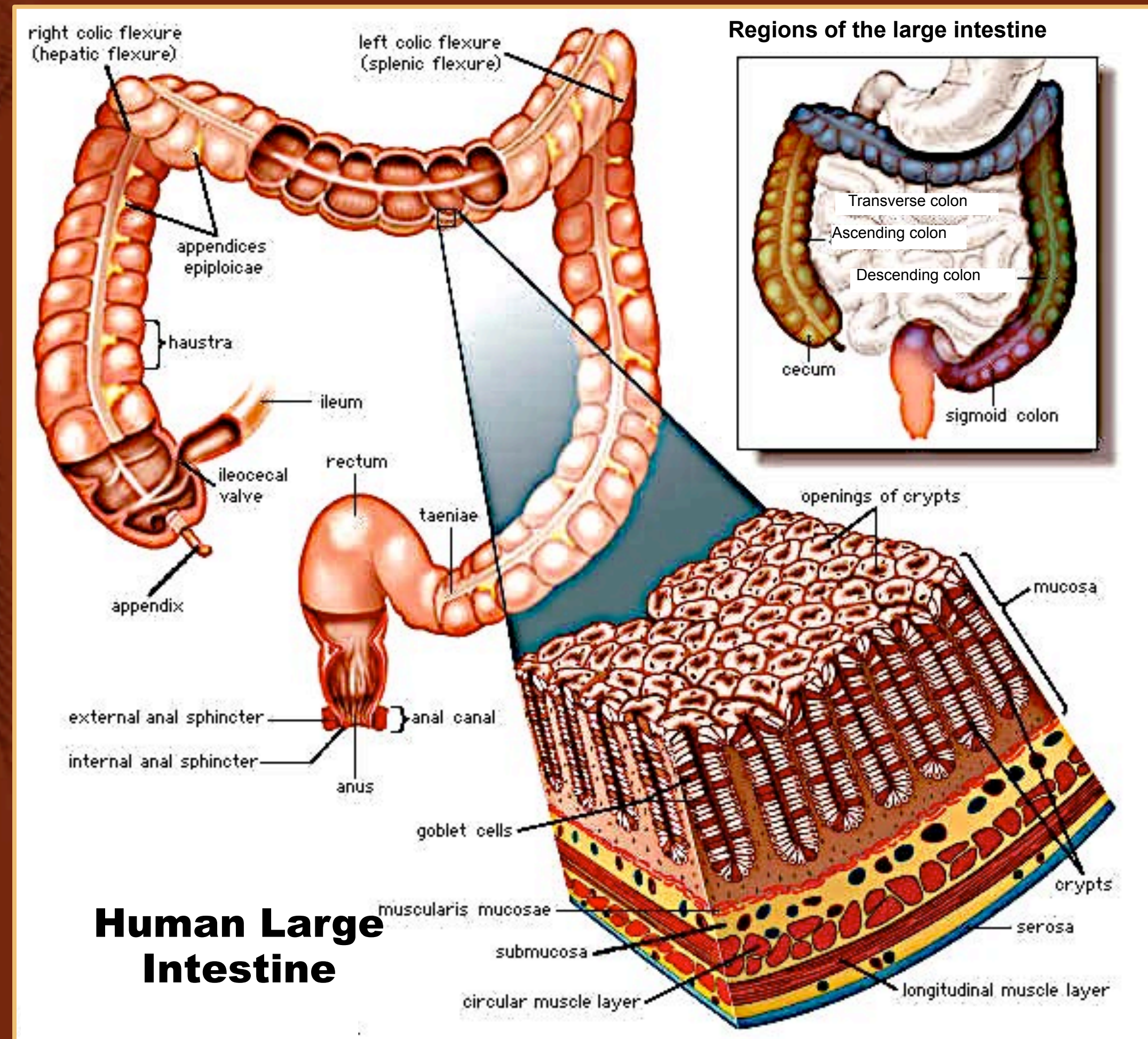
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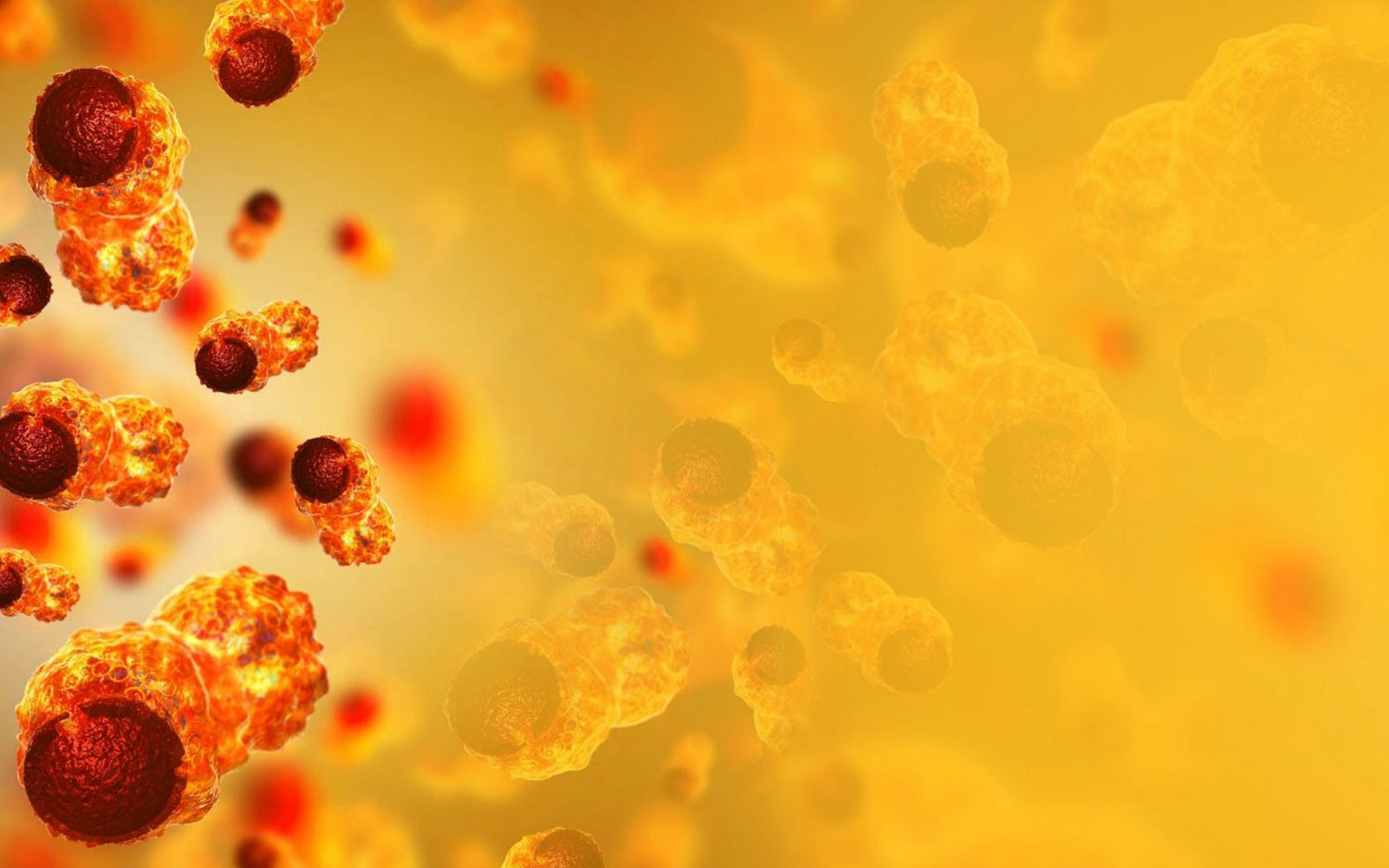
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- Food spends **more time in the colon** than the stomach and small intestine **combined!**
- Fermentation of fiber in the colon **generates SCFA's that are vitally important** to “normal” human physiology
- **Low fiber diets** predispose us to *a number of serious health problems and diseases*





Anti-Cancer Effect of Fibers

There Are Two “**Types**” — but Many *Varieties* of Fiber

Water Soluble Fibers

Gums	Pectins	Mechanism
Oatmeal Oat Products Dried Beans Legumes Lentils Peas Okra Squash	Squash Apples Citrus fruits Cauliflower Green beans Cabbage Dried peas Carrots Strawberries Potatoes	Decreases blood cholesterol by binding with cholesterol-containing bile acids in the gut, preventing re-absorption. Also, delays glucose absorption and gastric emptying, thus facilitating better control of blood sugar level. Protective against: Heart Disease Diabetes IBS/Colitis Cancers

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Celluloses	Hemicelluloses	Mechanism
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Fiber Consumption and Breast Cancer Incidence: A Systematic Review & Meta-Analysis of Prospective Studies *Farvid Maryam, et al., Cancer Month* 0, 2020; DOI: 10.1002/CNCR.32816

Anti-Cancer Effect of Fibers

“The majority of polyphenol phytonutrients may be bound to fiber, helping to explain the marked difference in health impacts between whole fruit and fruit juice.”



nutritionfacts.org/video/juicing-removes-more-than-just-fiber

N NutritionFacts.org

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— but
over

mechanism

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Increases concentration of
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Colon cancer
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Dysbiosis

“Inadequate consumption of prebiotics—the fiber and resistant starch concentrated in unprocessed plant foods—can cause a disease-promoting imbalance in our gut microbiome.”



Dysbiosis

- “**Dysbiosis**” is a term for a pathological **microbial imbalance** or **maladaptation** inside the body.

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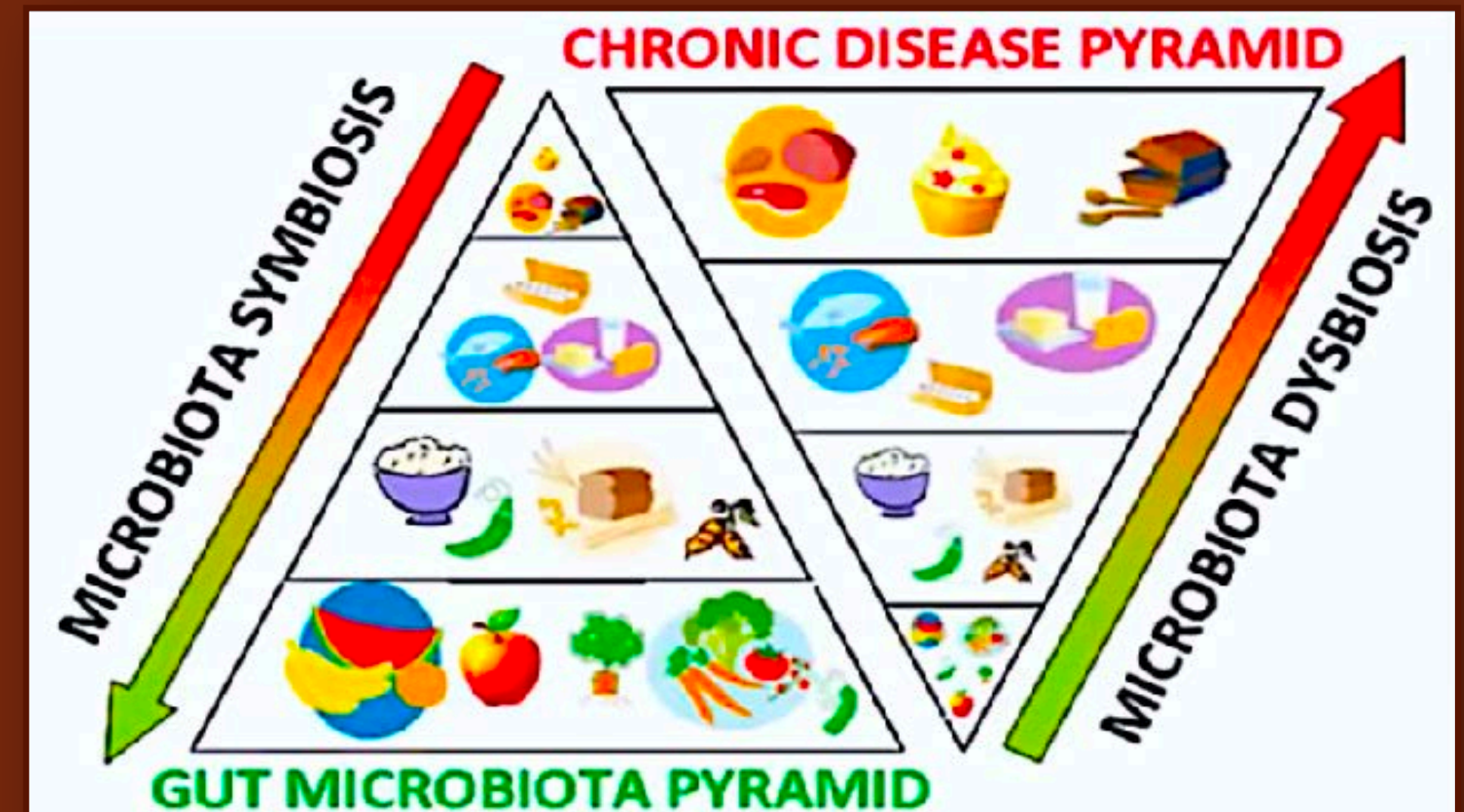


Fig. 1. (colour online) A schematic representation of how diet shapes the human gut microbiota and impacts on chronic disease risk.

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nutritionfacts.org/video/gut-dysbiosis-starving-microbial-self



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- Dysbiotic bacteria can “**re-toxify**” carcinogens by **reversing the detoxification actions** of *Broccoli-stimulated detox enzymes*.

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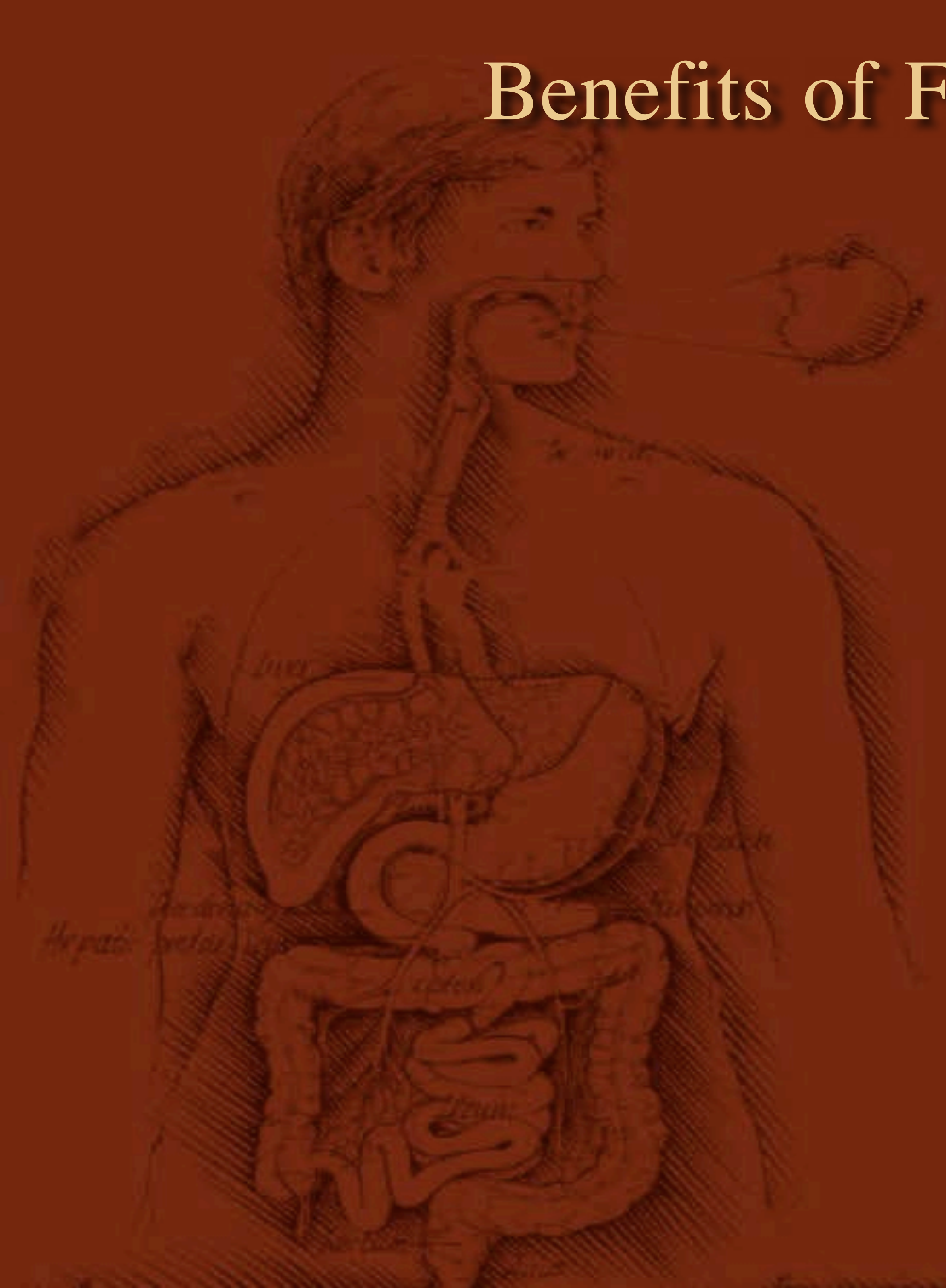


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- One month on a PBD will **increase** populations of **healthy bacteria** and **reduce** pathogenic species.
- Studies show this **changeover results in reduced intestinal inflammation** which result in *improved metabolic and immunologic parameters*.
- By contrast, **anerobic degradation of animal protein residues is “putrefaction”** and generates multiple **toxic** compounds.
- **Animal food-associated bacteria** can **directly injure the mucosal barrier** thereby causing **leaky gut phenomena**.
- Dysbiotic bacteria **influence tumor progression** via **chronic inflammation; altering tumor micro-environment; and by** generating toxic bile acid metabolites and other bacterial antigens and toxins that can **increase cancer risk**.
- Chronic inflammation **increases** cancer risk, tumorigenesis and tumor growth through *elevated cytokines, chemokines and bacterial antigens/toxins*.
- **Dysbiosis** has been shown to be **associated** with **Gastric cancer, Colorectal cancer, Prostate and Breast cancer**.

Benefits of Fiber Fermentation



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Activation of **Phytoestrogens & Lignans**



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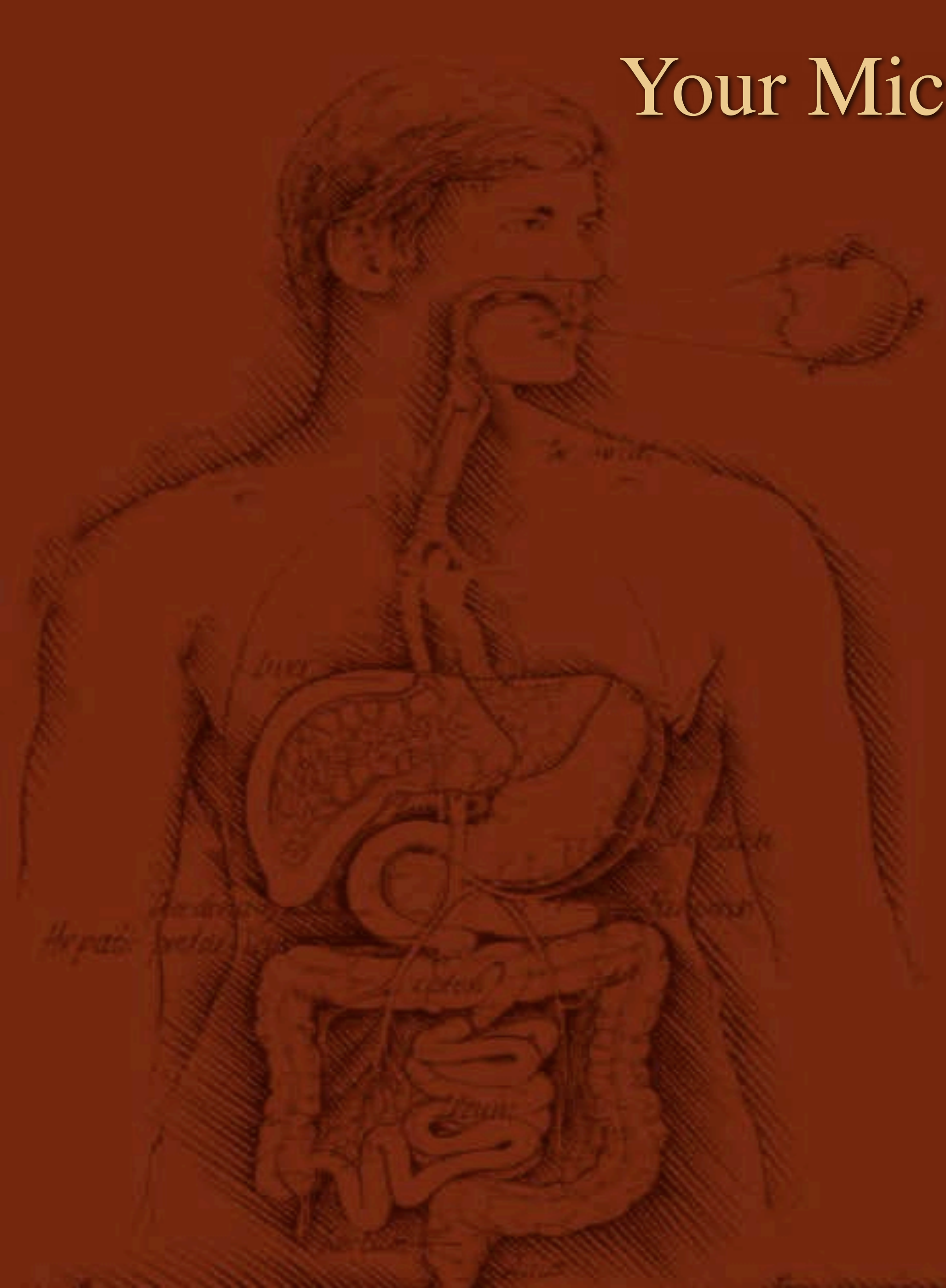
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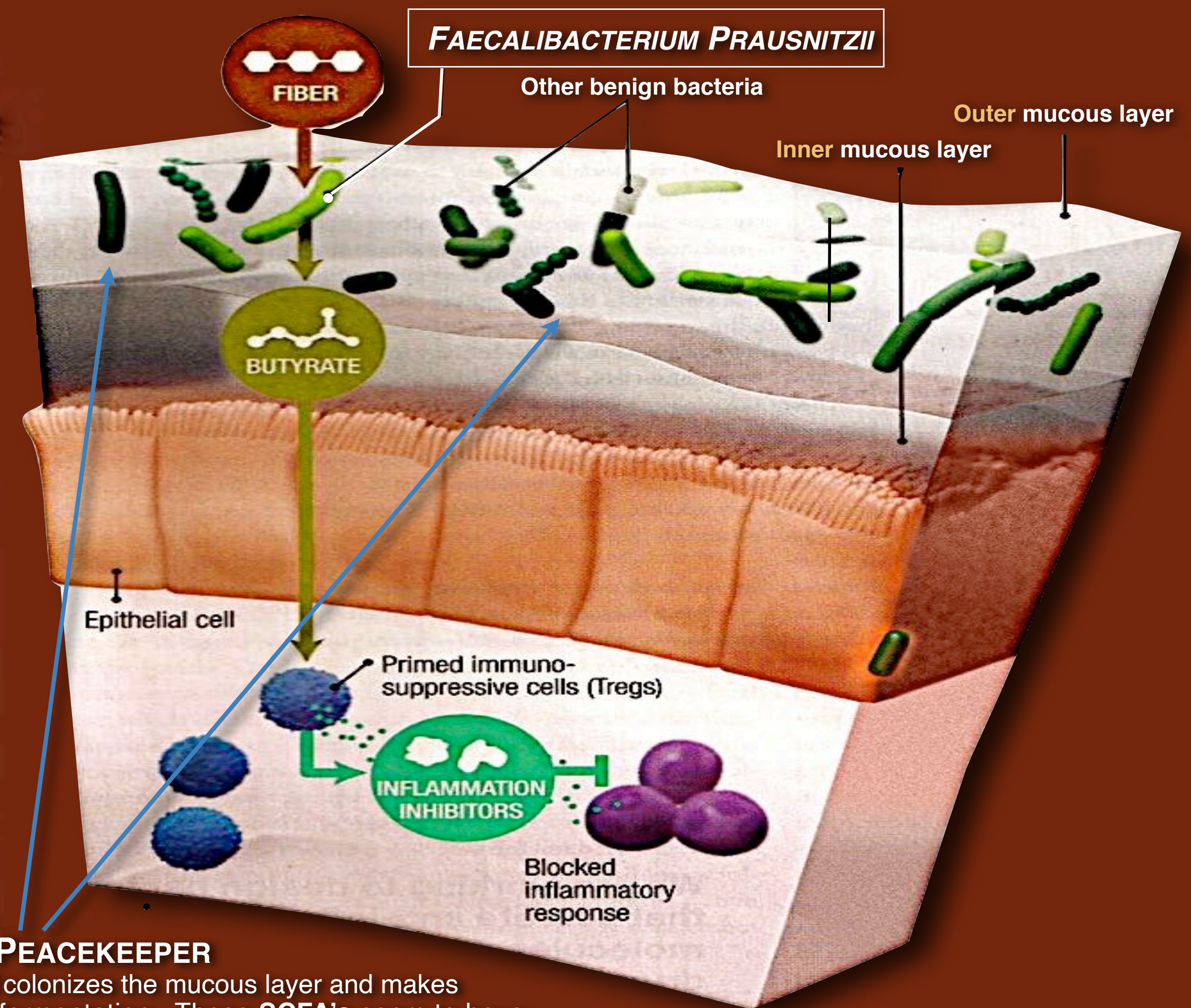
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- Bacterial strains that are **most effective at activating PE's** are **those associated with plant-based diets**



Your Microbes At Work



Your Microbes At Work



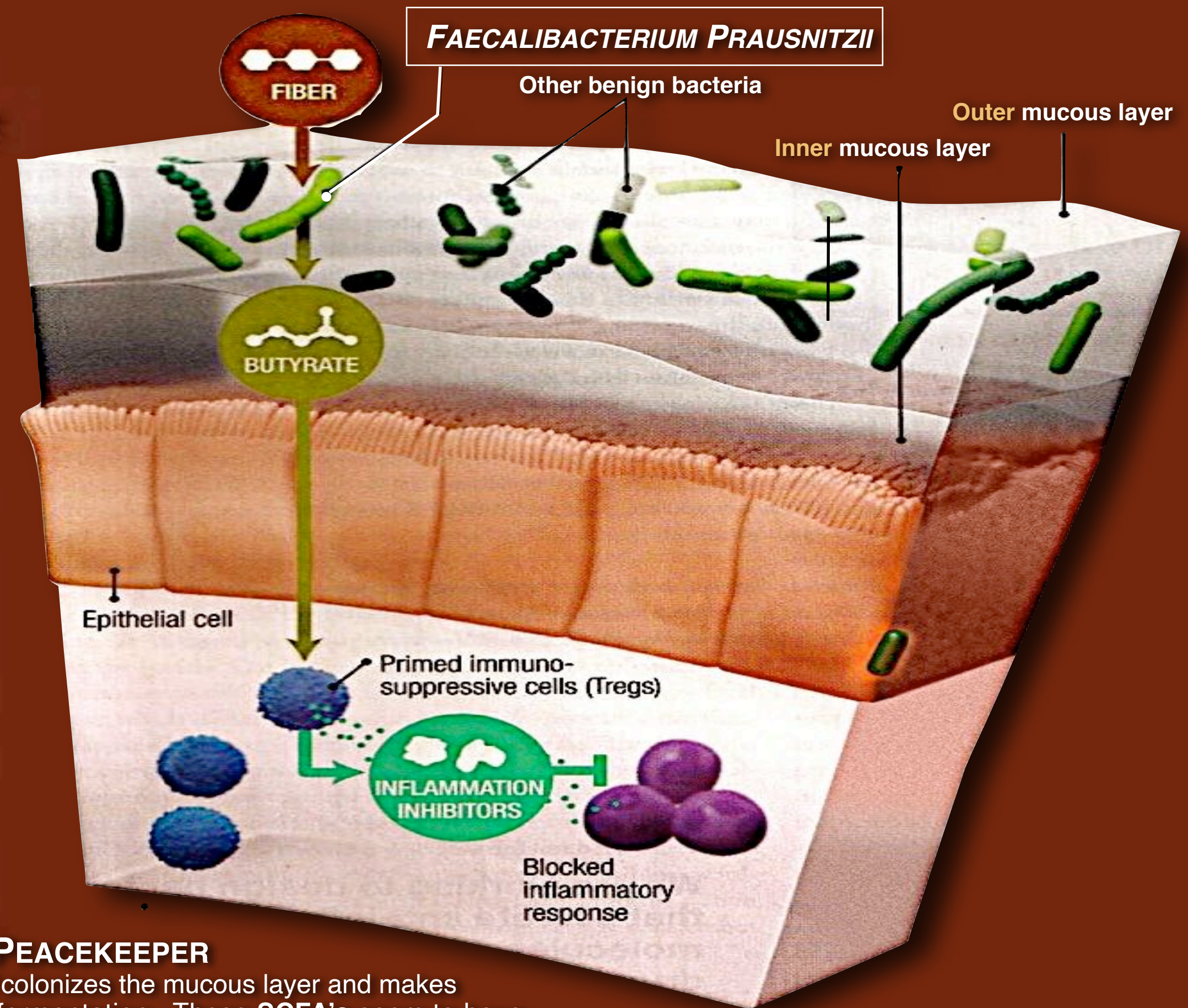
RESIDENT PEACEKEEPER

F. prausnitzii colonizes the mucous layer and makes **Butyrate** via fermentation. These **SCFA's** seem to have an **anti-inflammatory effect** by inducing **regulatory T cells** (Tregs), which in turn control aggressive aspects of the immune system. The **absence** of *F. prausnitzii* and other microbes that perform similar functions **often correlates with diseases** such as **IBD** and **obesity**. Related bacteria called **clostridial clusters** have similar properties.

Bollrath, J et al. Science
Vol. 341: August 2013

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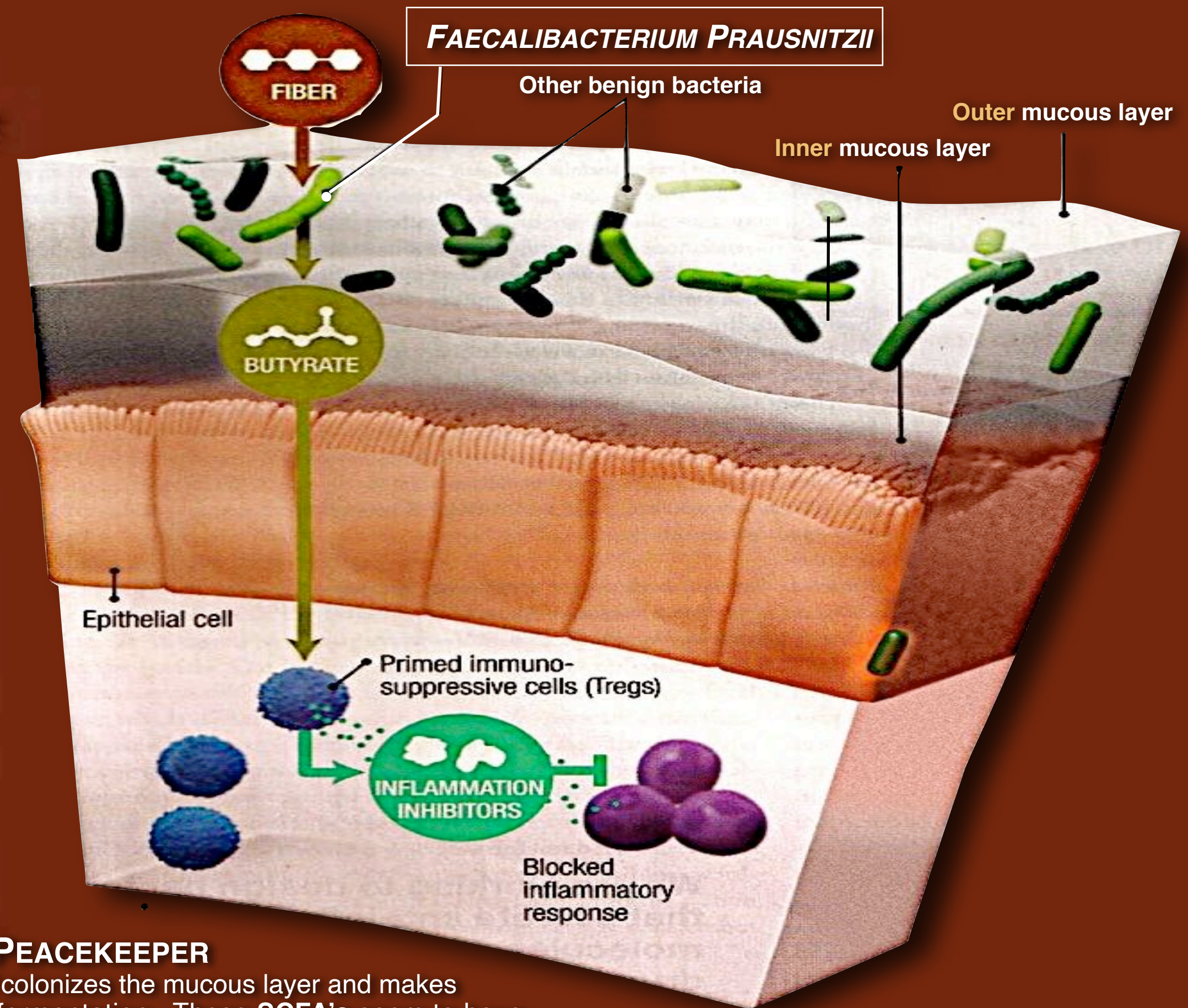
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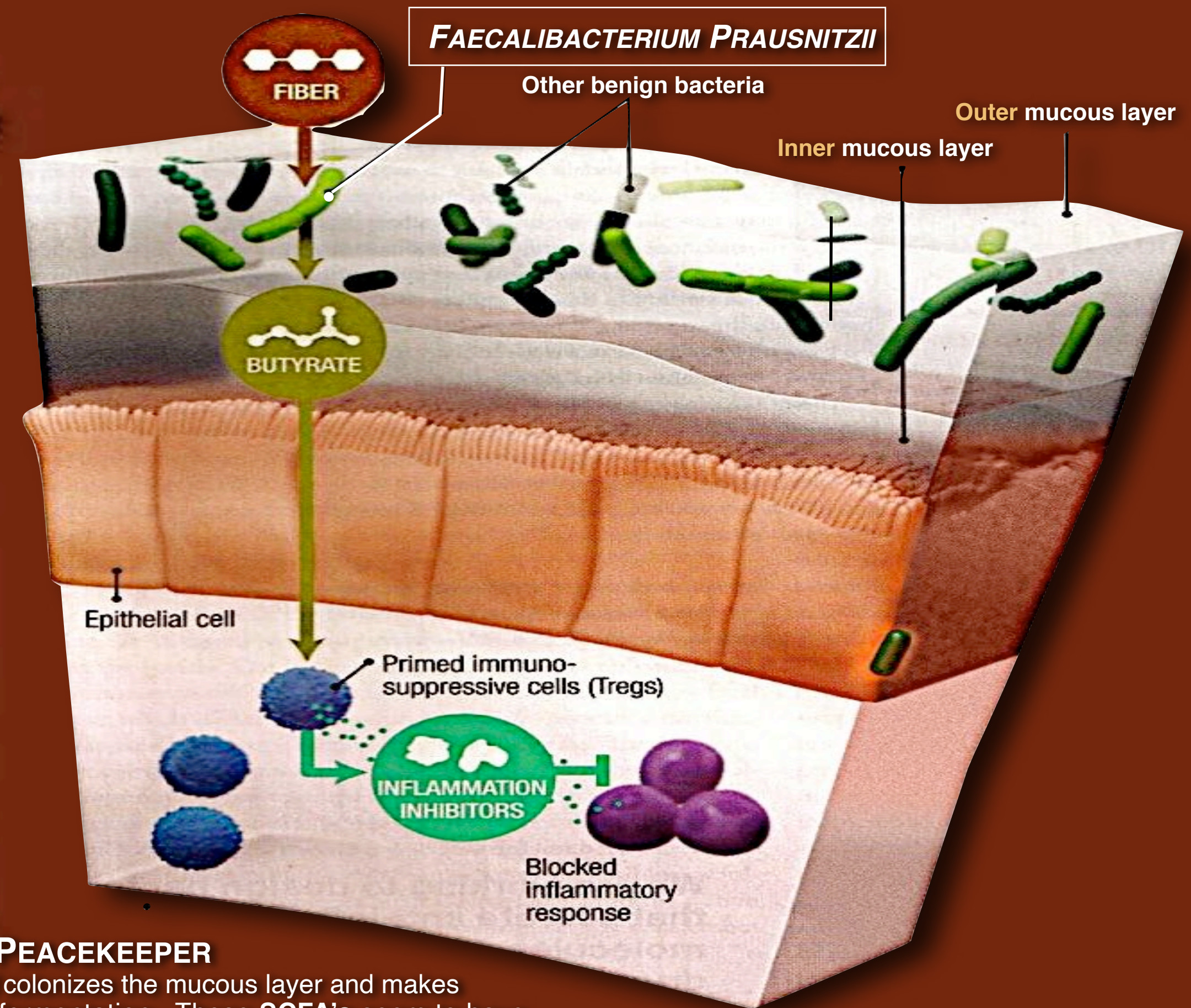
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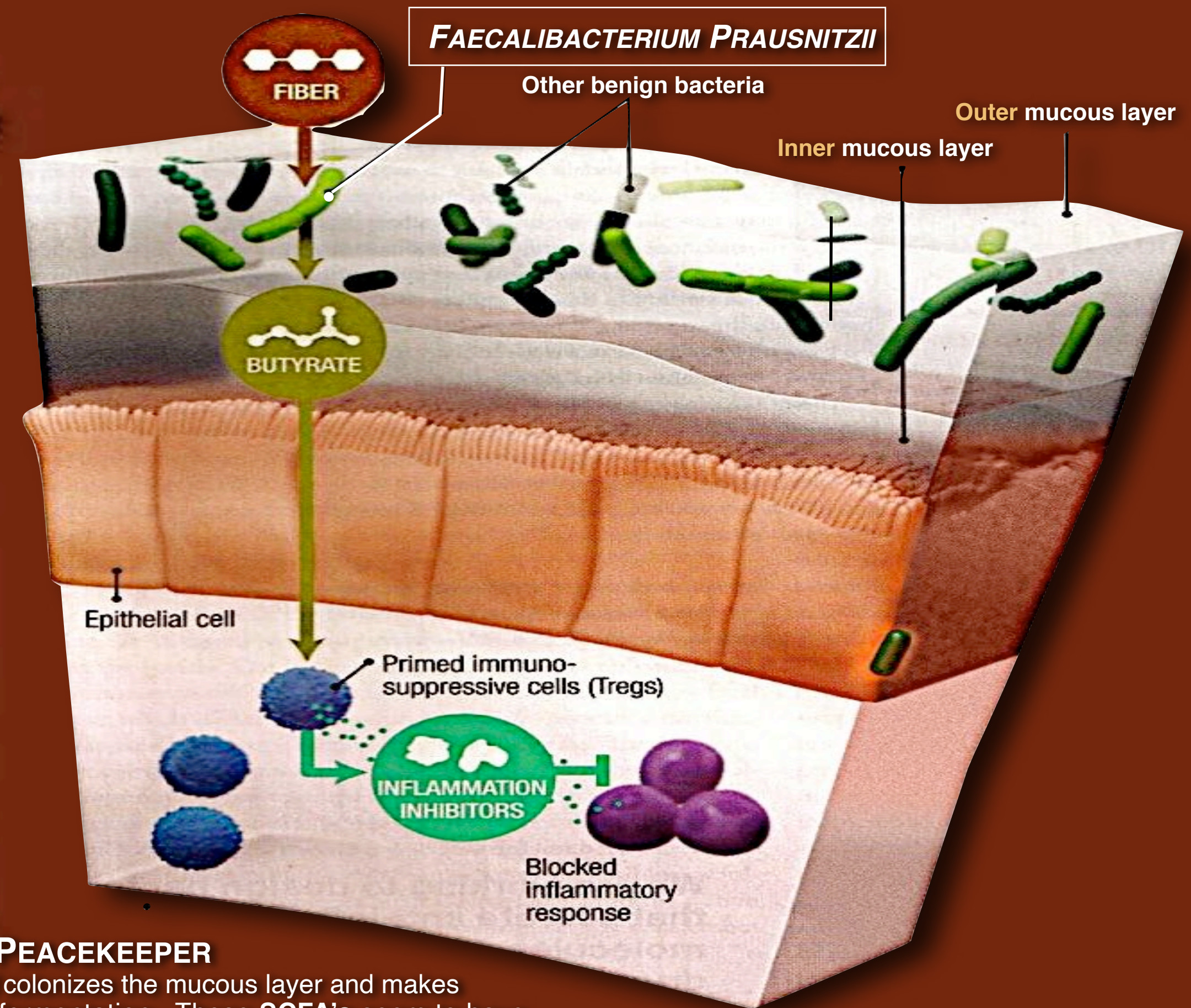
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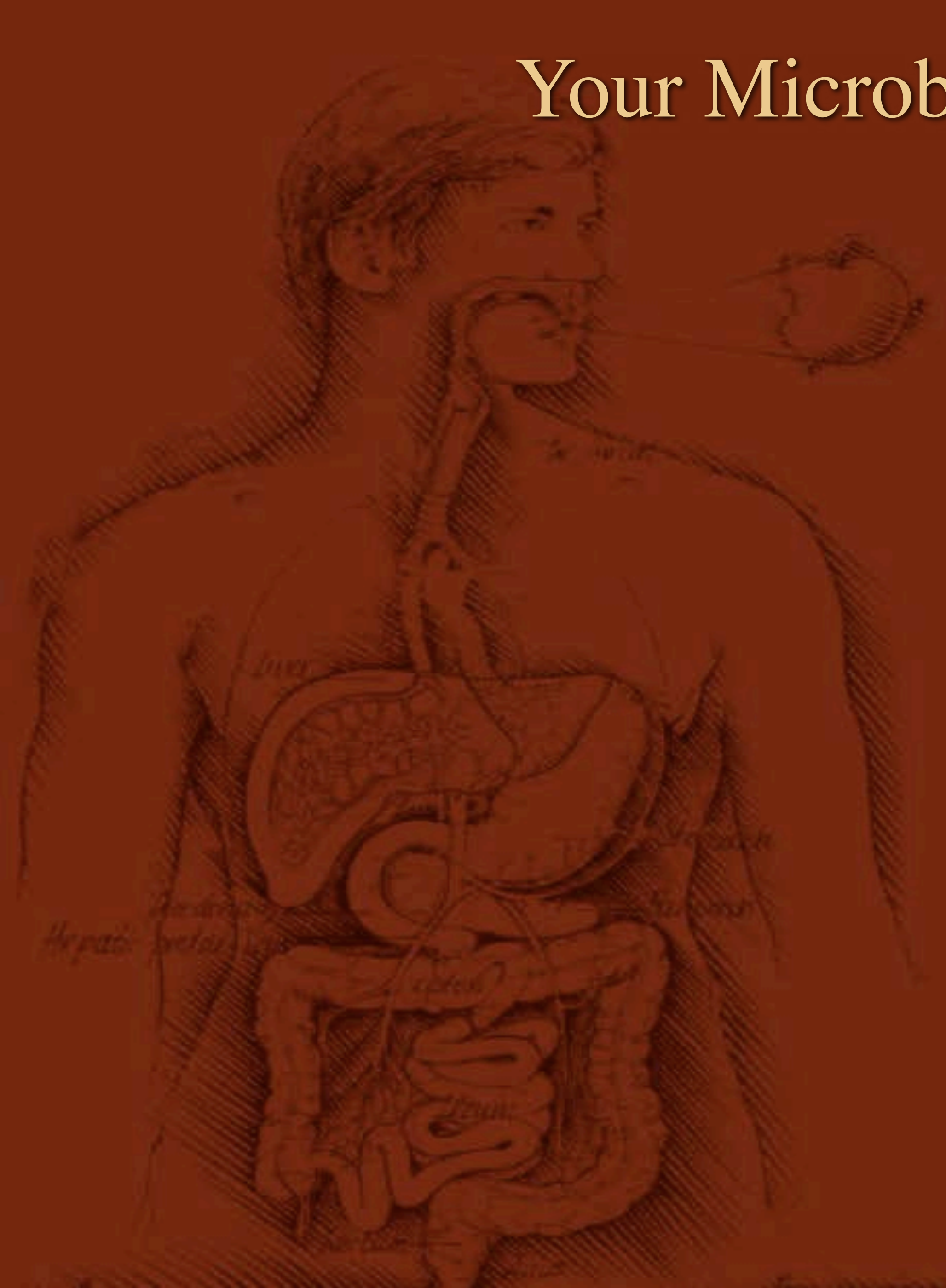


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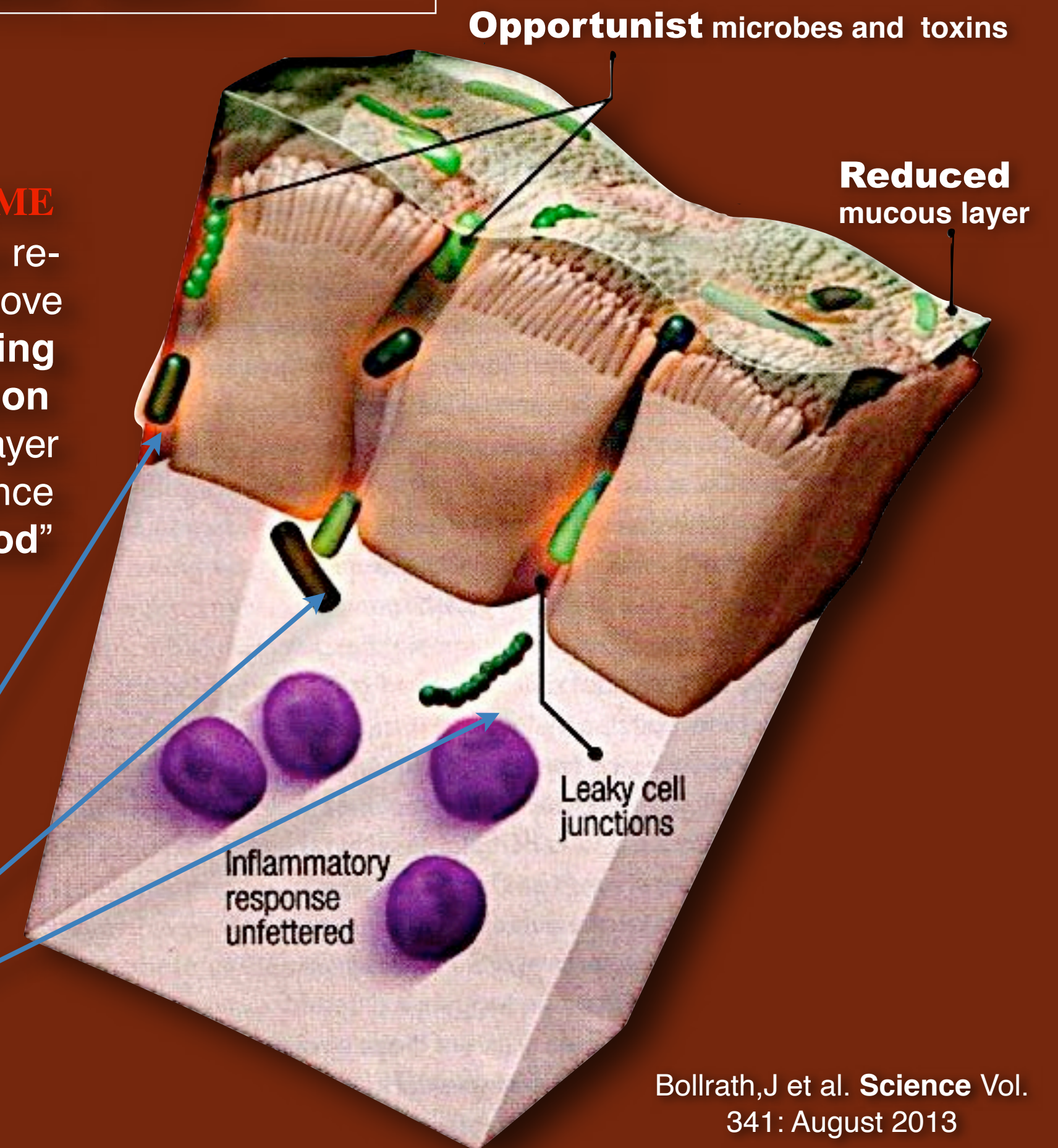


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DISRUPTED MICROBIOME

When the **mucous layer** is reduced, **opportunists** can move close to the gut lining **inciting inflammation**. **Fermentation of fiber** keeps the mucous layer **intact**. So does the presence of **specific strains of “good” bacteria**.



“**LEAKY GUT**” MECHANISM

Bollrath, J et al. **Science** Vol.
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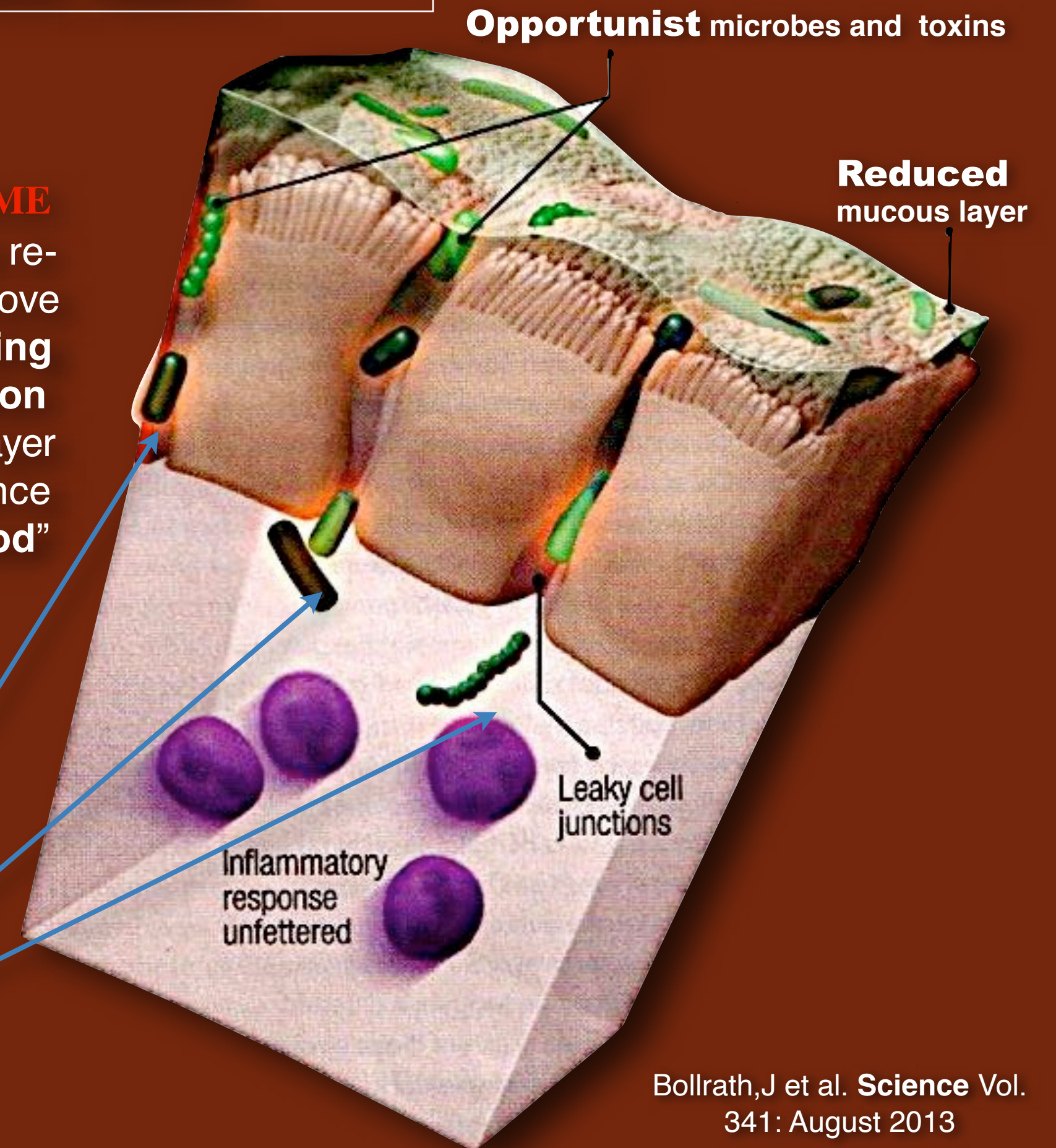
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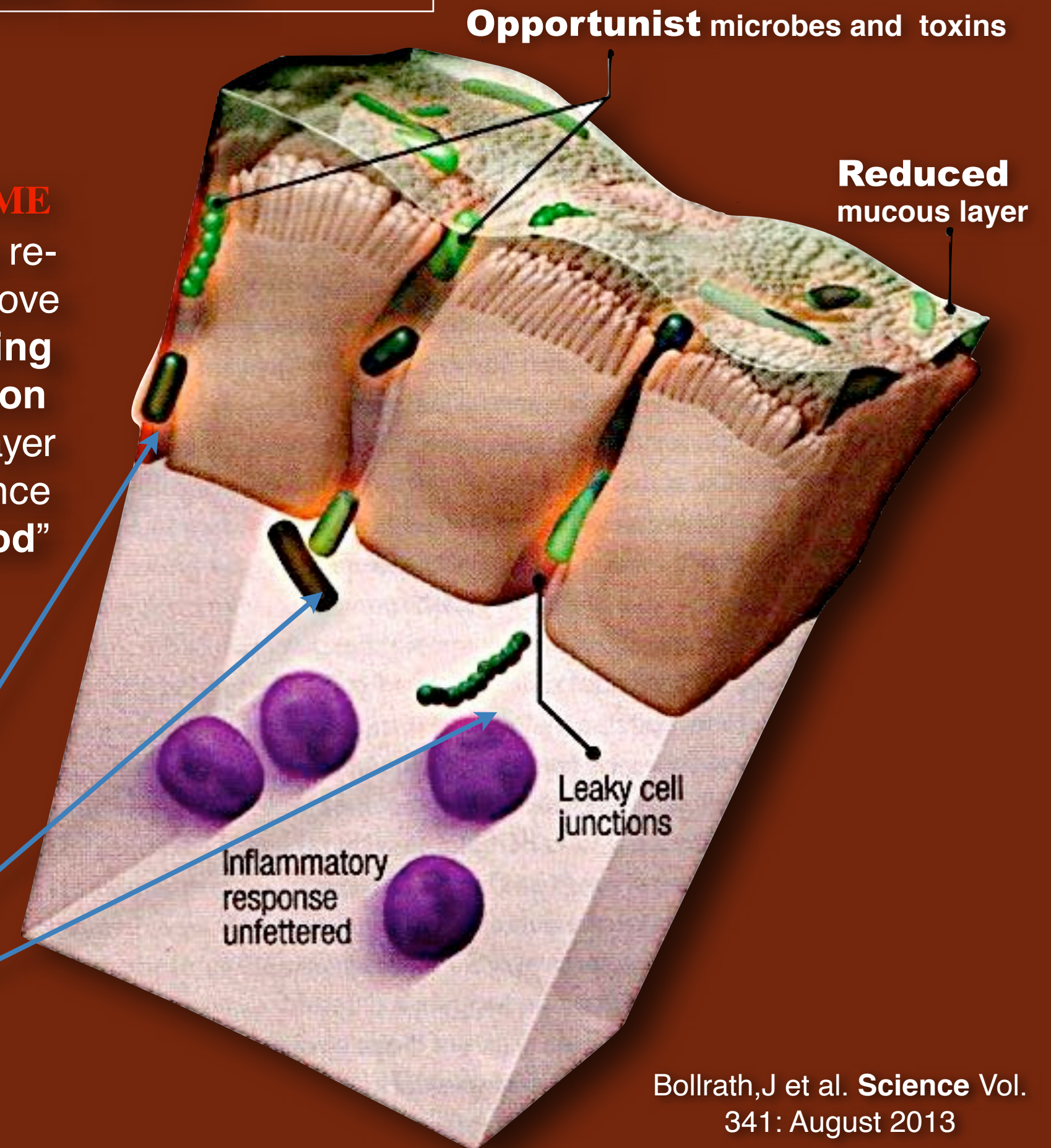
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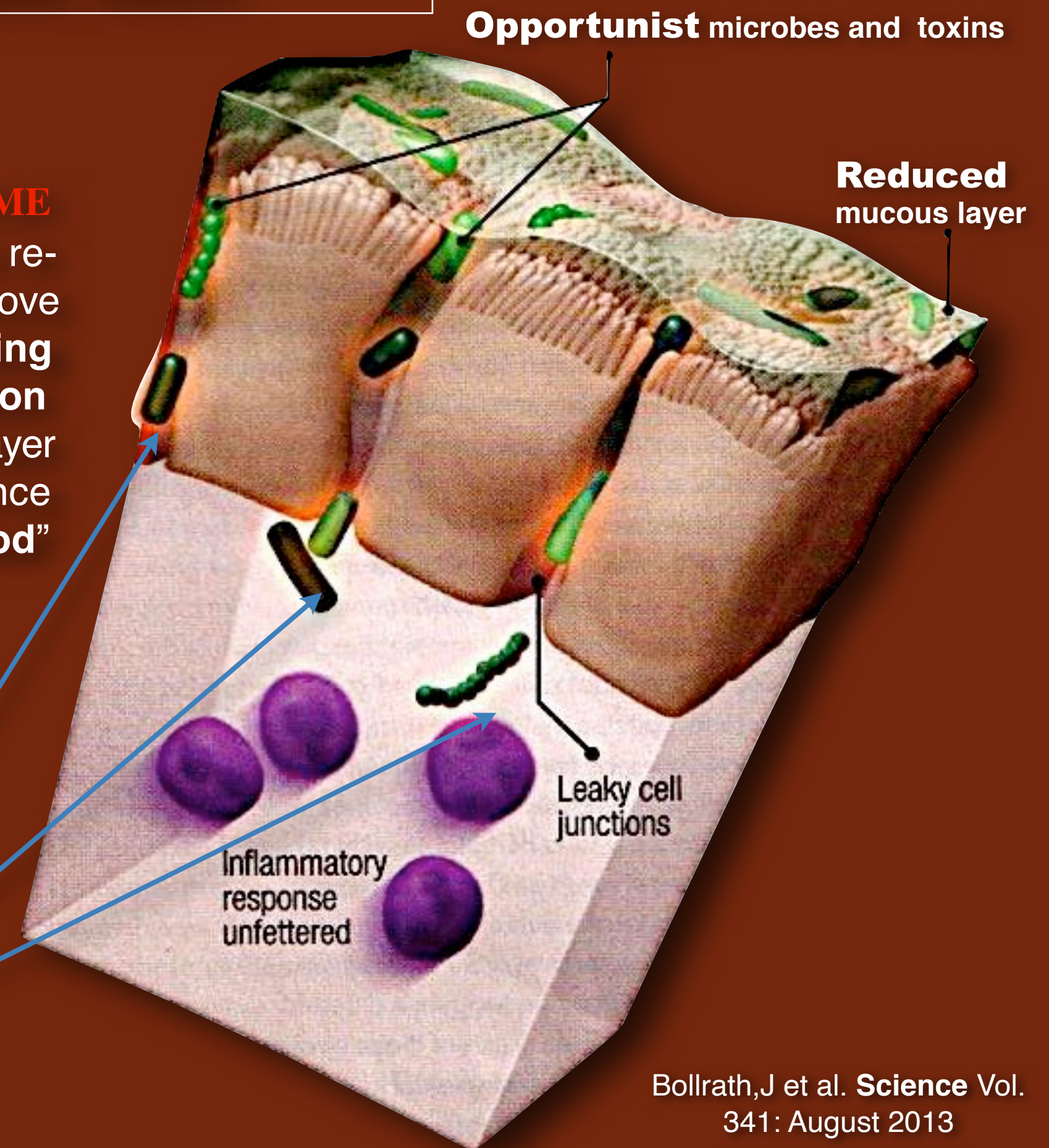
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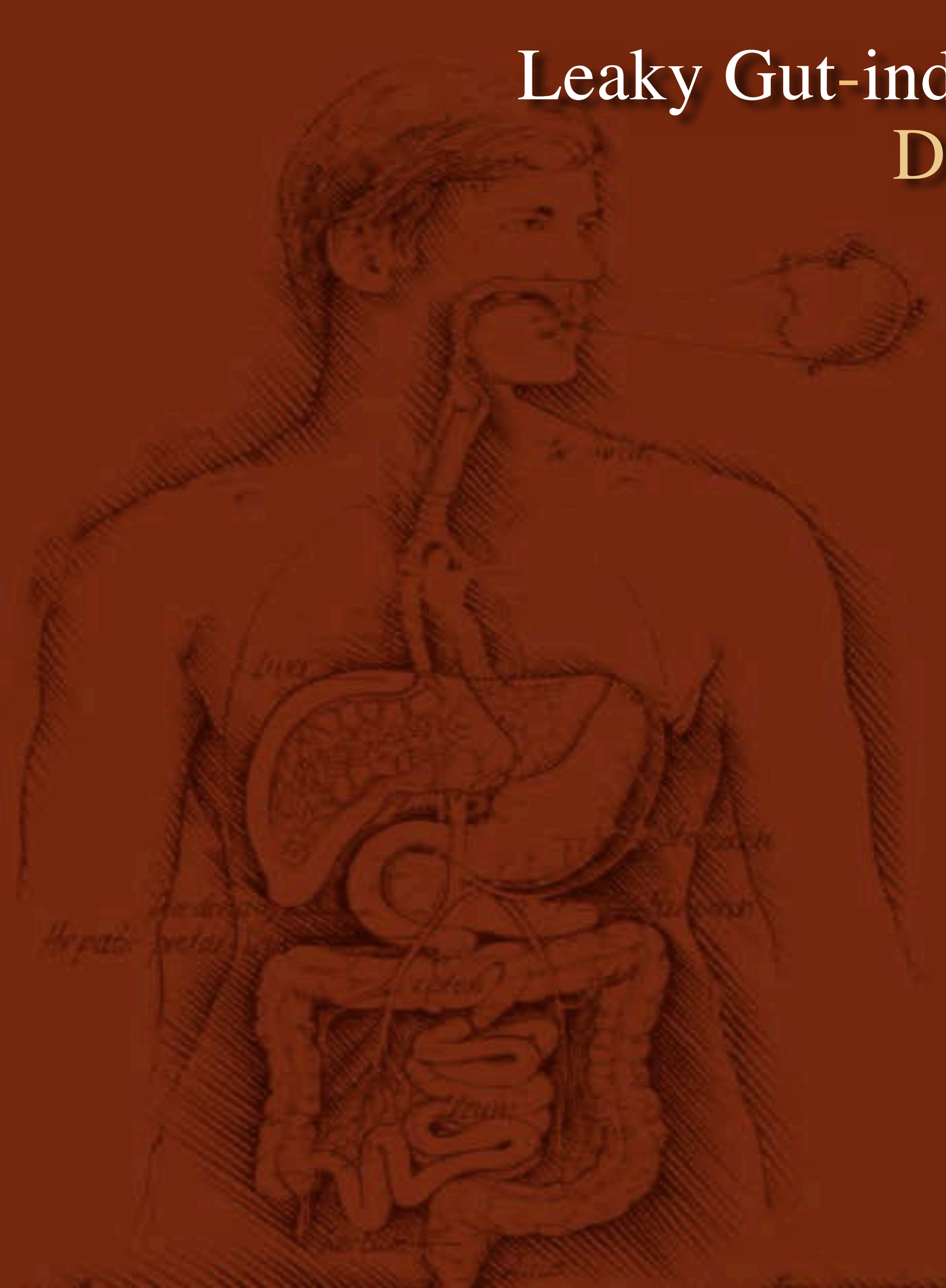
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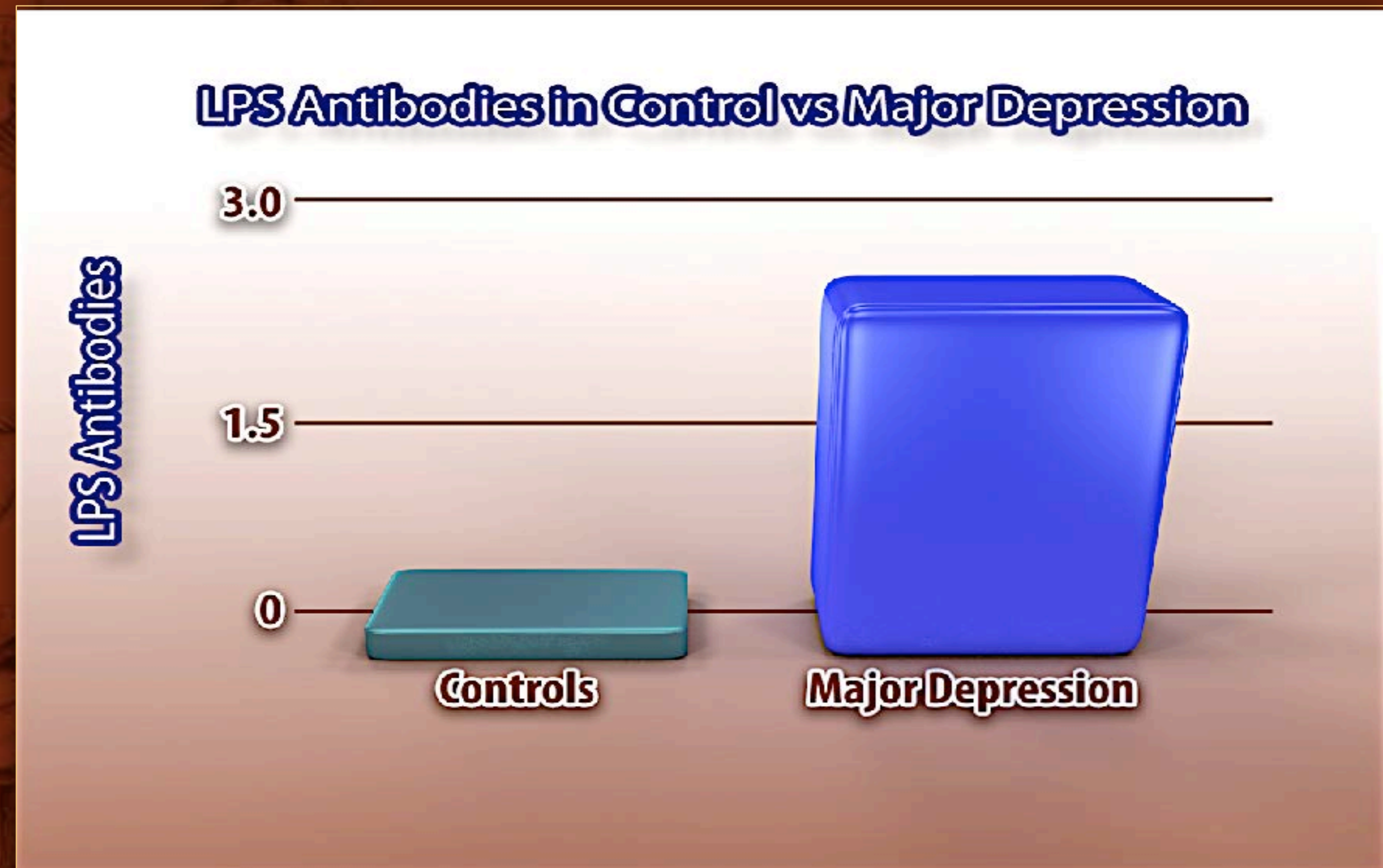


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Leaky Gut-induced Inflammation & Depression

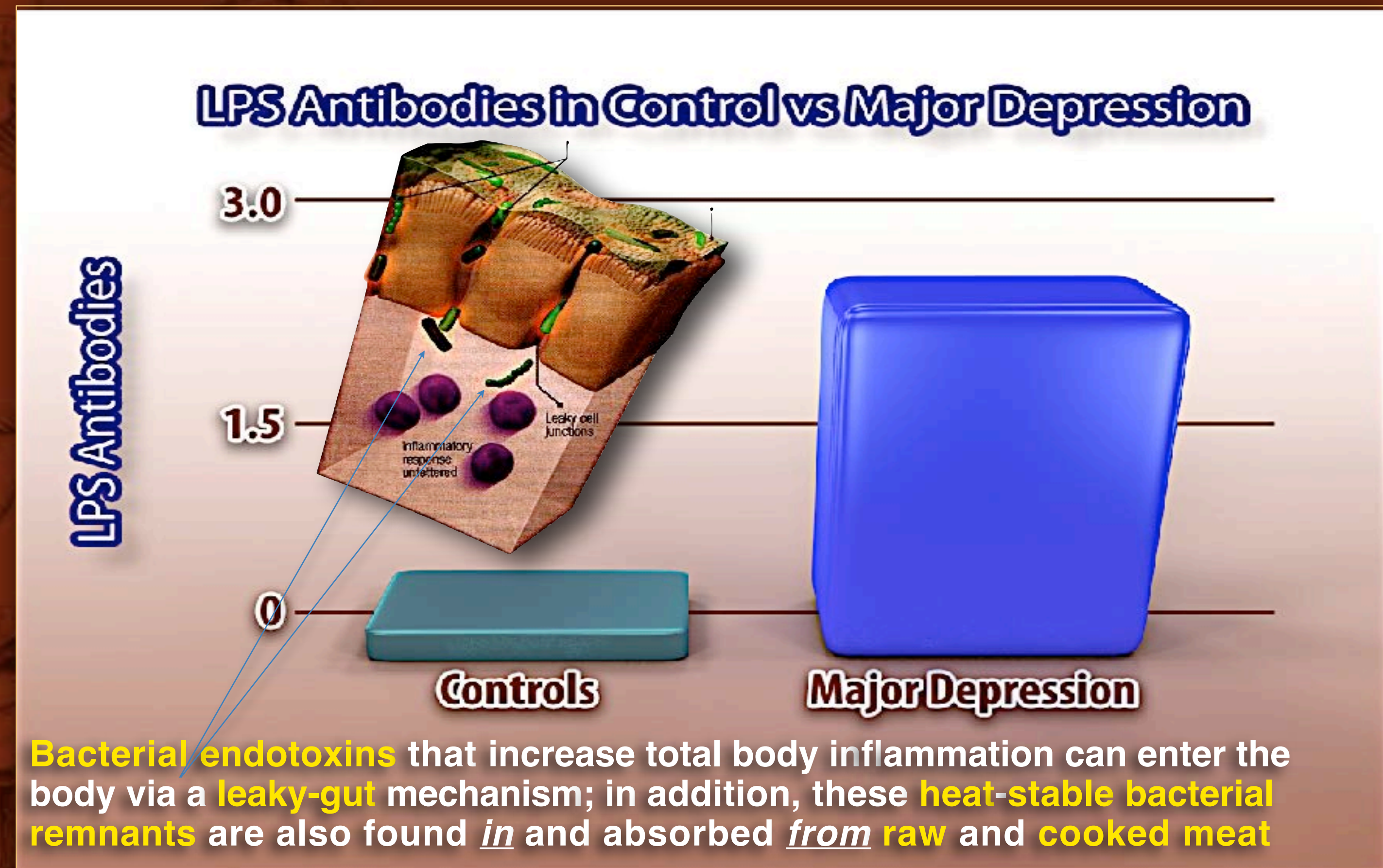


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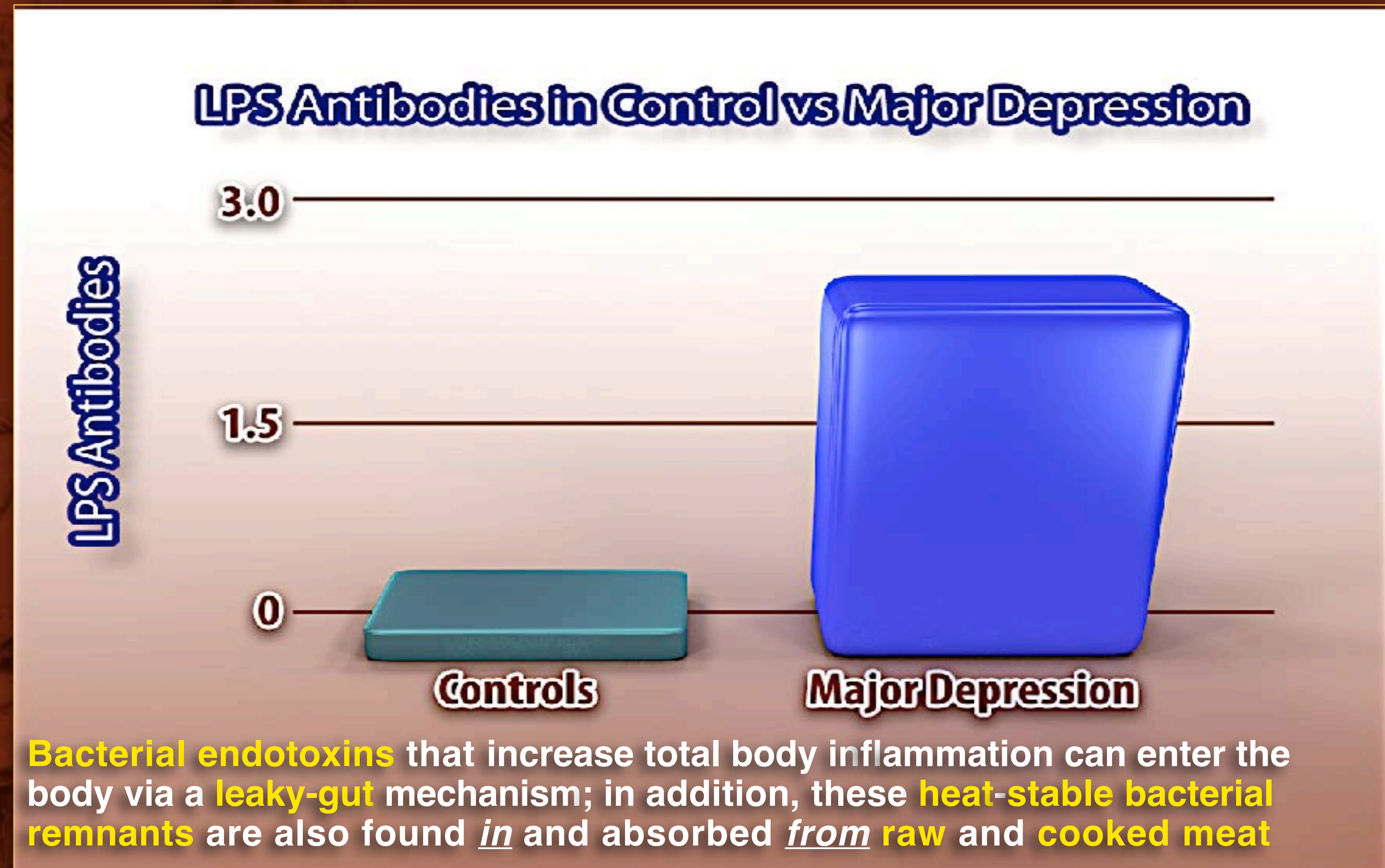
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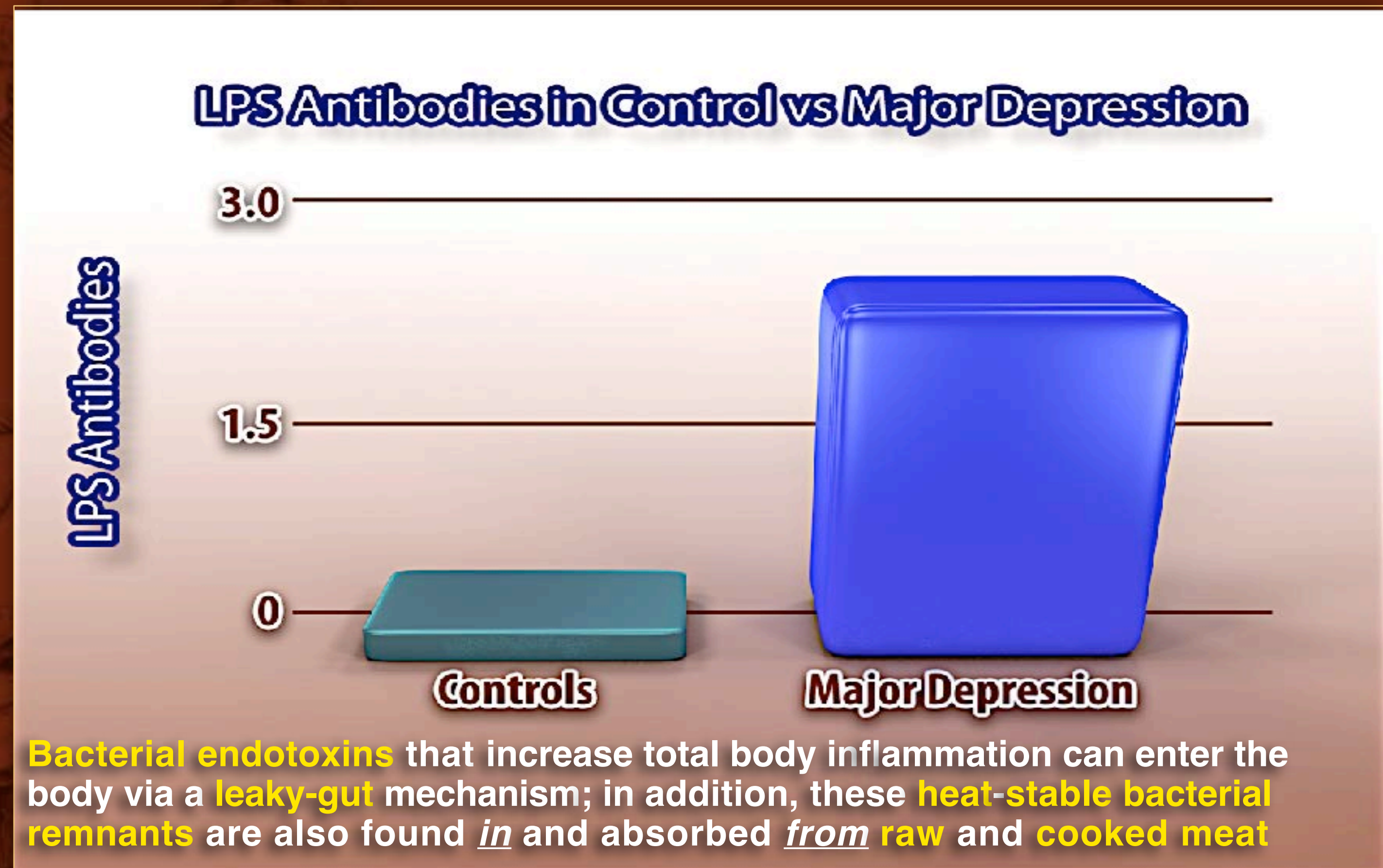
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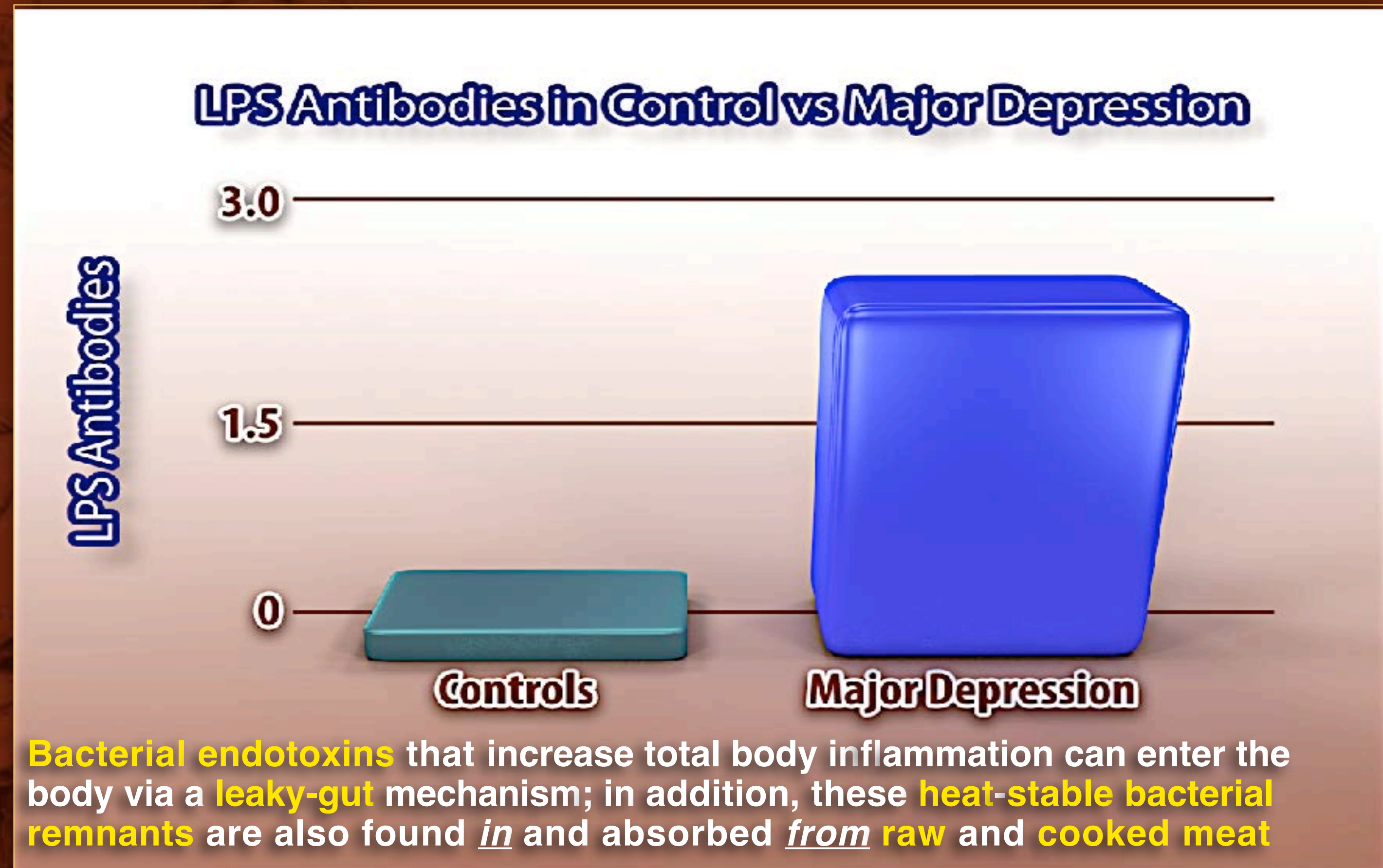
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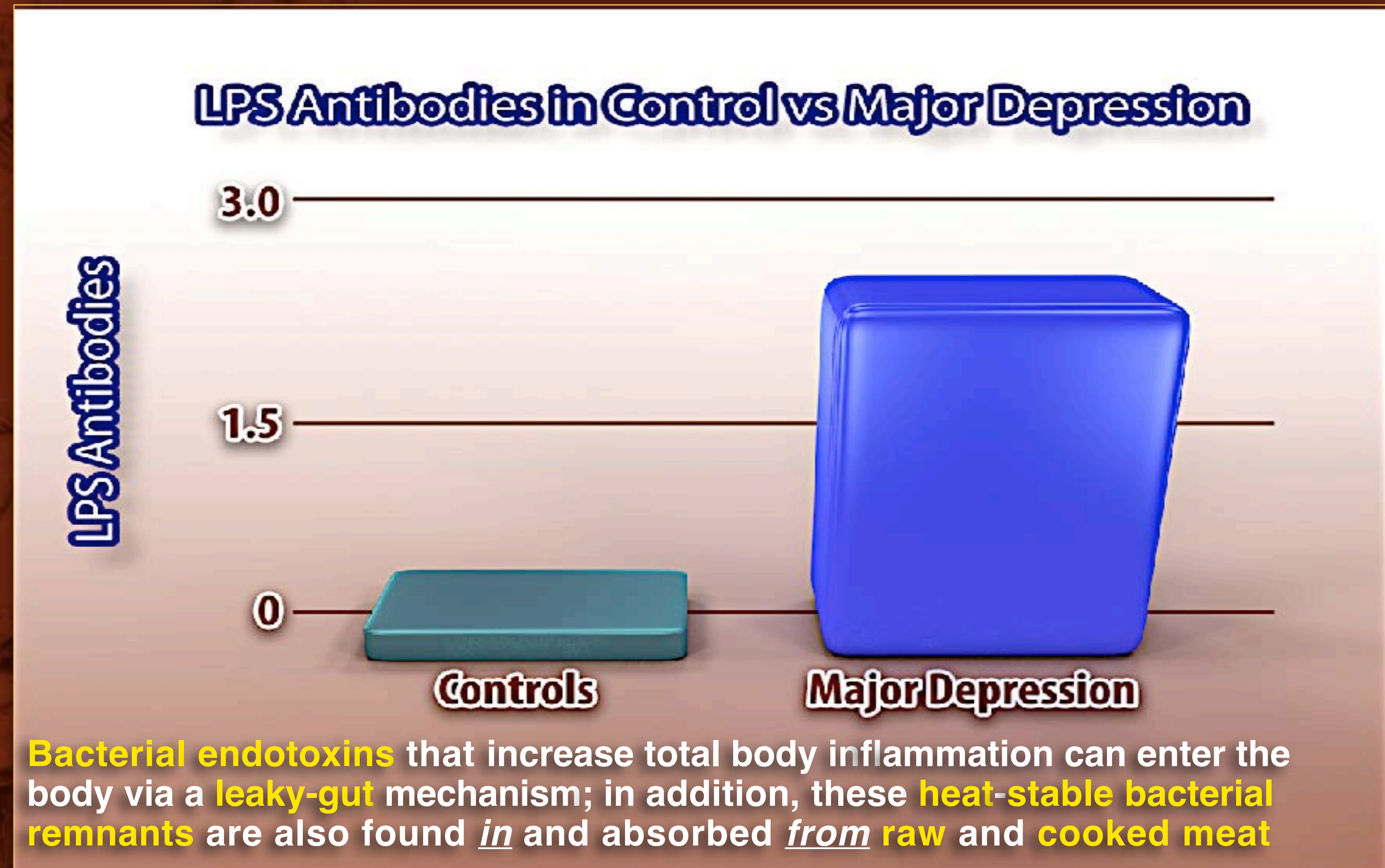
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Neufeld, KM et al. *Neurogastroenterol Motil* 23, No. 3 (March 2011)

Leaky Gut-induced Inflammation & Depression

- **Inflammatory markers** correlate with **major depression (MD)**. **Lipopolysaccharide (LPS)** *increases* these inflammatory chemicals.
- Studies show MD is **accompanied by an activation of the IRS** and **elevated levels** of pro-inflammatory **cytokines** and LPS may *induce* depressive symptoms.
- LPS and also **bacterial lipoprotein (BLP)** were found to be **highly resistant** to **cooking**, **low pH** and **protease** treatment.
- Studies have also shown a **single meal high in animal fat** can **induce endotoxemia**.

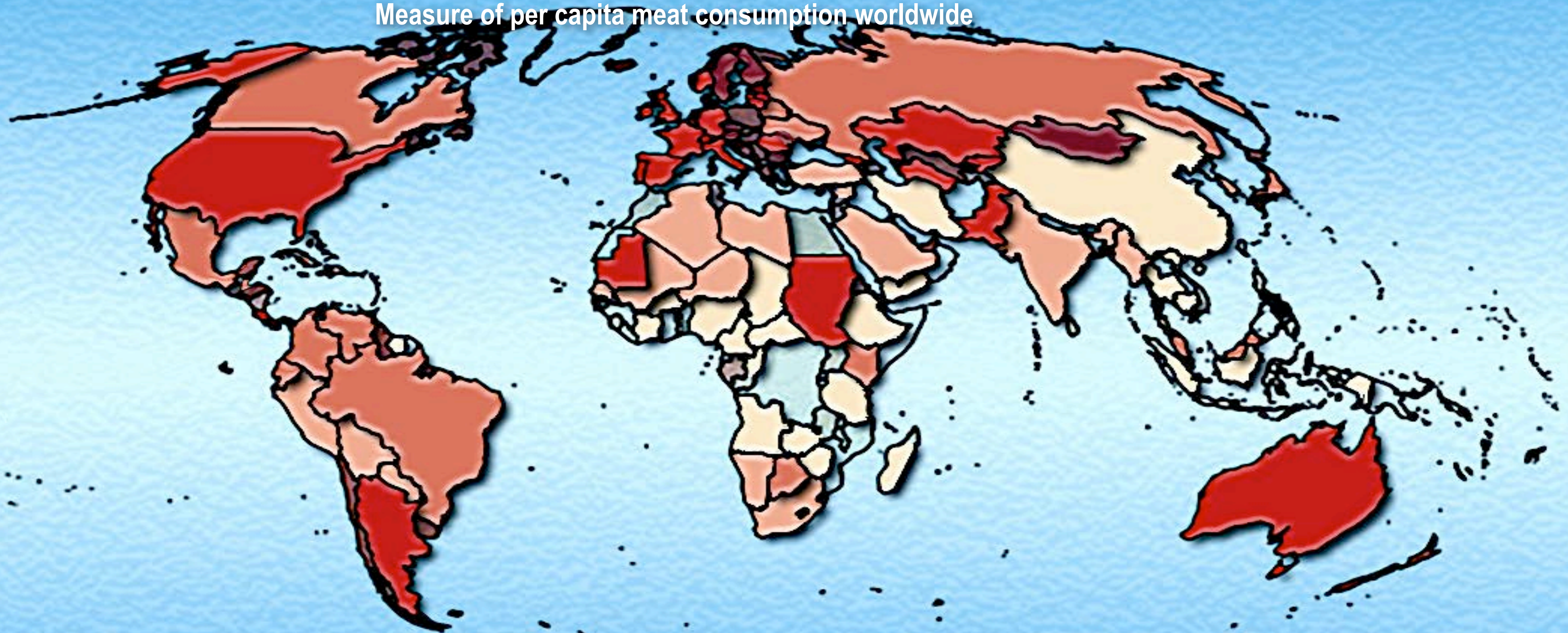


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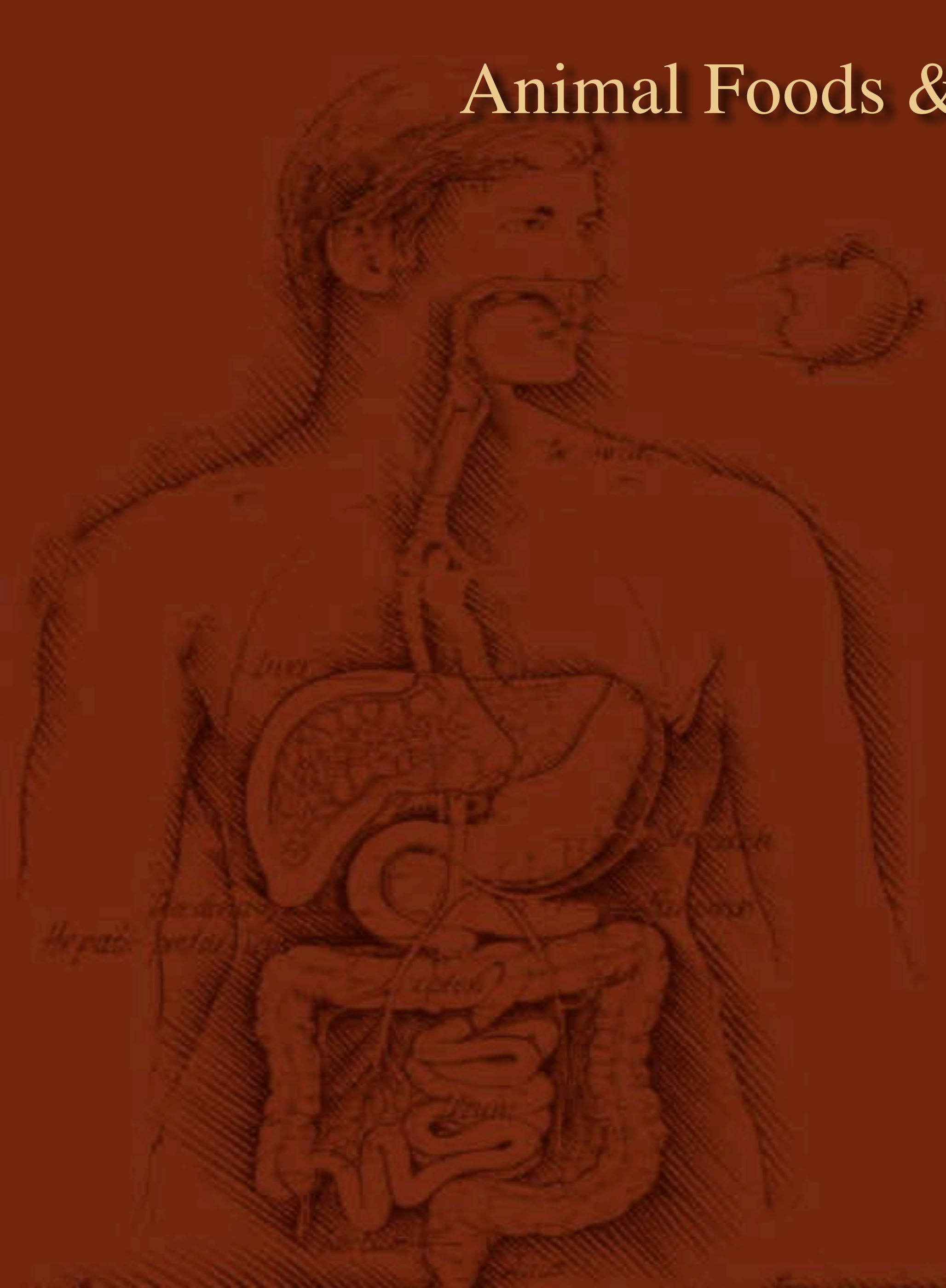
Median trophic levels of various countries 2005 - 2009

Measure of per capita meat consumption worldwide



Map courtesy of Bonhommeau et al.

Animal Foods & Alzheimer's Disease

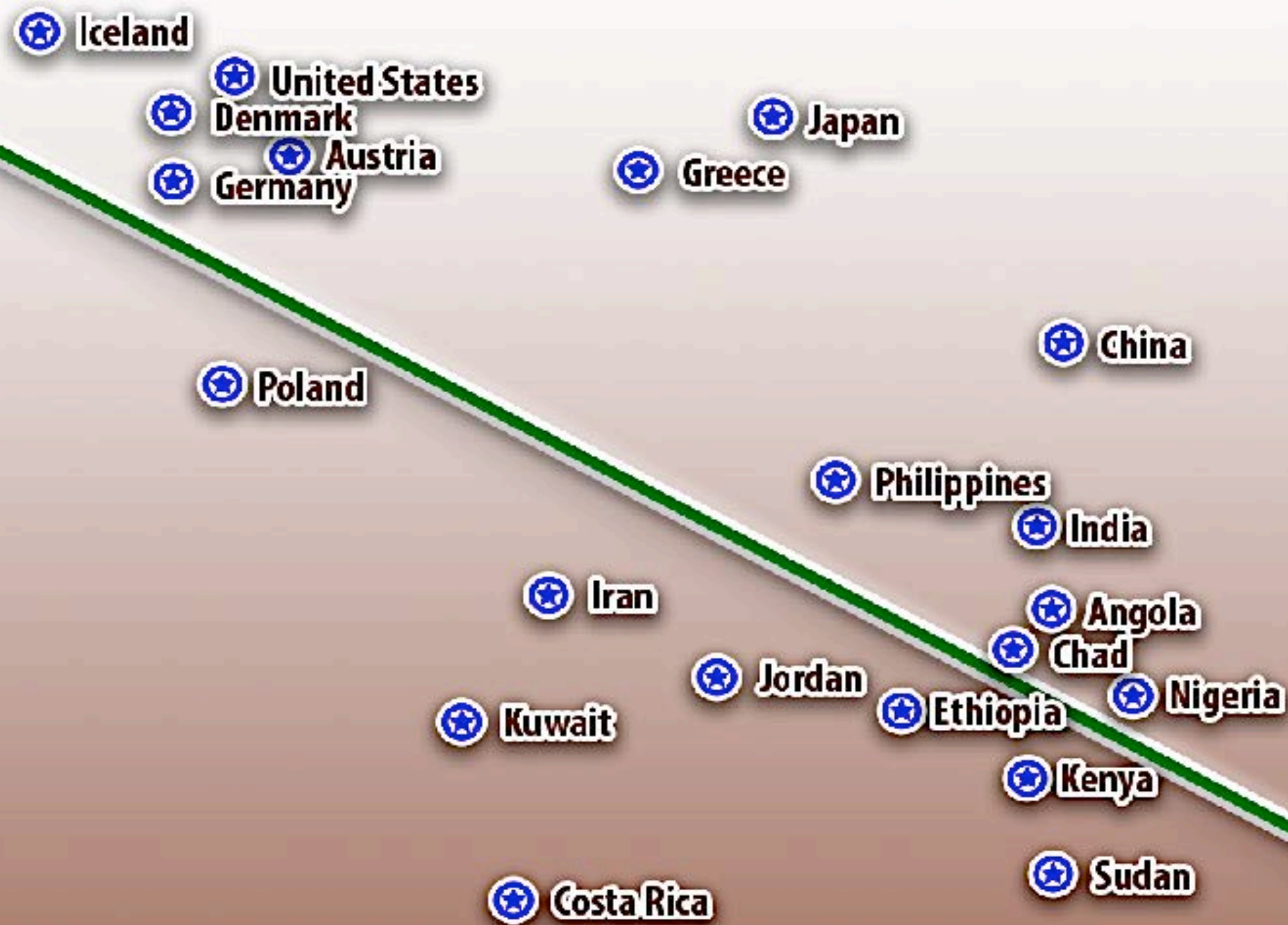


Animal Foods & Alzheimer's Disease

← Increasing Meat Consumption



Increasing Alzheimer's Prevalence



Alzheimer's Association, 2012 Alzheimer's Disease Facts and Figures

→ Increasingly Plant-based Diets

Animal Foods & Alzheimer's Disease

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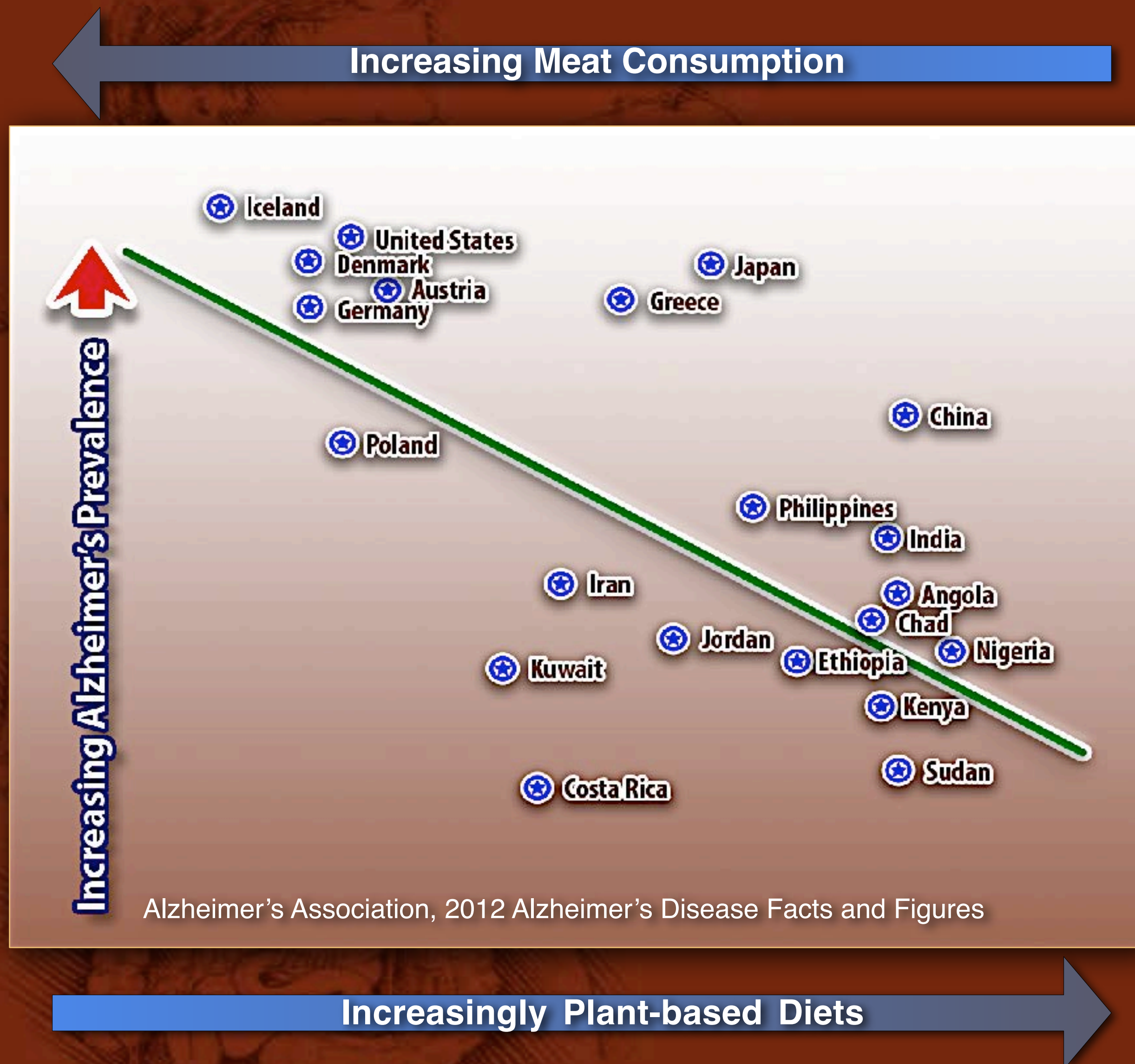


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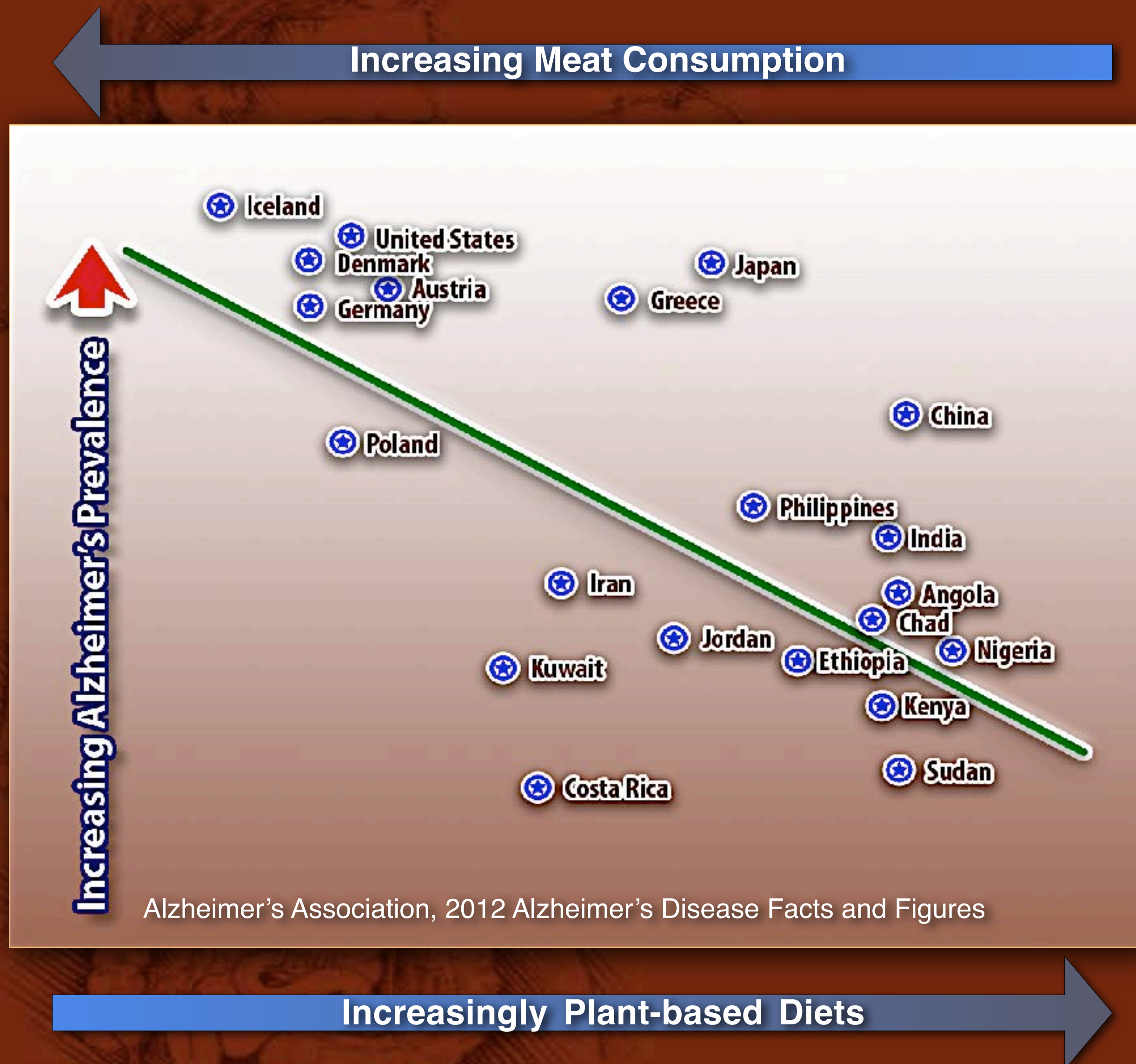
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Animal Foods & Alzheimer's Disease



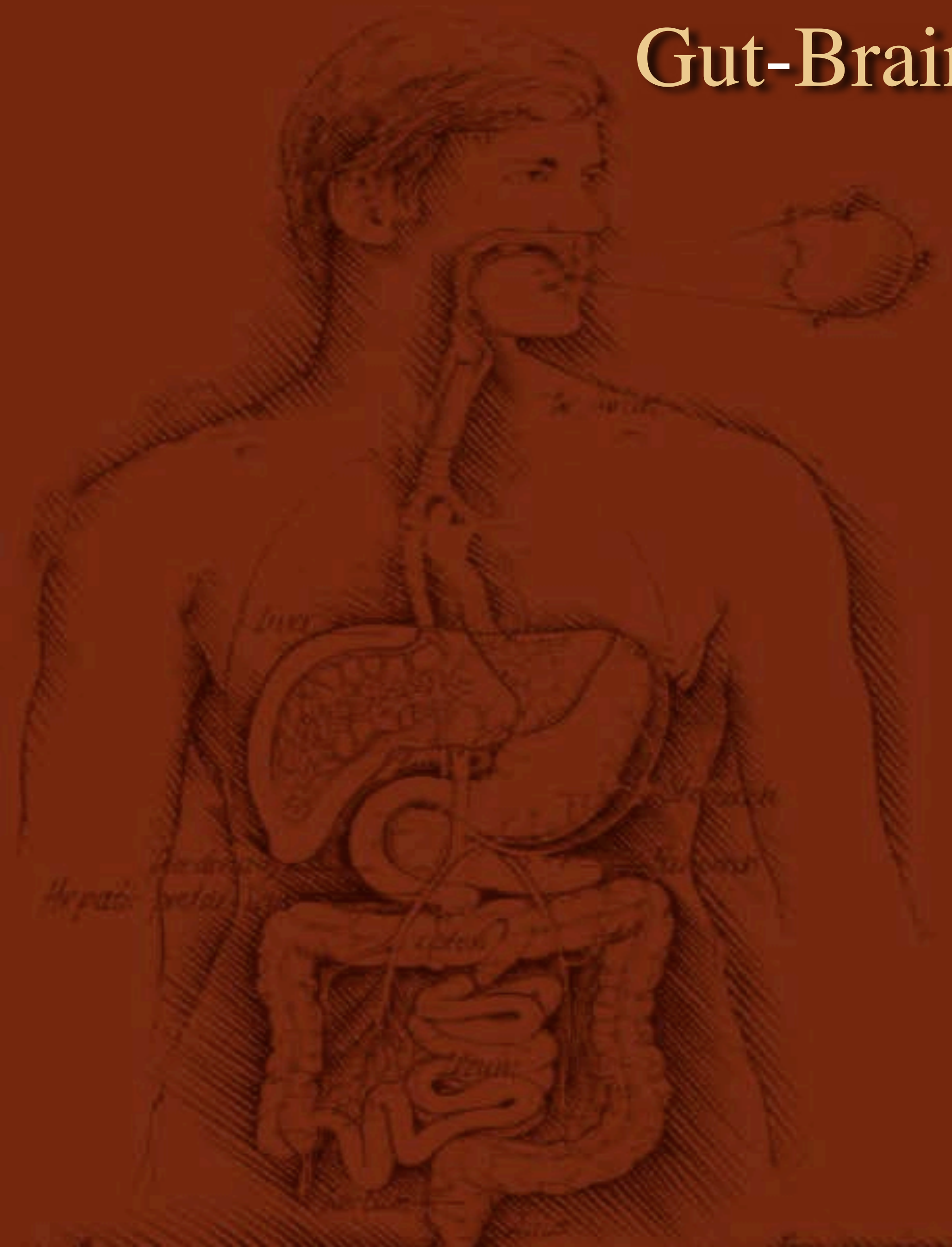
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Animal Foods & Alzheimer's Disease



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- Research suggests risk for Alzheimer's disease can be **decreased** by *reducing* intake of **saturated and trans fats, animal protein, alcohol, maintaining a healthy weight and stopping smoking**.
- Fruits, vegetables and Fruit and vegetable juices, Antioxidants, Vitamins C and E, Exercise and Omega-3 fatty acids **have all been shown to *protect* against this disease**.

Gut-Brain Connections



Gut-Brain Connections



Gut feeling: Sensory neurons inside the gut inform the vagus nerve (yellow) and brain how our stomachs and intestines are doing. NICOLLE R. FULLER/SCIENCE SOURCE

Your gut is directly connected to your brain, by a newly discovered neuron circuit

- The human gut is lined with more than **100 million nerve cells** — it's practically a brain unto itself. And indeed, **the gut actually talks to the brain, releasing hormones into the bloodstream** that, **over the course of about 10 minutes**, tell us how hungry it is

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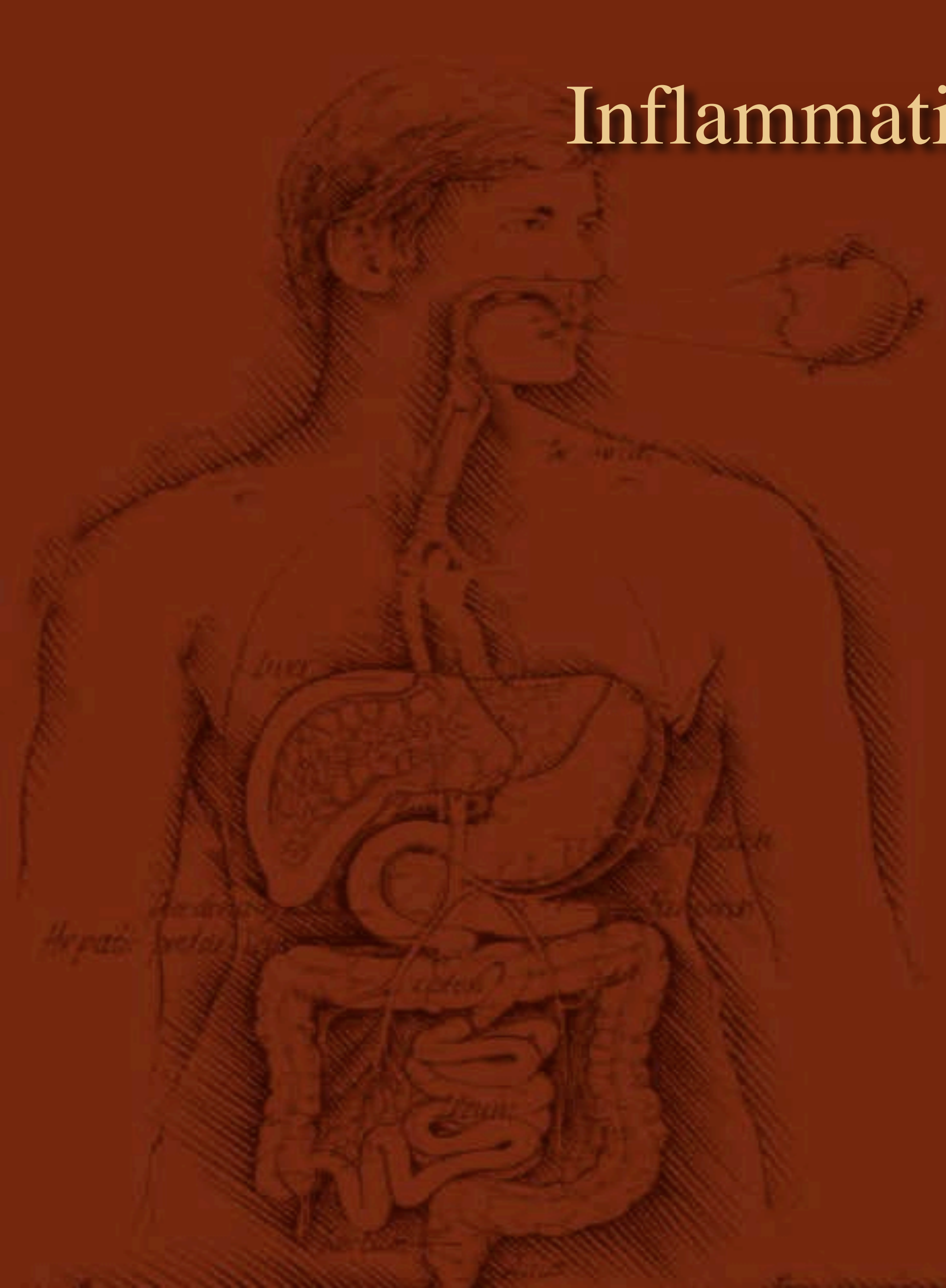


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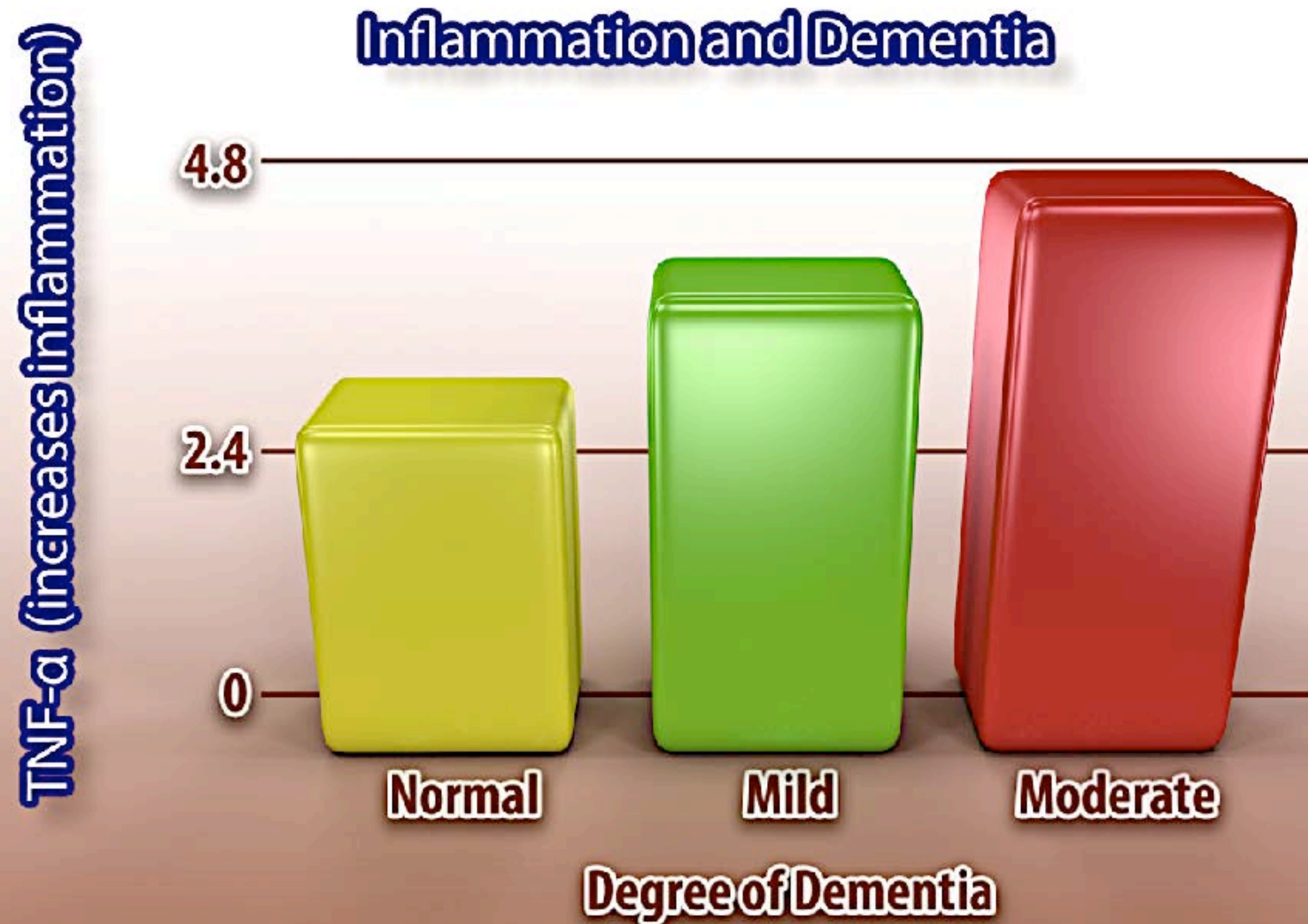
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- The study reveals “**a new set of pathways that use gut cells to rapidly communicate with...the brain stem,**” says Daniel Drucker, a clinician-scientist at the Lunenfeld-Tanenbaum Research Institute in Toronto, Canada.

Inflammation & Dementia



Inflammation & Dementia

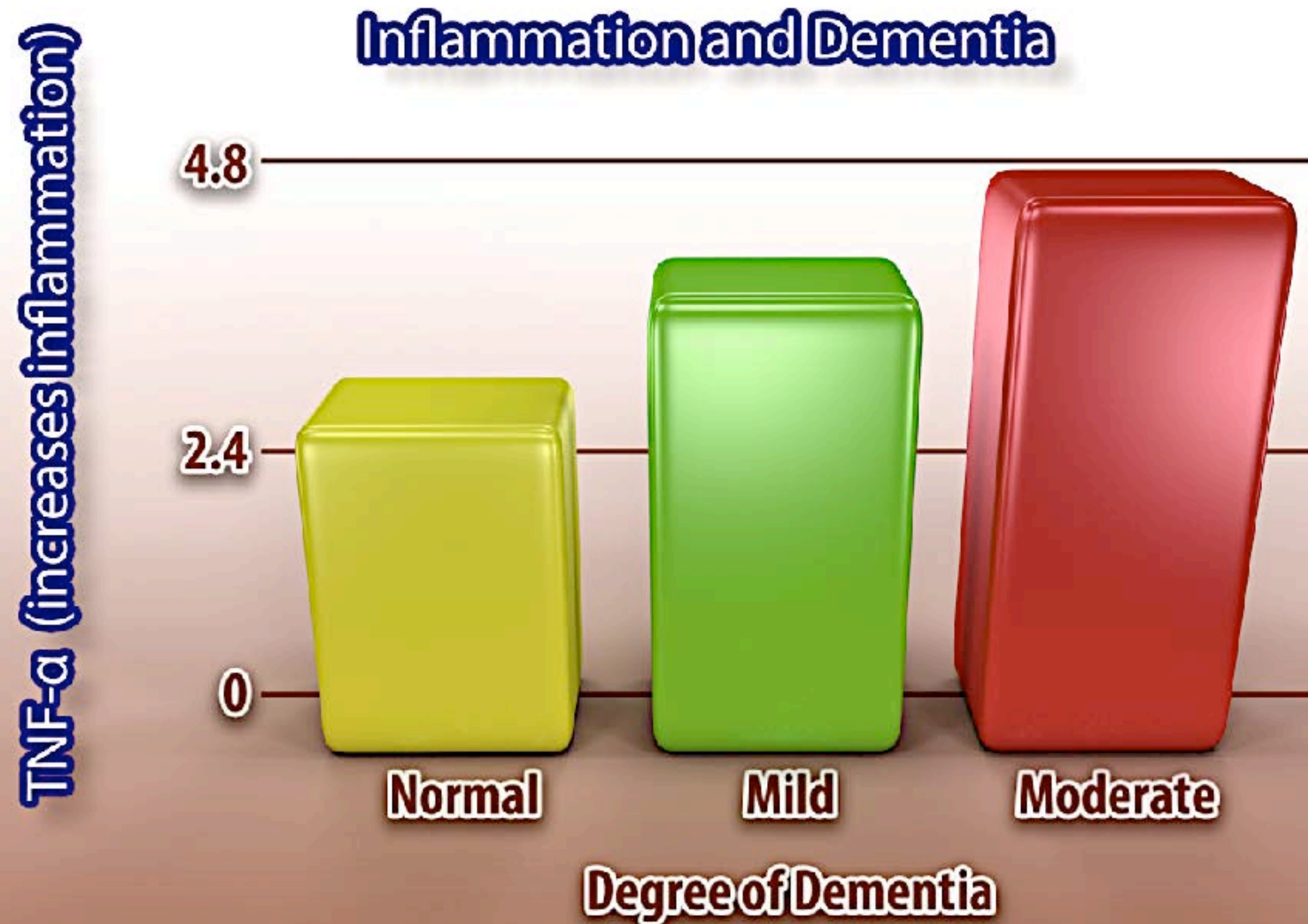
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Bruunsgaard, H. Danish Med Bull 53, No. 3 August 2006

Inflammation & Dementia

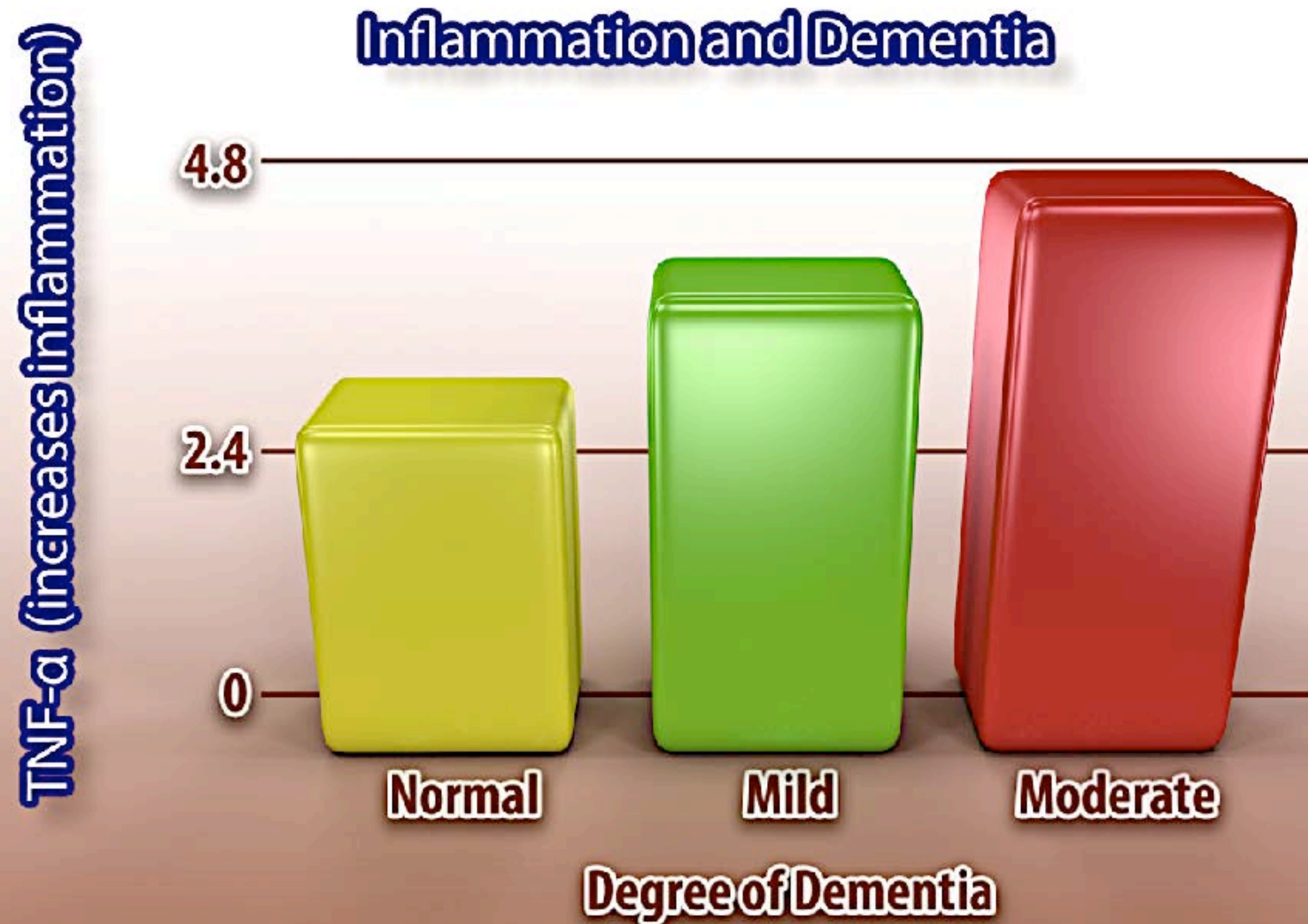
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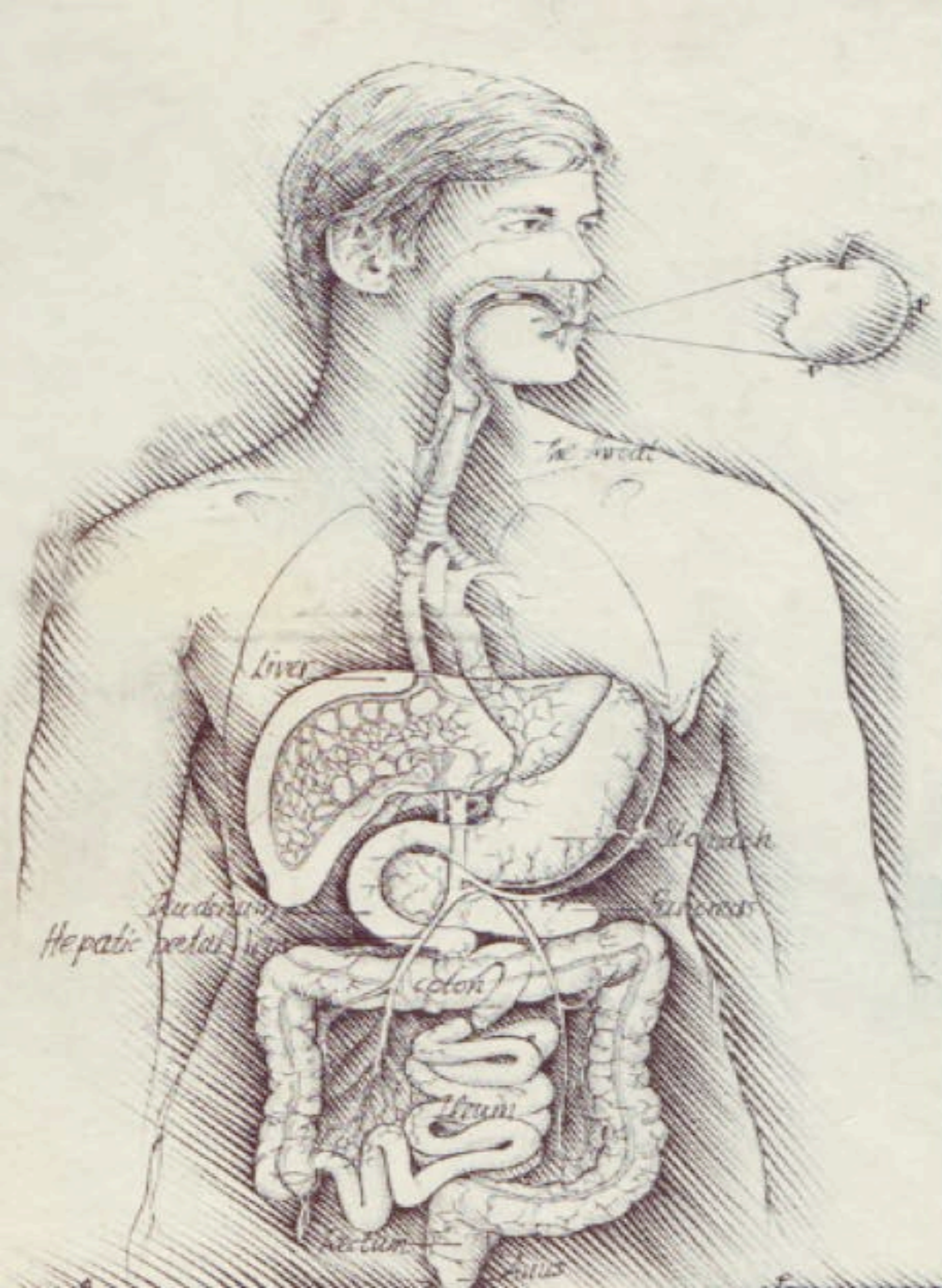
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- In fact, some scientists believe that **levels of inflammatory markers** can actually be used to **predict cognitive decline** and the **development of dementia**.

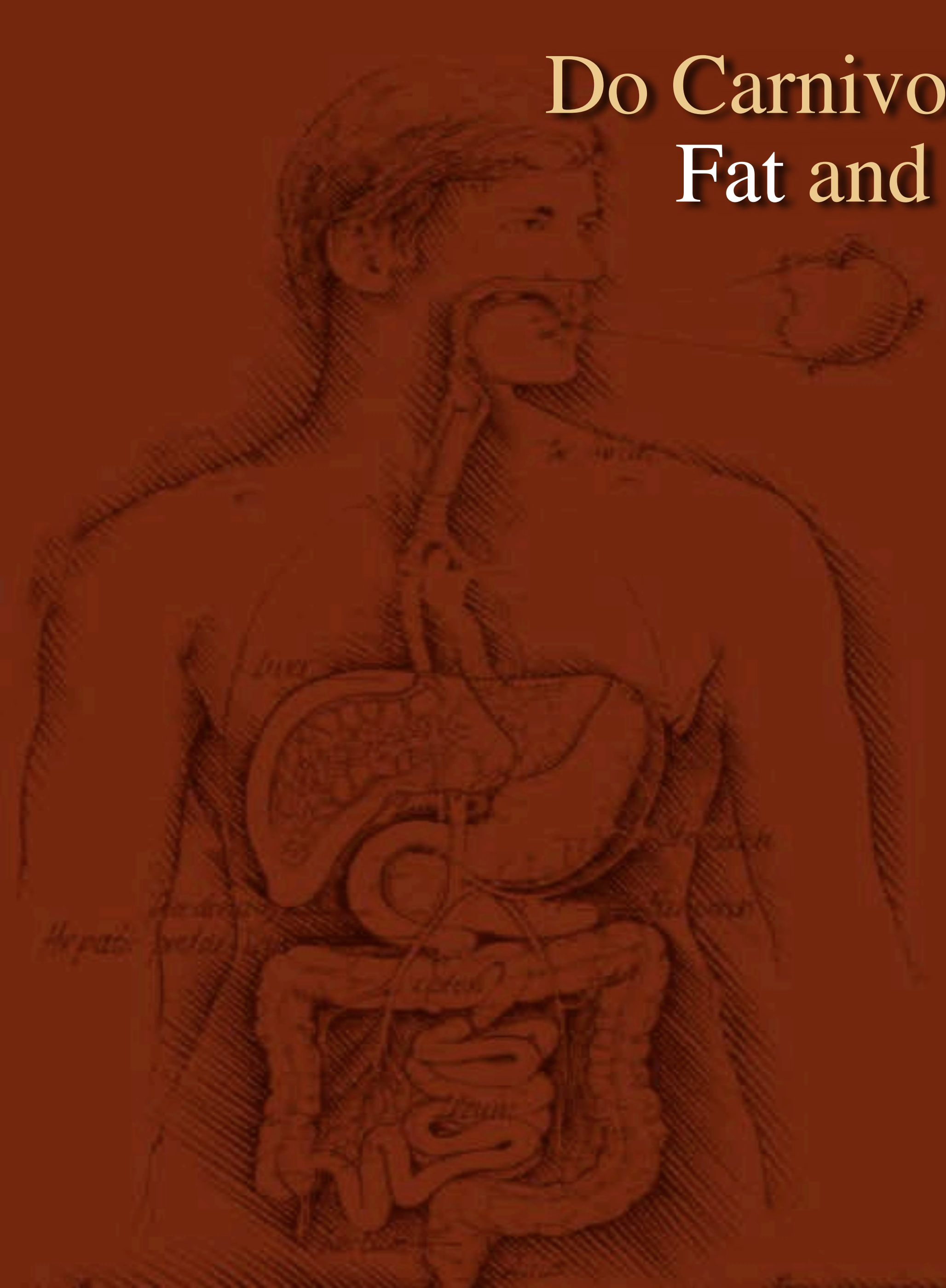


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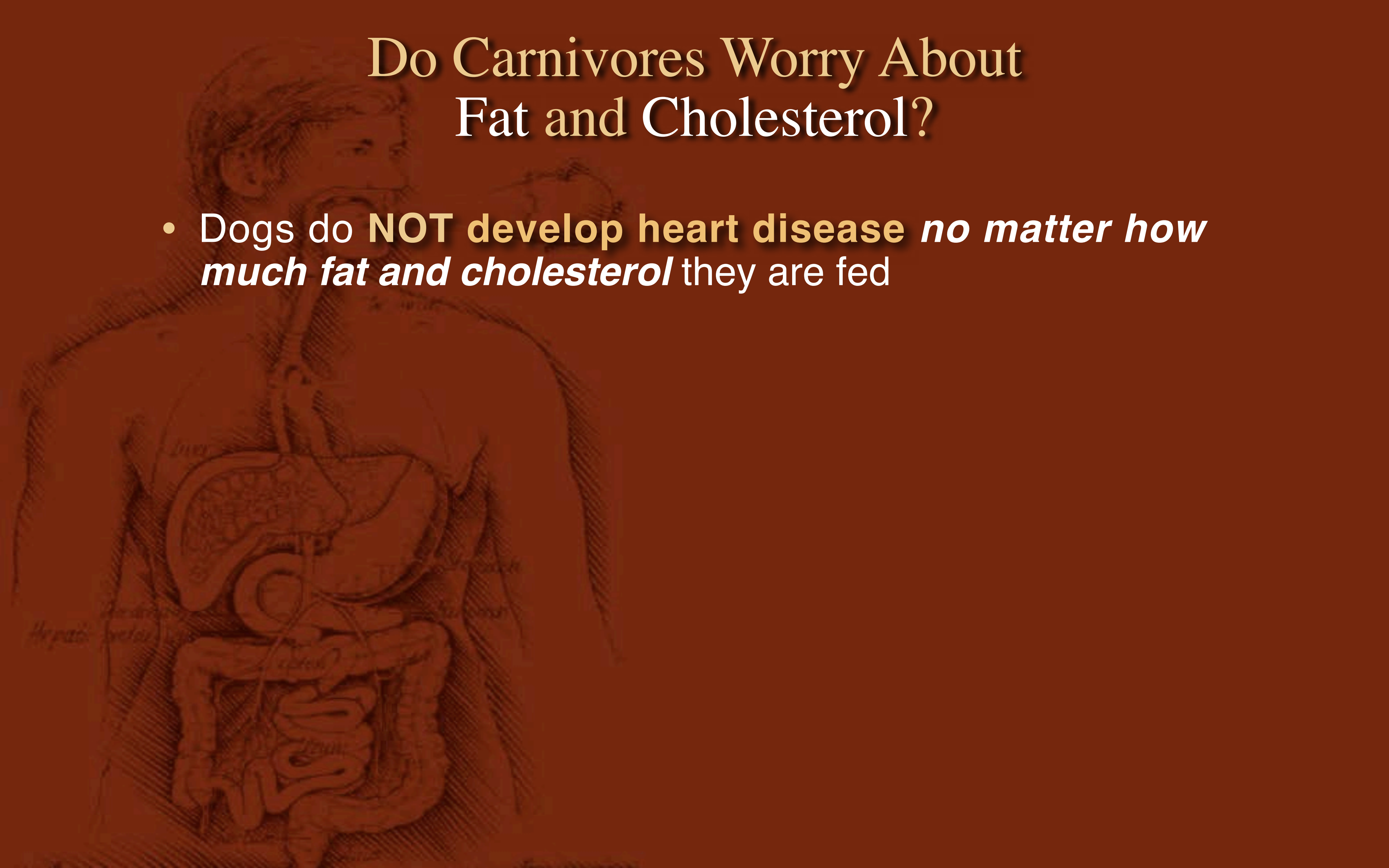
PHYSIOLOGY

Do Carnivores Worry About Fat and Cholesterol?



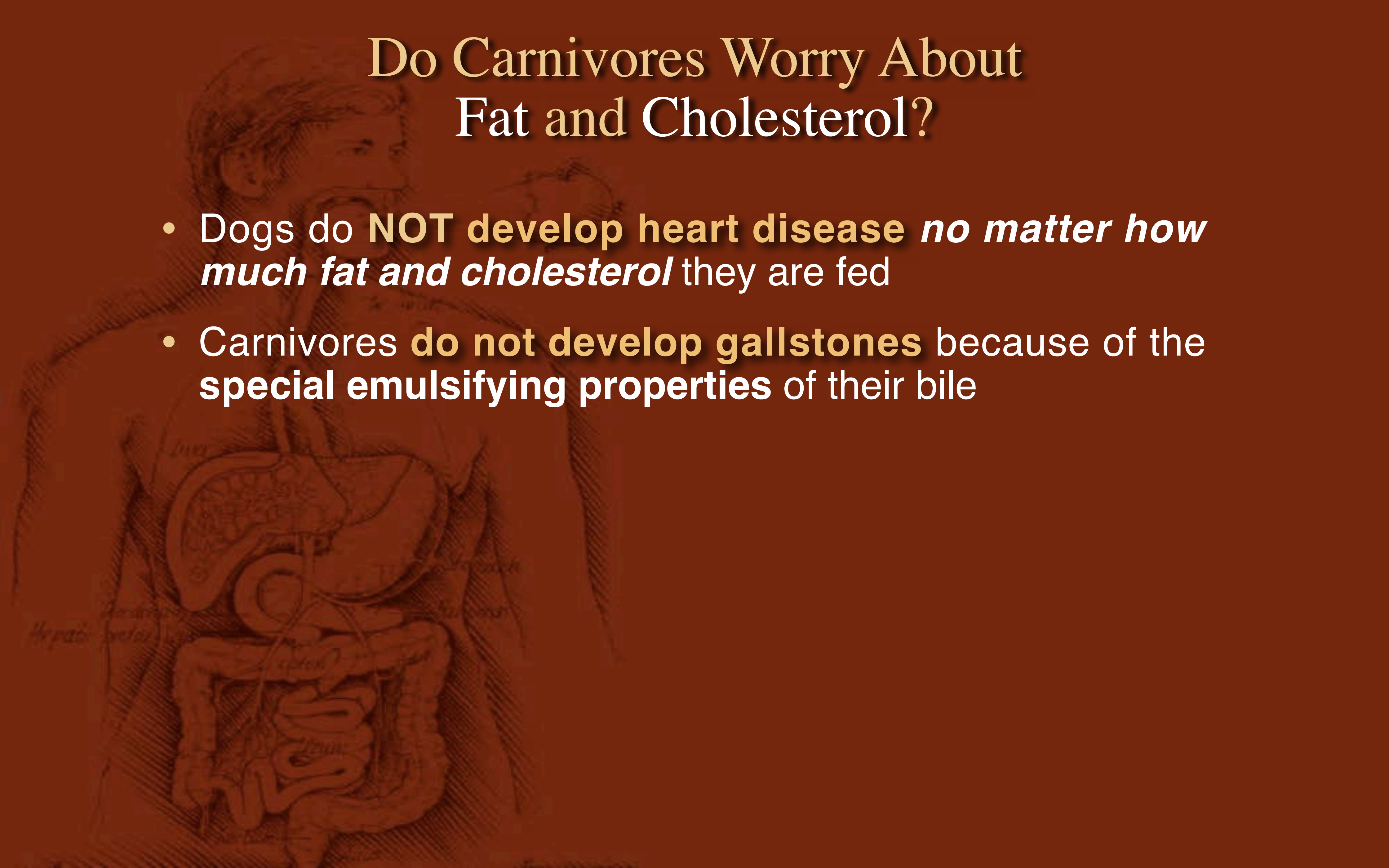
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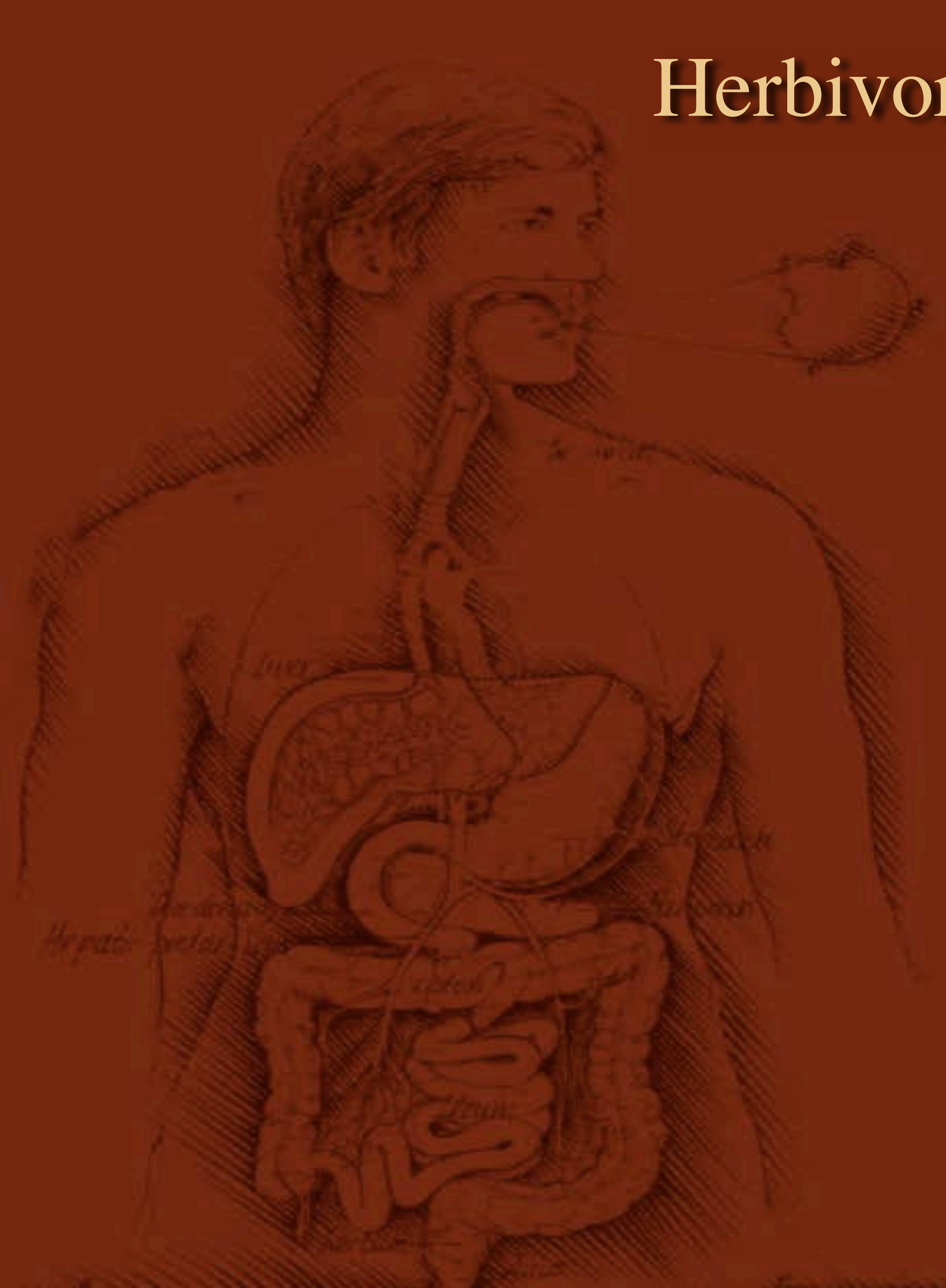
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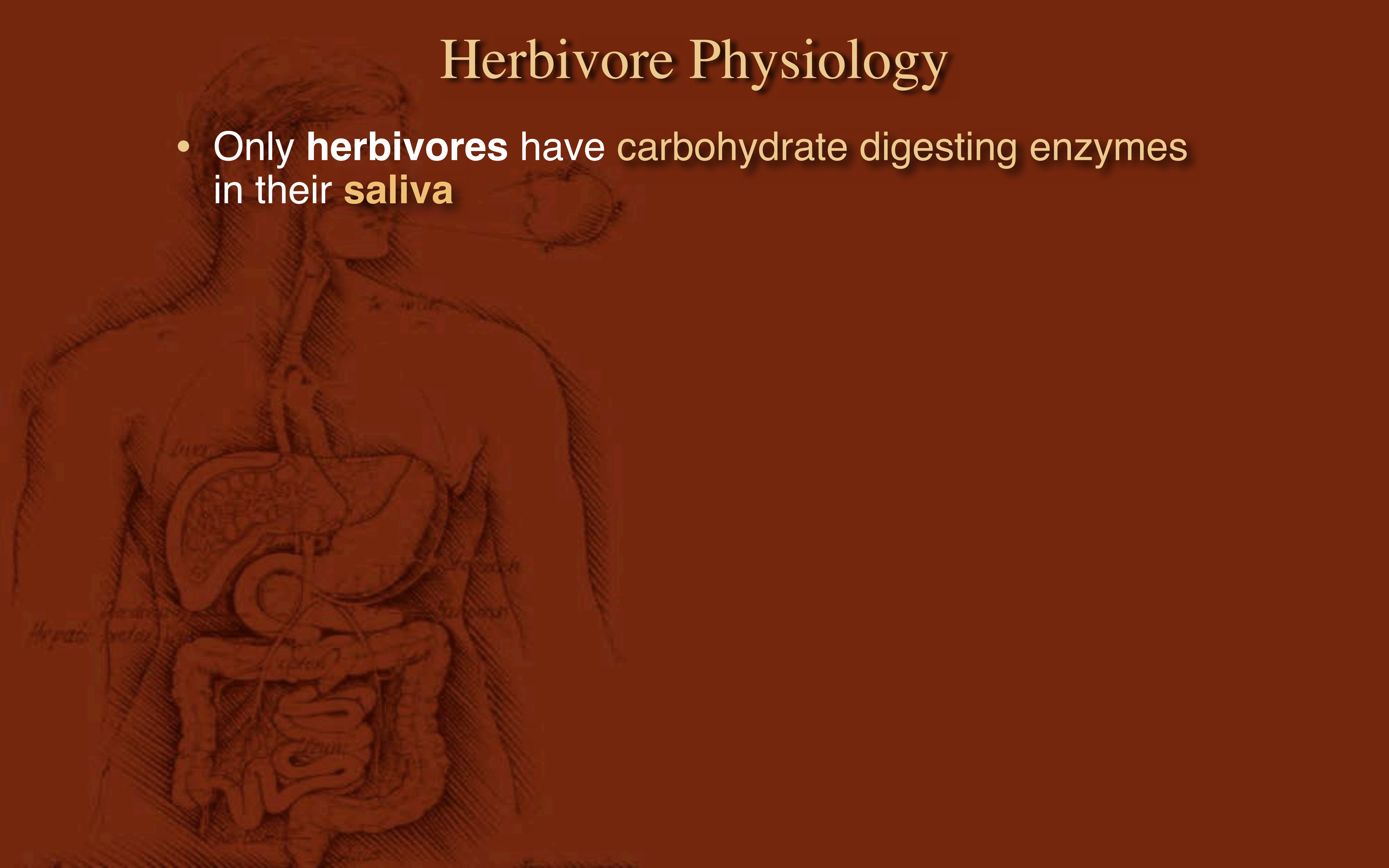
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- Can metabolize **excess animal protein** *without damaging their bones*

Herbivore Physiology



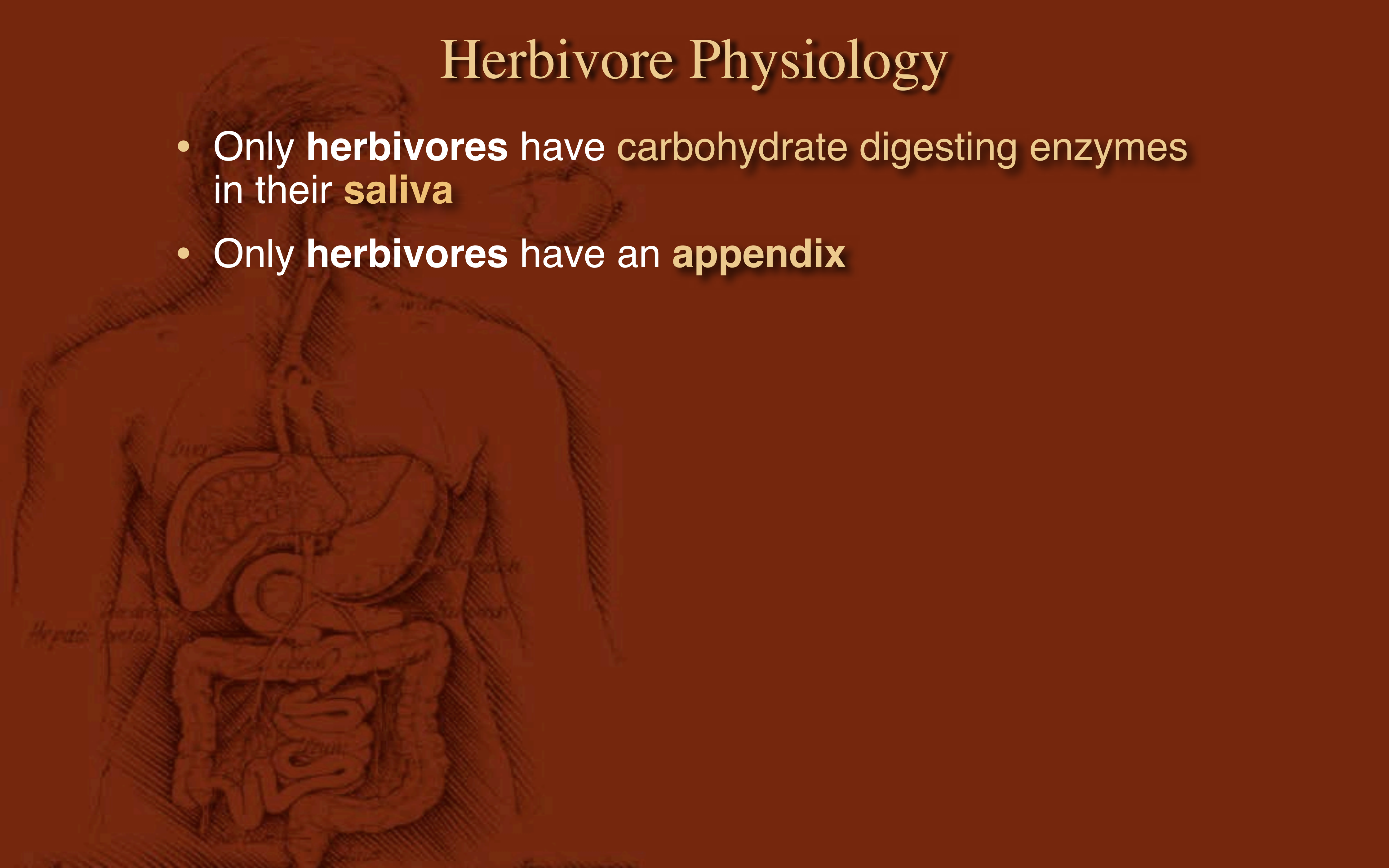
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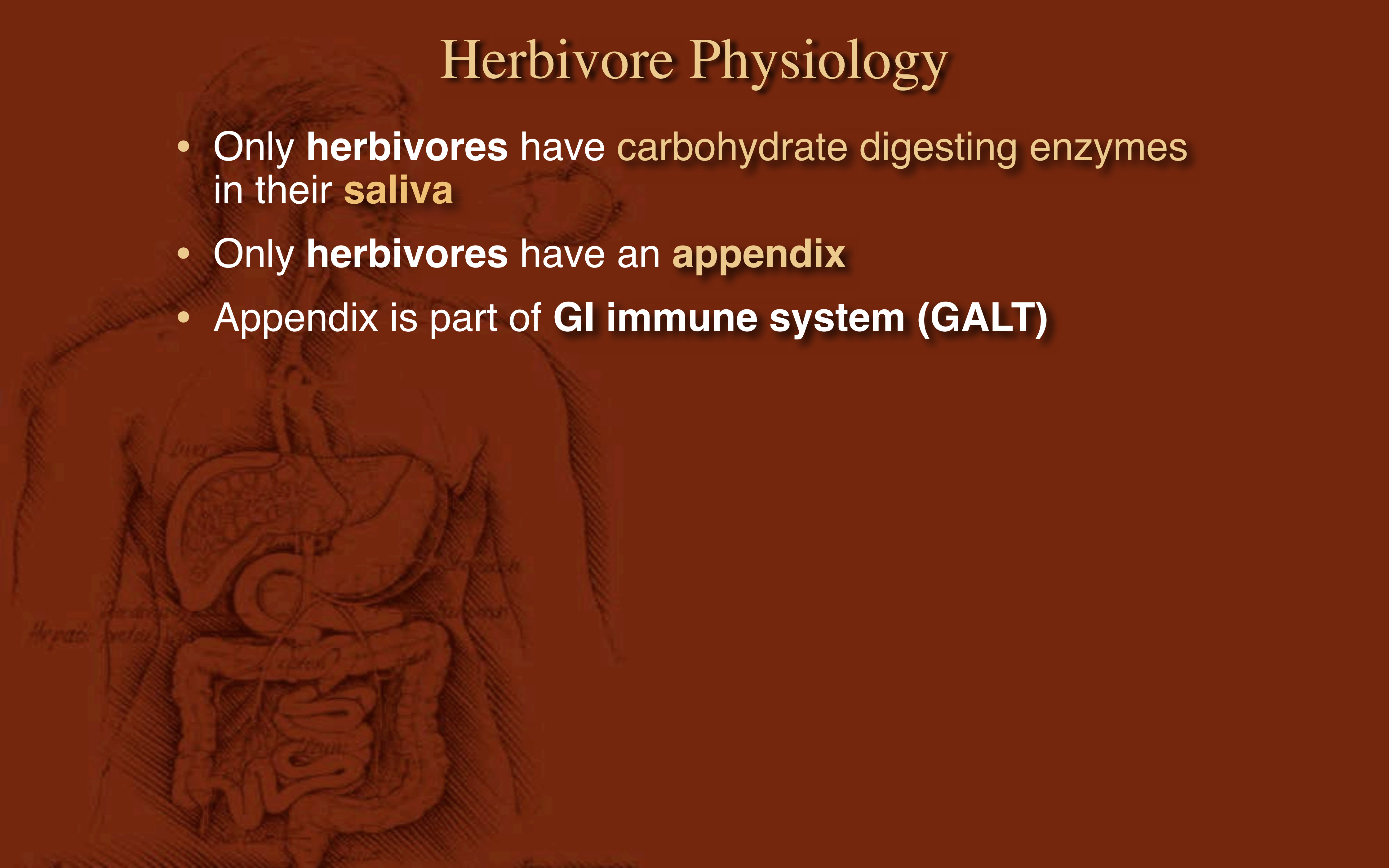
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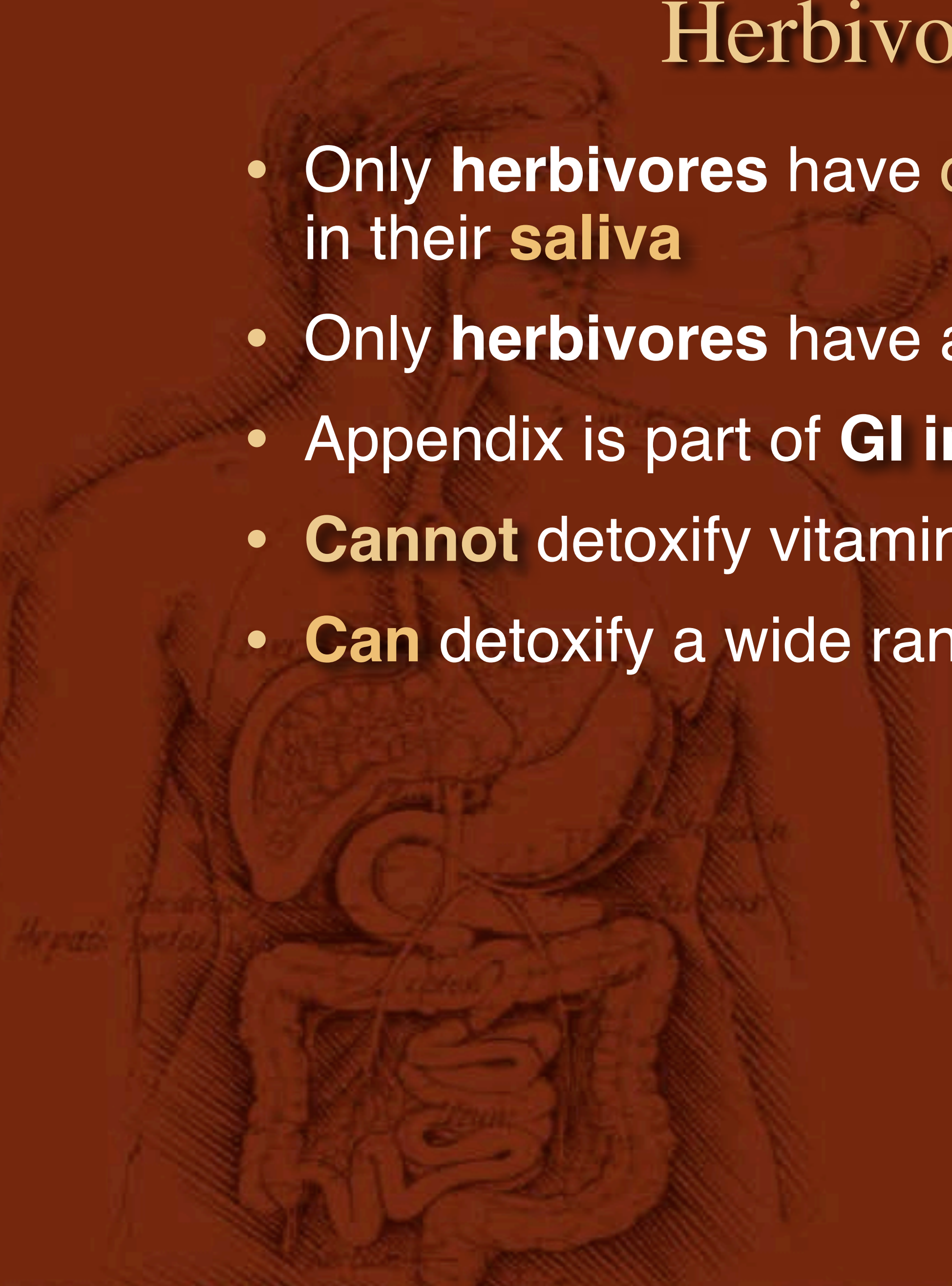
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- **Can ferment fiber** to beneficial SCFA's

Herbivore Physiology

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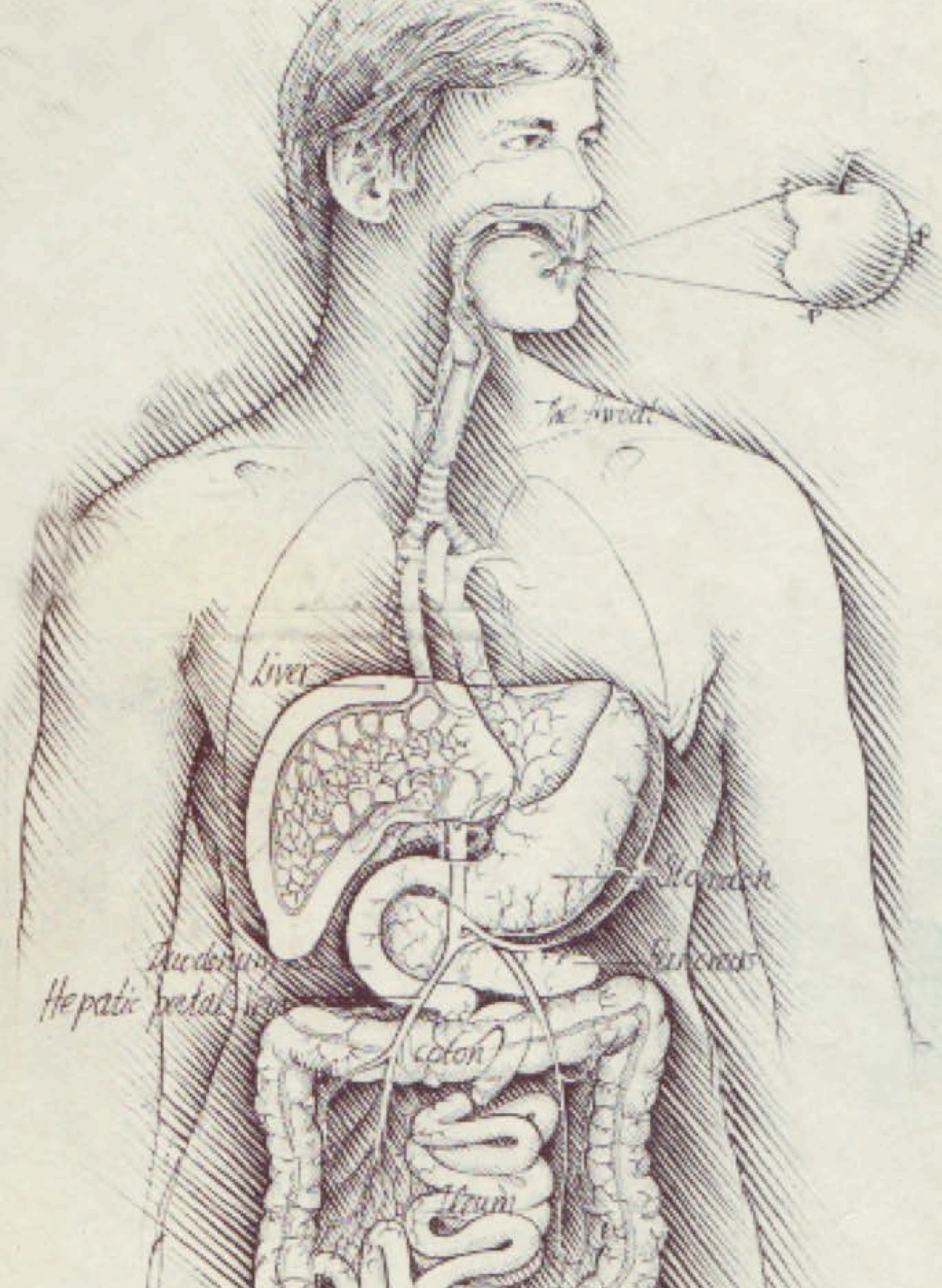
"The population with perhaps the highest life expectancy in the world doesn't eat any meat at all—the California Adventist vegetarians."

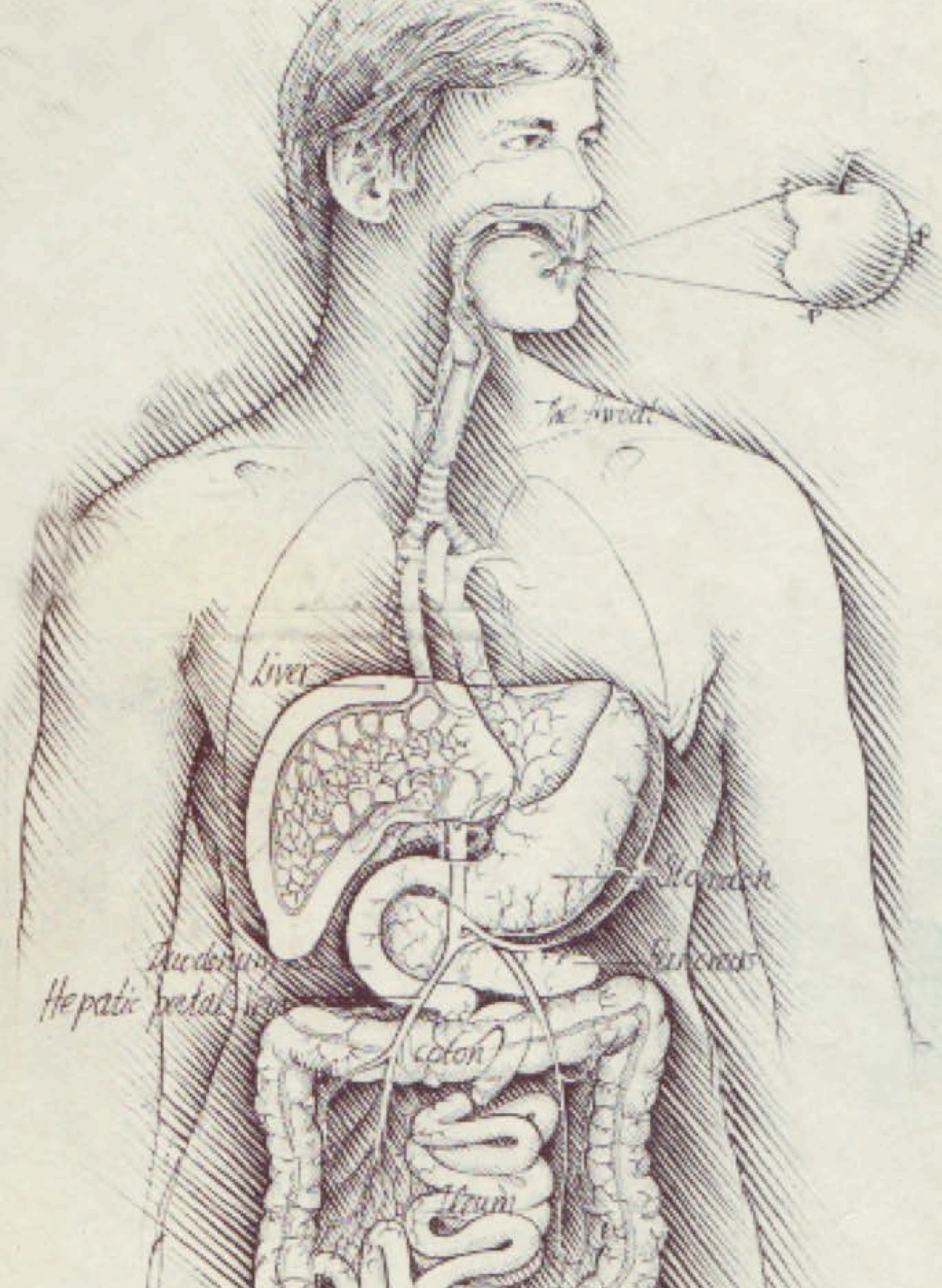


nutritionfacts.org/video/do-flexitarians-live-longer

N NutritionFacts.org

h in







Humans have
the palate ,
preferences
and *Psychol-
ogy* of an
Herbivore.

We naturally
love & *crave*
the tastes,
textures,
colors and
variety of
Plant foods!





Fragrance & the Mind

- Many carnivores roll in **rotting carcasses** and other fetid substances to make themselves *more desirable*.



Rusty makes his move.

Fragrance & the Mind

- Many carnivores roll in **rotting carcasses** and other fetid substances to make themselves *more desirable*.
- If we are natural flesh eaters, why don't *we* arrive at a date's door wearing **scraps of meat** and smelling of **putrid flesh** rather than **Flowers and Fruit**?



Rusty makes his move.







Flowers in Culture



Flowers in Culture

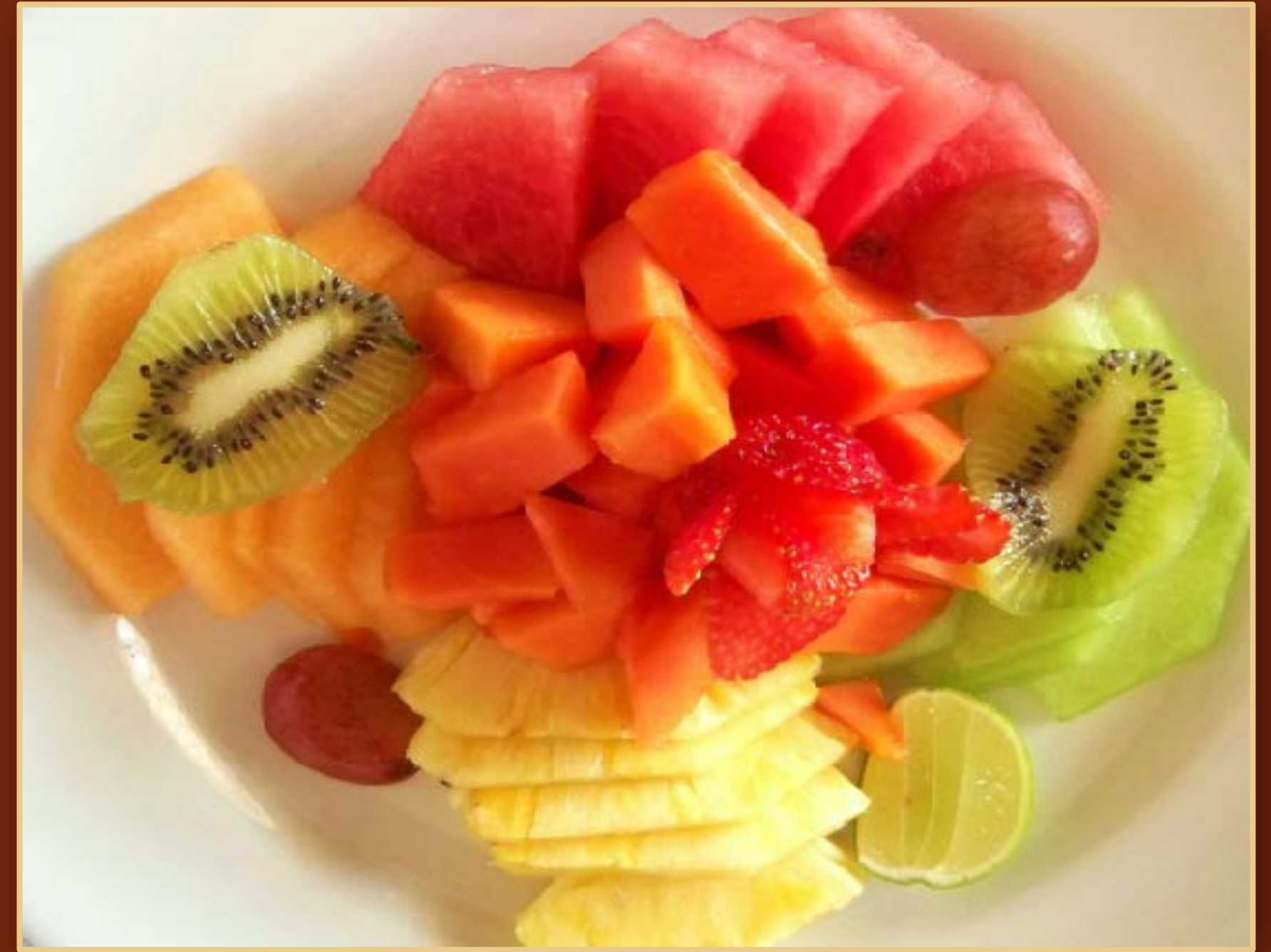
- Flowers are used as **agents of courtship** in almost every culture in the world.
- Men and women *decorate themselves **with** and/or present Flowers **to** each other as **symbols of their fitness as mates!***
- *And we humans tend to **respond favorably to seeing and/or being given Flowers.***
- Why?

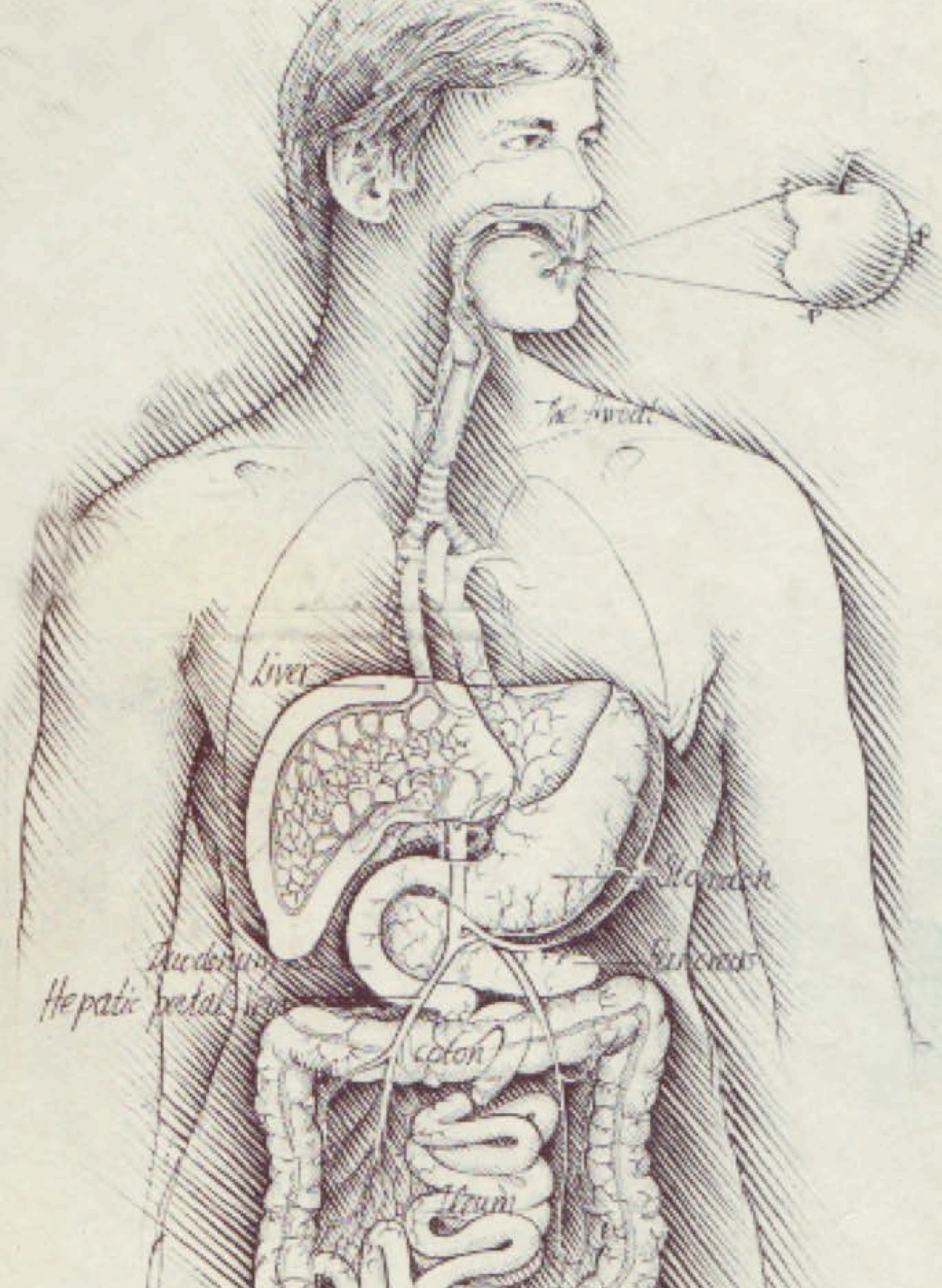


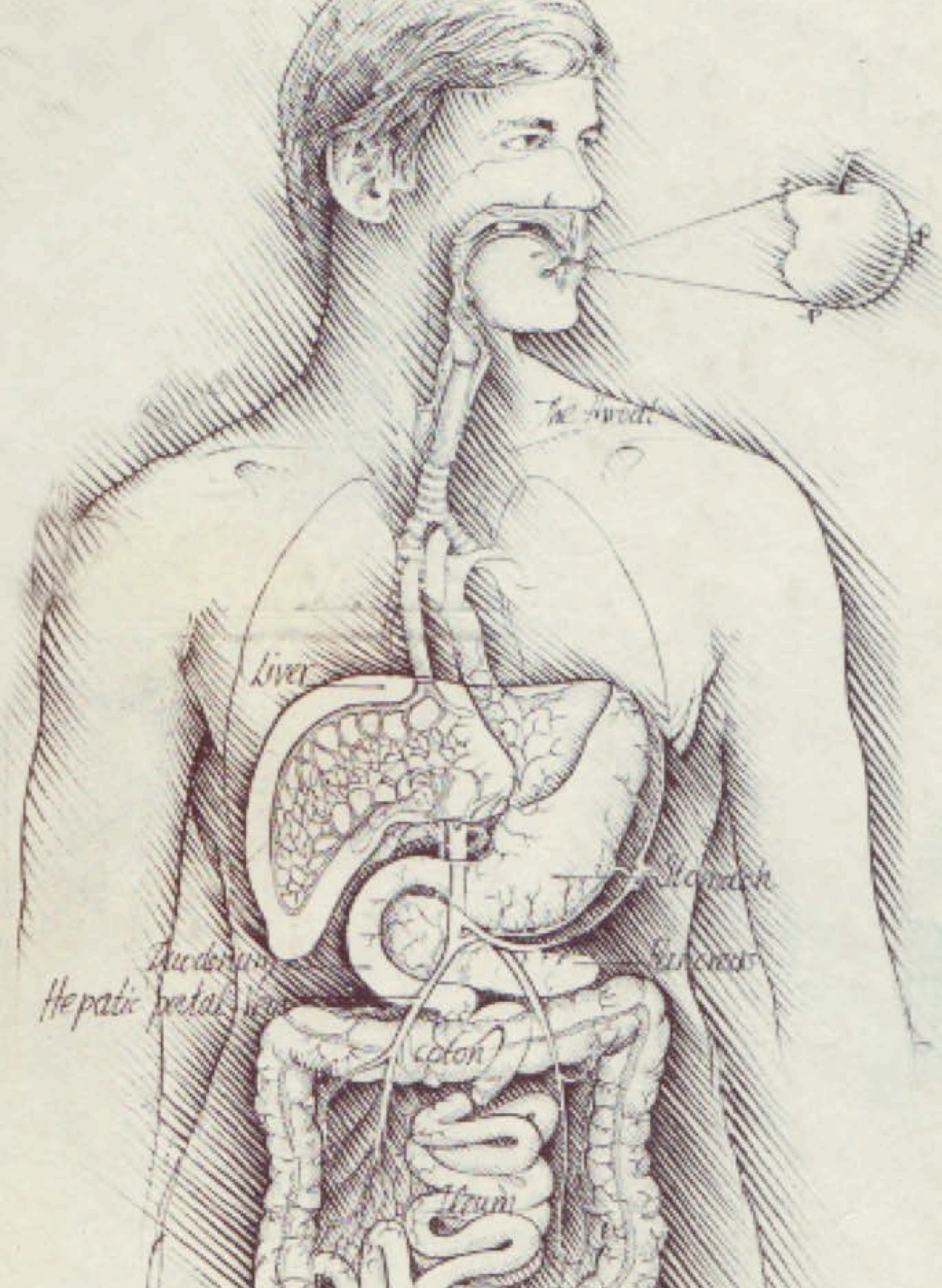


Price List
Boneless =
Bonemeau =
Undercut = 400
G01/A = 300

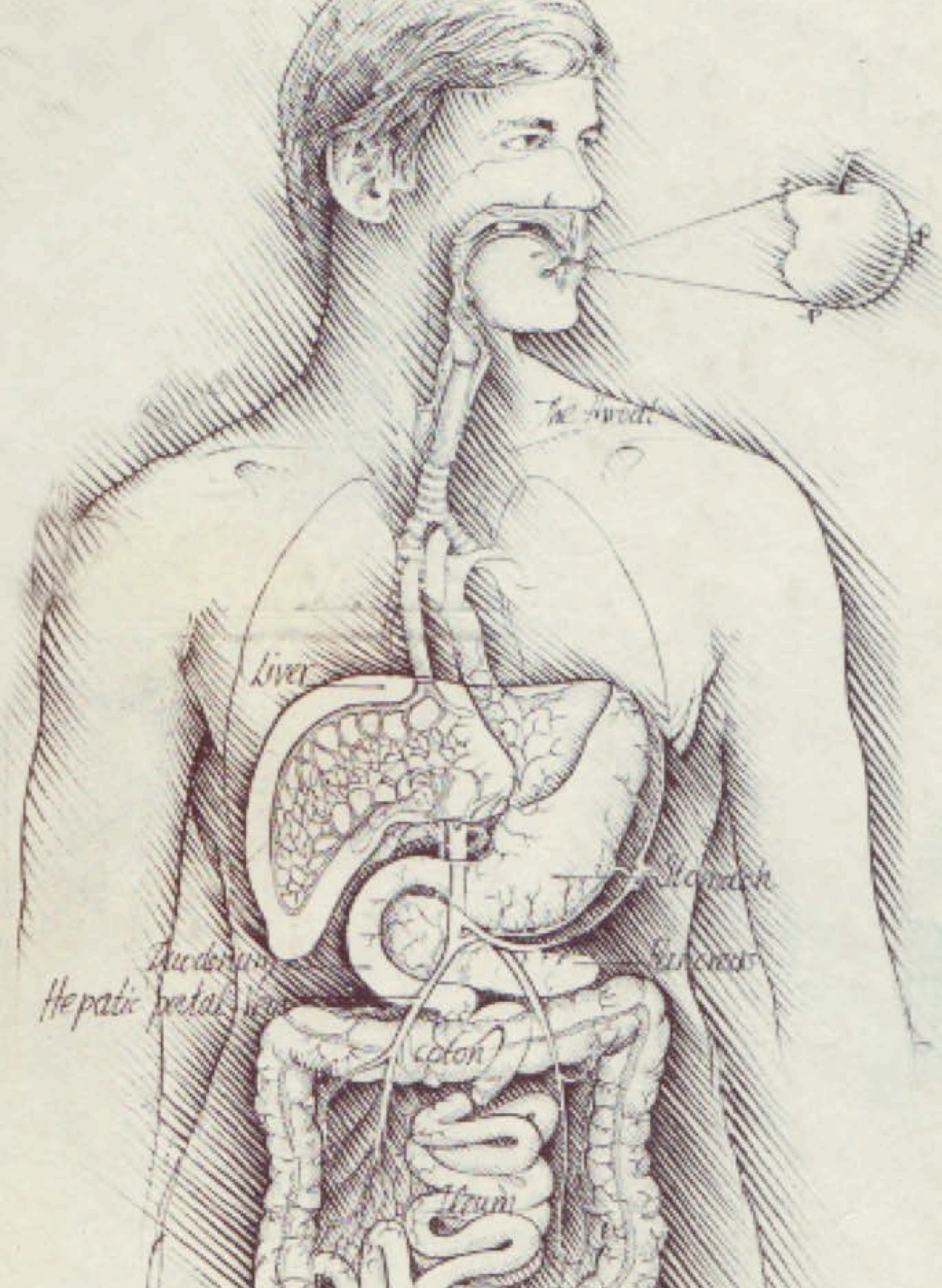






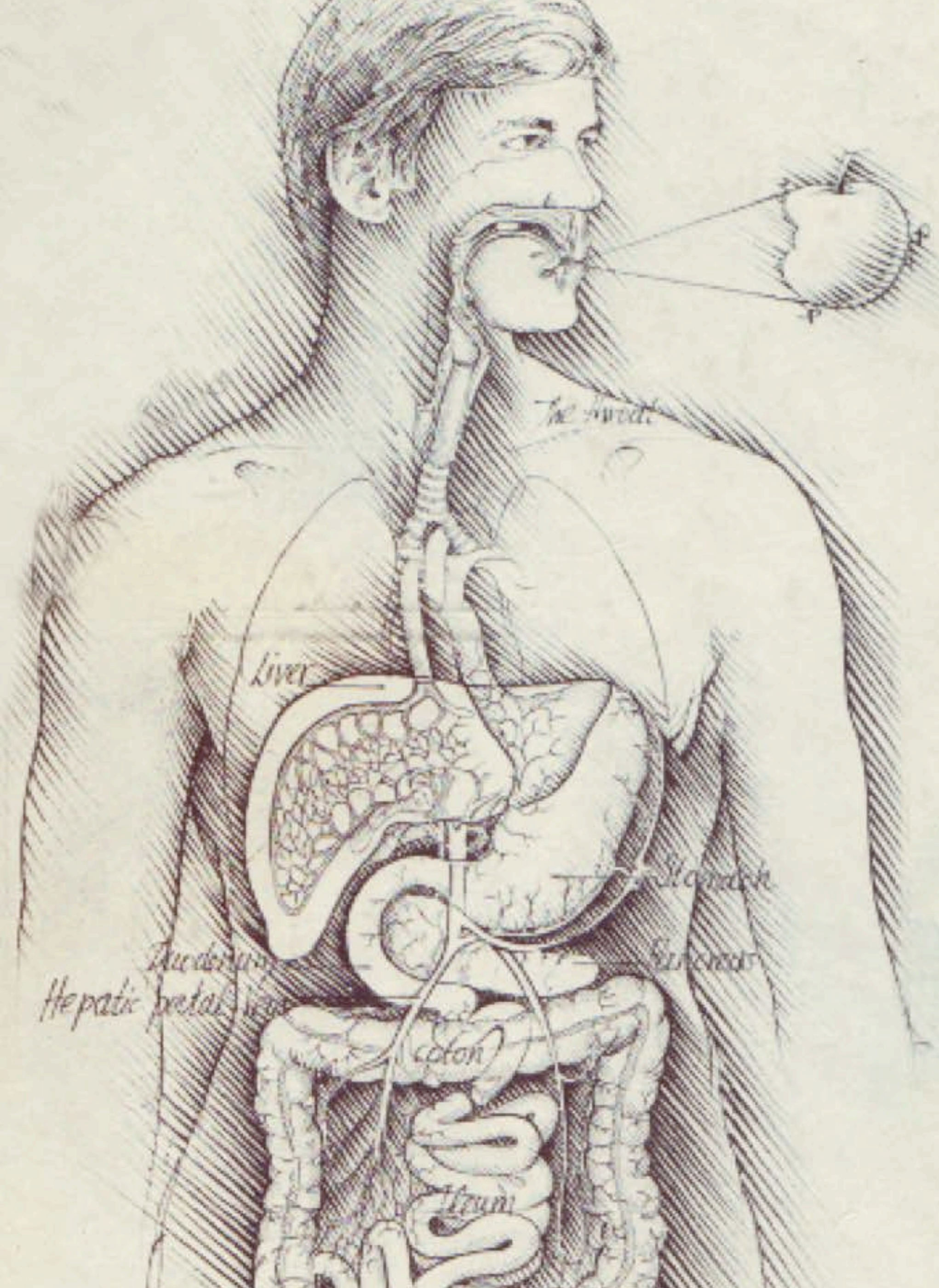


We have abdicated responsibility for our health and that of our children by allowing profit-driven marketing campaigns to dictate how we eat and feed our families. We gorge on unhealthy foods and stuff our children full of misnamed “happy meals” until they come to resemble pint-sized Michelin men, and then throw our hands up in despair when they, and we, develop **asthma, obesity, diabetes, heart disease, cancers, depression** and other chronic ailments.



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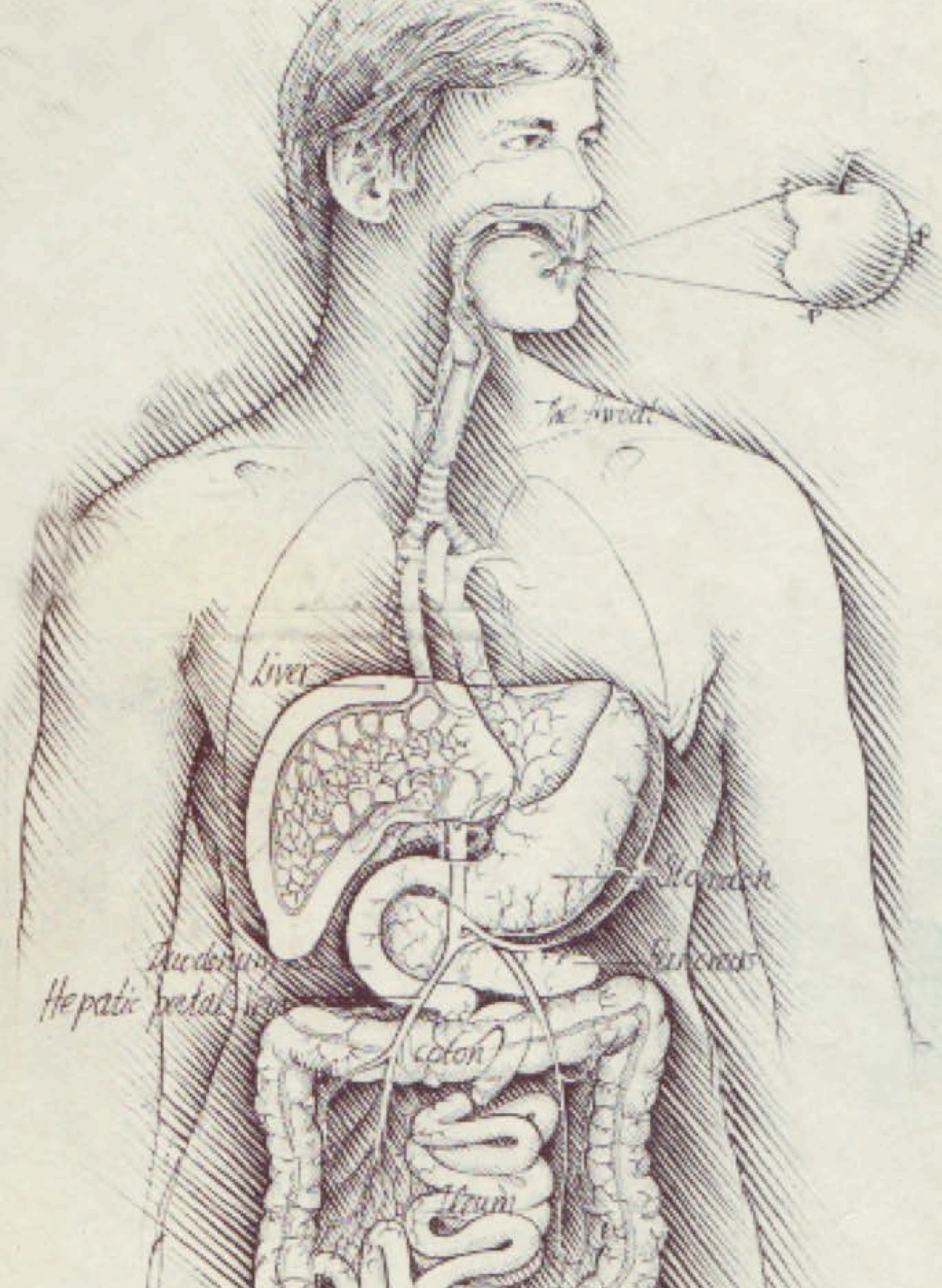
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We were all born ***without*** preferences. No one asked for **fried chicken, ice cream** or a **pork chop** in the delivery room. The unhealthy things we eat, we had to *learn* to like. ***We can learn to like healthy foods instead. We can change for the better.***



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We must do this not only for **our own** benefit, but also ***for the health and well-being of our children, and for the planet and its other inhabitants as well.***