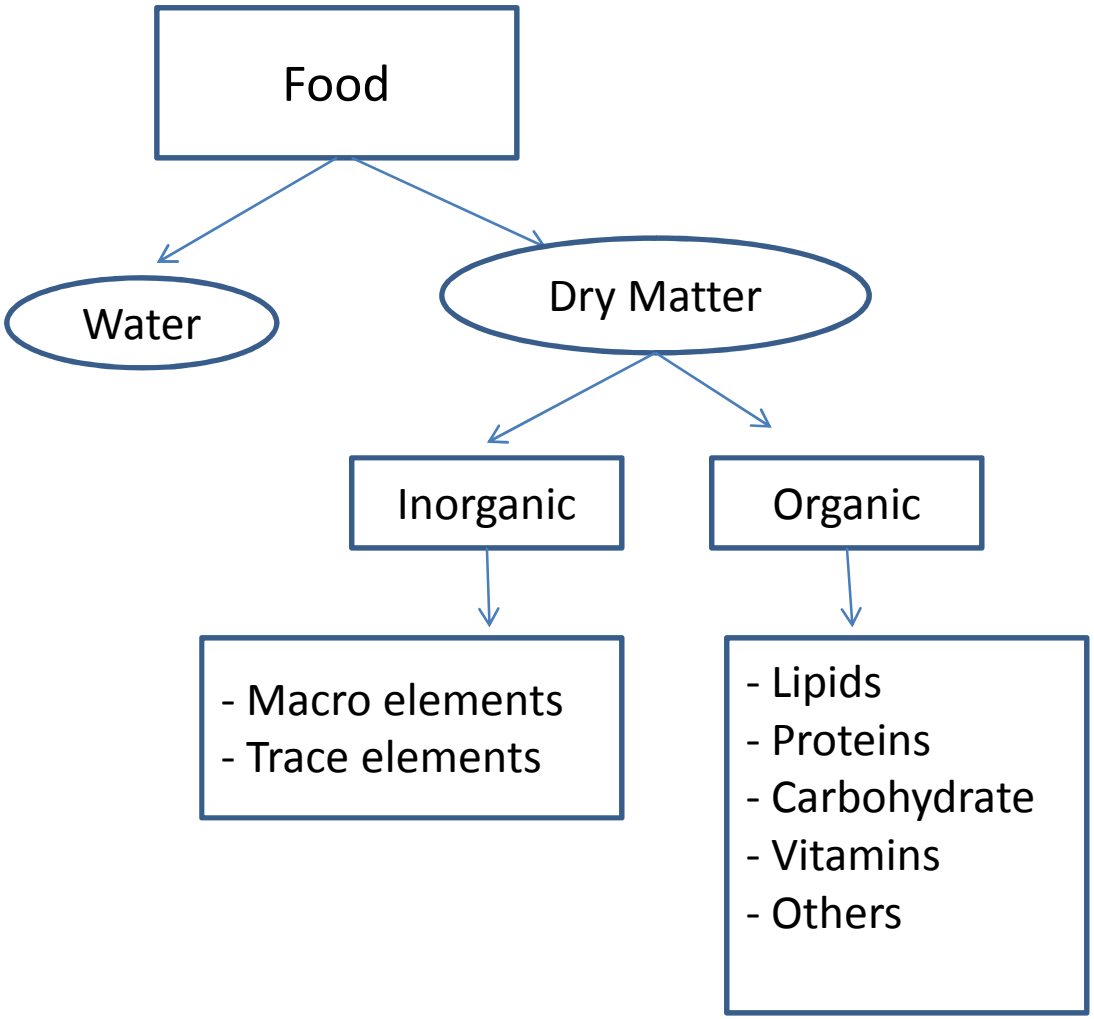
DIGESTIVE SYSTEM IN PRIMATES

Ani Mardiastuti

Main Components of Foods



Water Sources for Primates

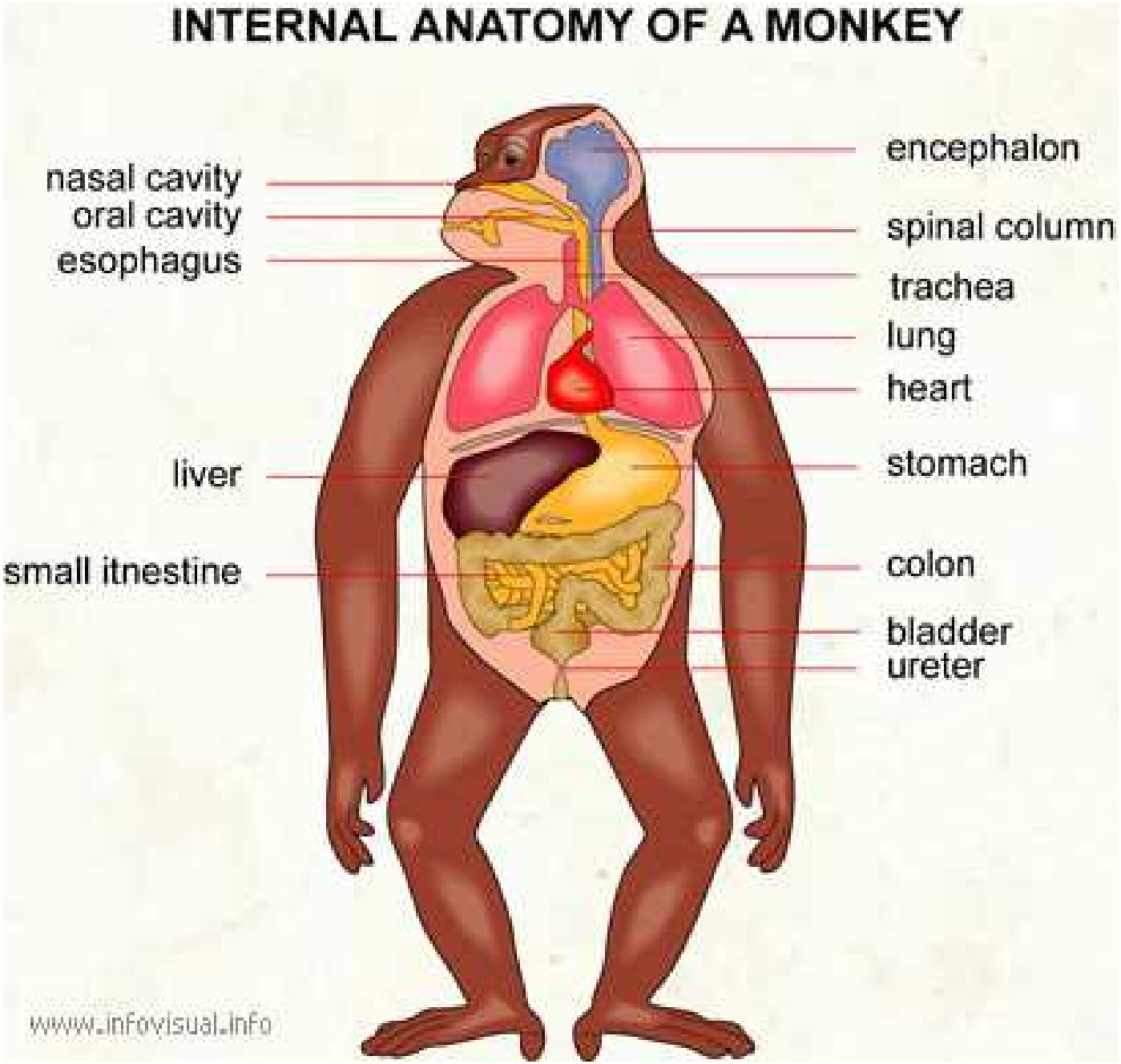
- Free waters

  Lakes, streams, dew on vegetation

- Water from food consumed
- Metabolic water

  Produced during the breakdown processed of proteins, carbohydrate and fats

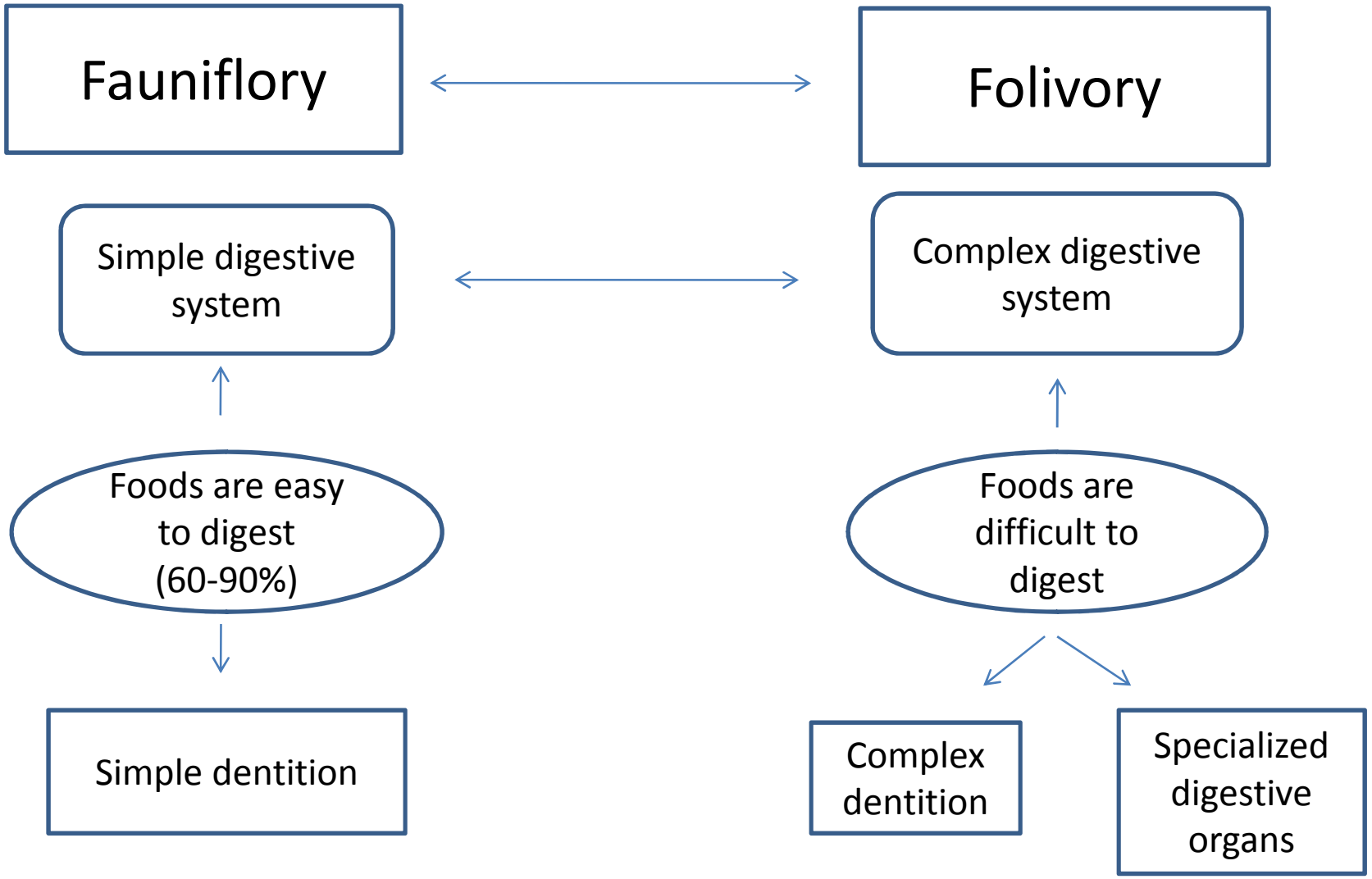
INTERNAL ANATOMY OF A MONKEY

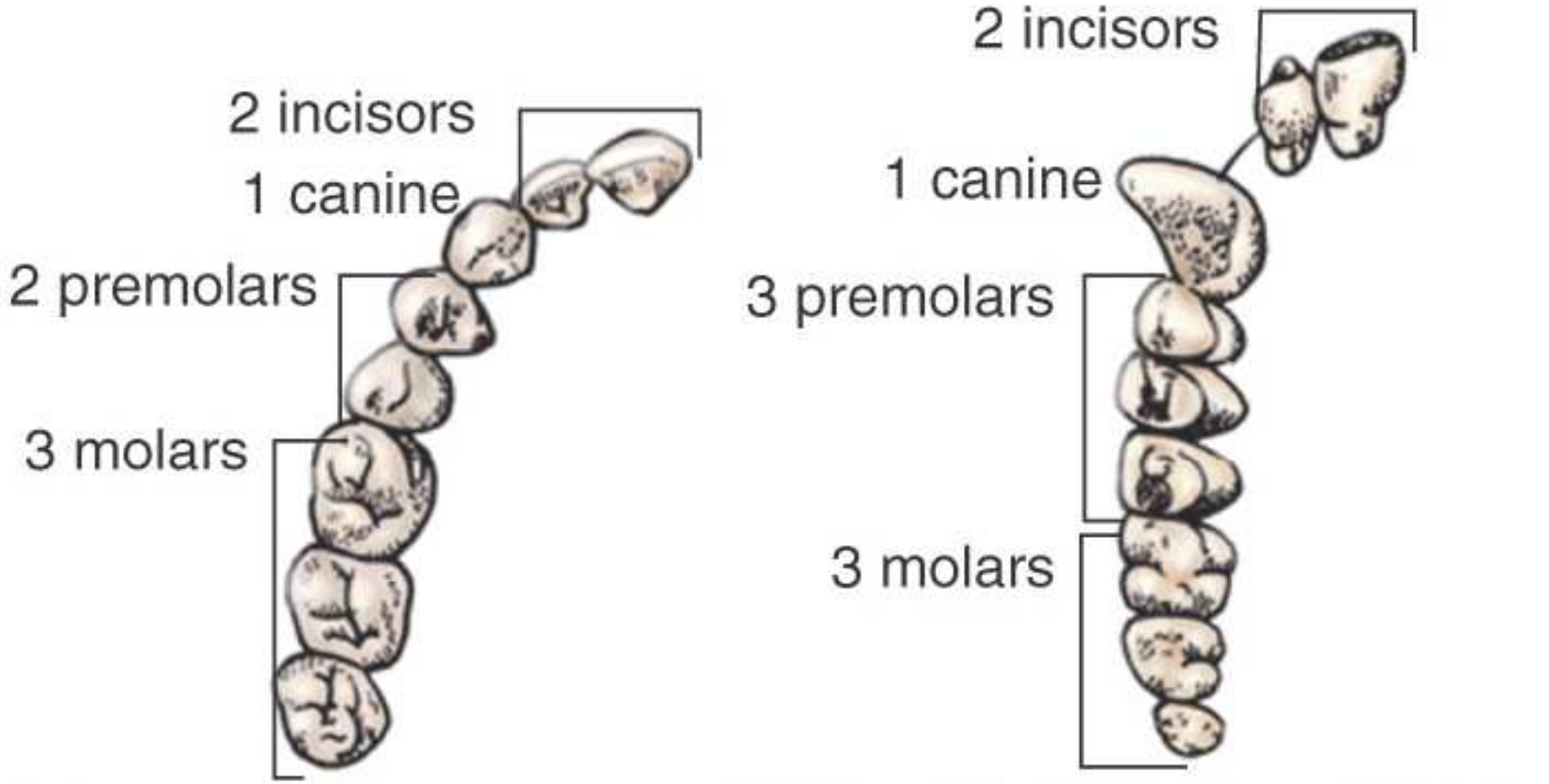


Folivore

- The long-chain carbohydrates found in leaves and structural plant parts require bacterial decomposition (fermentation) for digestion and assimilation
- Adaptations for fermentation:
  - chambers in the fore-gut (stomach)
  - chambers or mid-gut (cecum and colon)

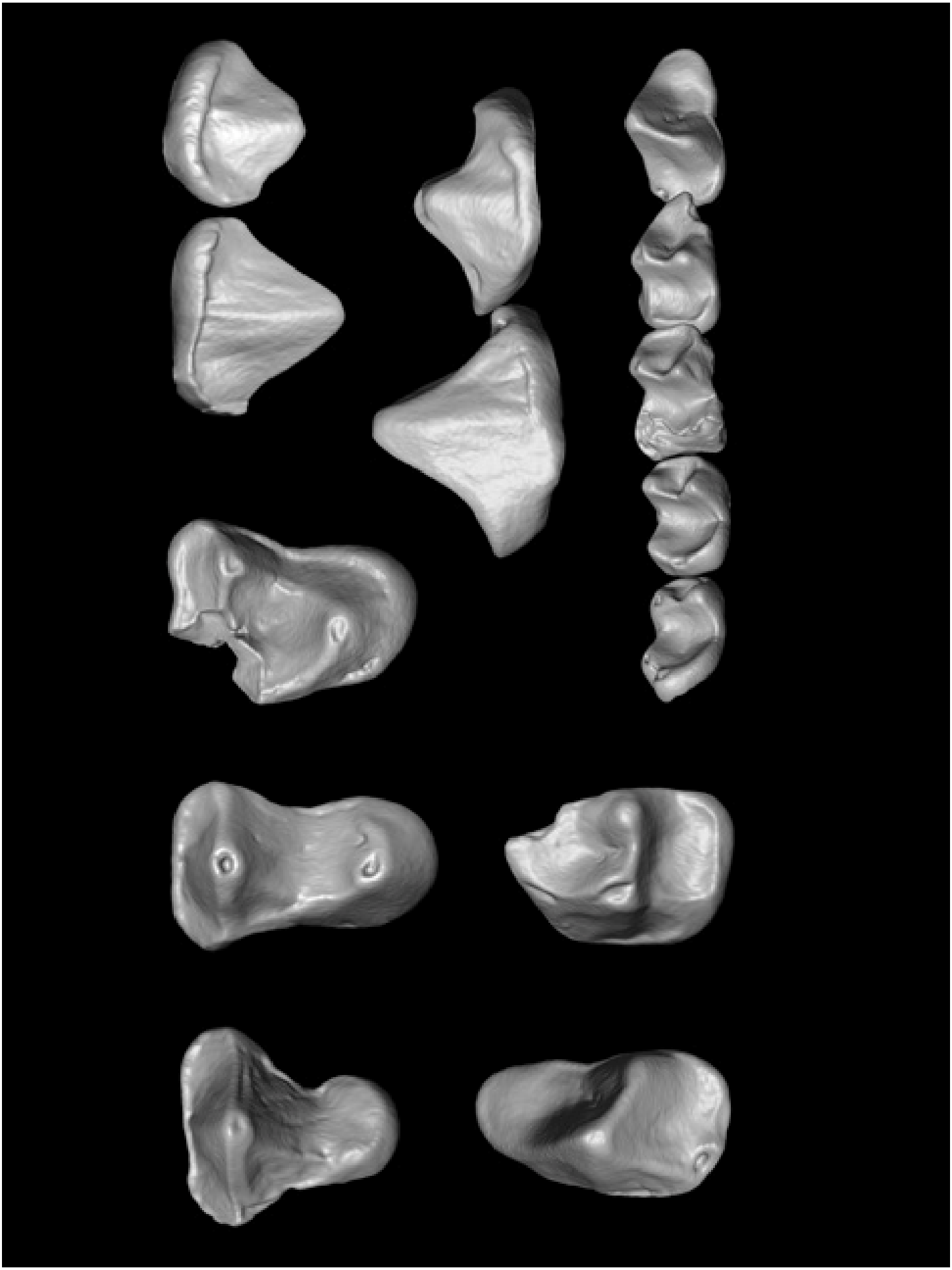
Digestive System

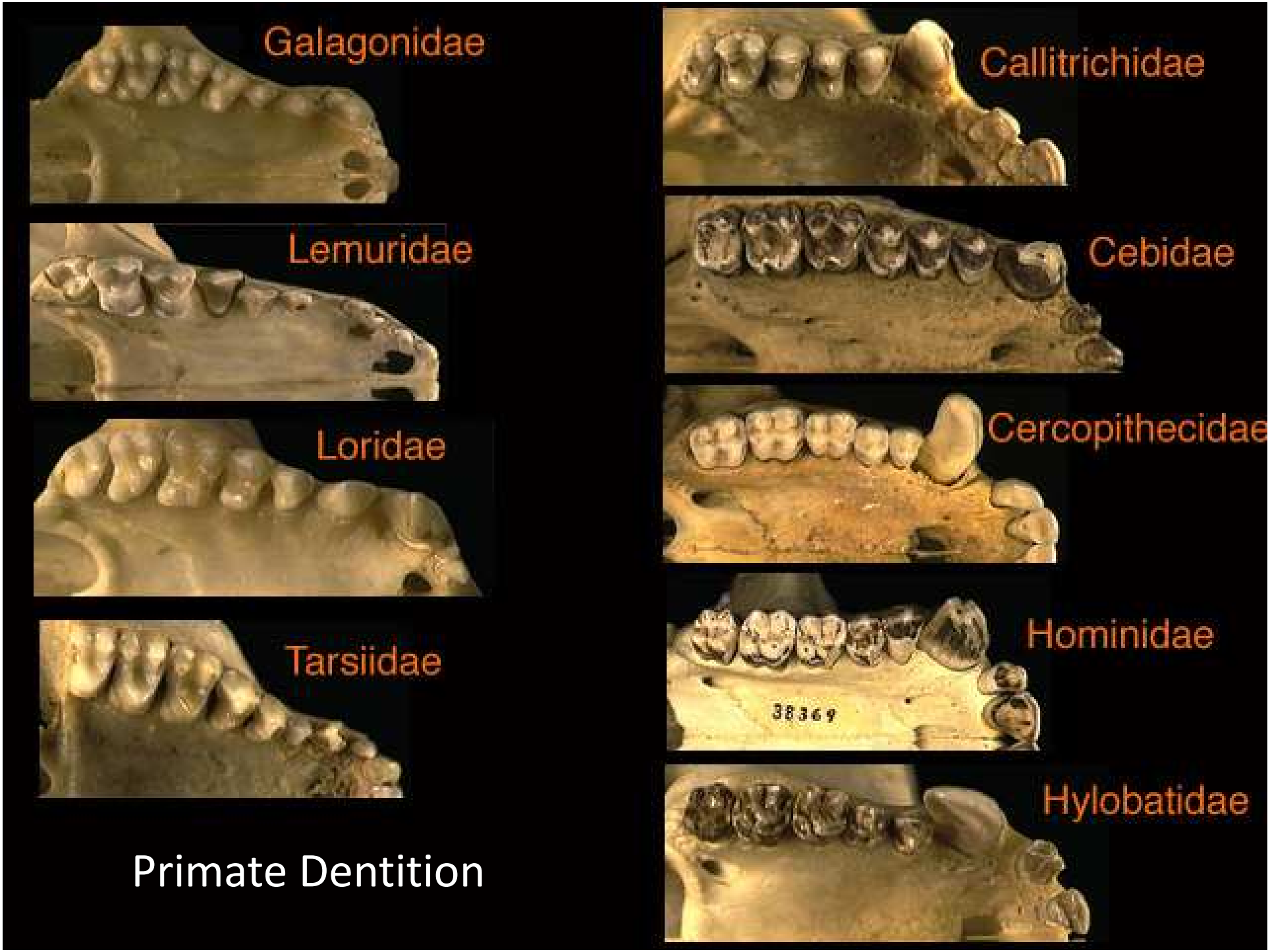




(a) Human: 2.1.2.3.

(b) New World monkey: 2.1.3.3.





Primate Dentition

Insectivores

- High, pointy cusps on the teeth, including the molars, for breaking into the insect's tough exoskeletons
- Short, simple digestive tract

Frugivores

- Wide incisors for scraping out the meat of fruits from their rinds
- Sturdy canines for puncturing and tearing fruit rinds without breaking off
- Low, rounded molar cusps for pulverizing fruit
- The gastrointestinal tracts: little structural specialization

Folivores

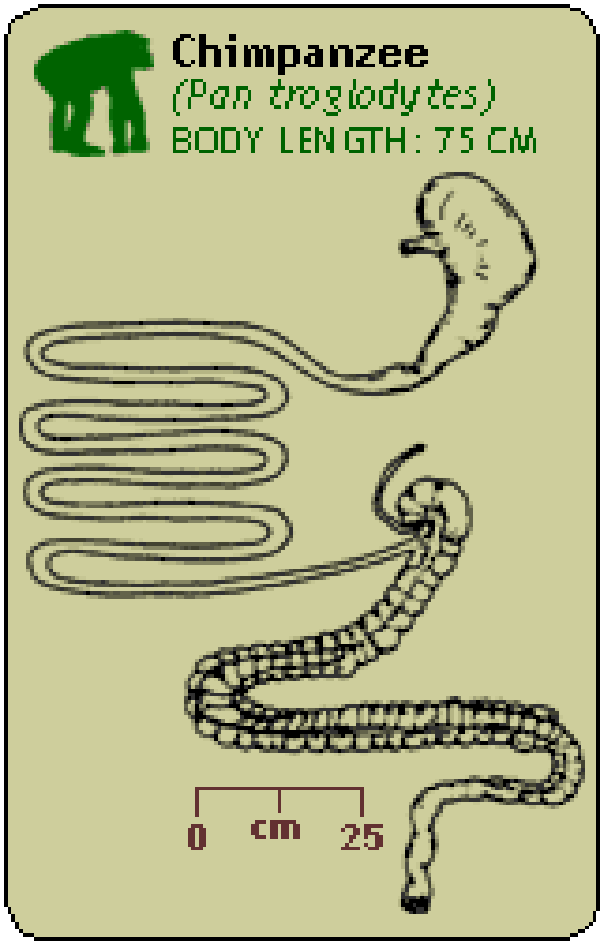
- Physical adaptations that promote - through symbiotic microbial fermentation and mechanical action - the degradation of the structural and chemical defenses of plants
- Enlargements of the stomach or the hind gut to accommodate microbial fermentation
- Gastrointestinal tract modification is related to the proportions of plant parts (leaves, seeds, and fruits) consumed

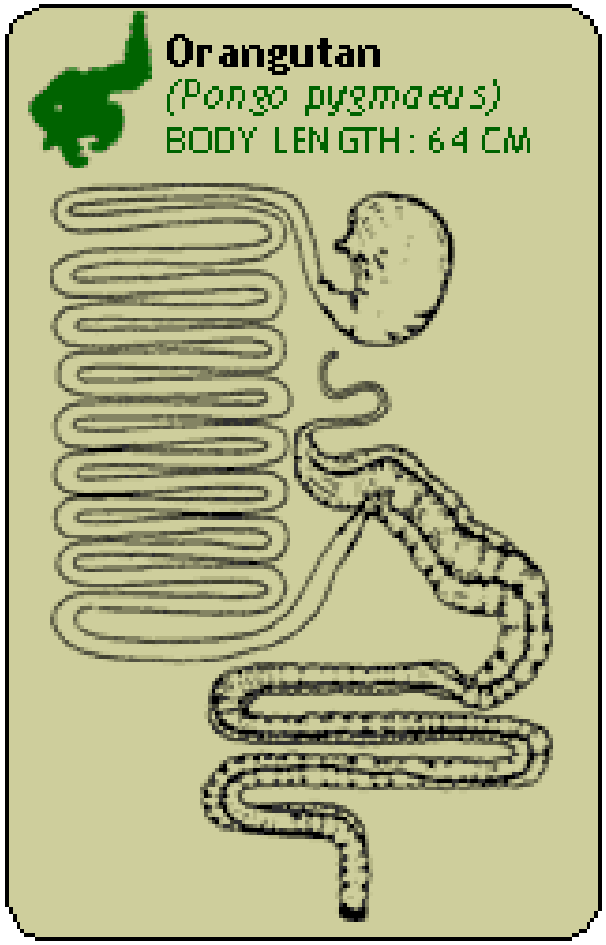
Asian Colobines

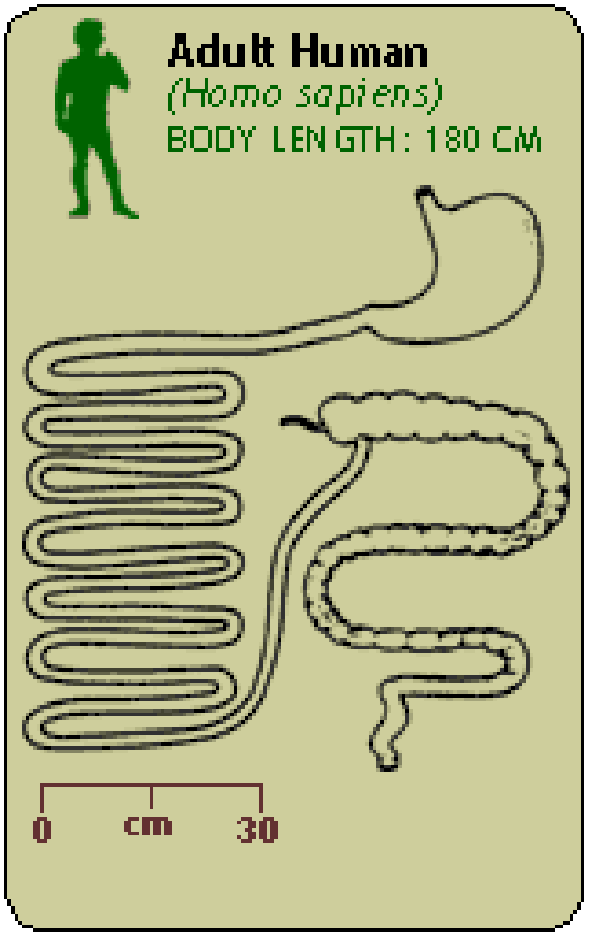
Nasalis, Presbytis, Trachypithecus

- Less-digestible plant materials in the natural diet
- Small intestines: 8x body length
- Large intestines: 2x body length
- Cecum: ¼ body length, secondary site of microbial fermentation

Gastrointestinal Tracts







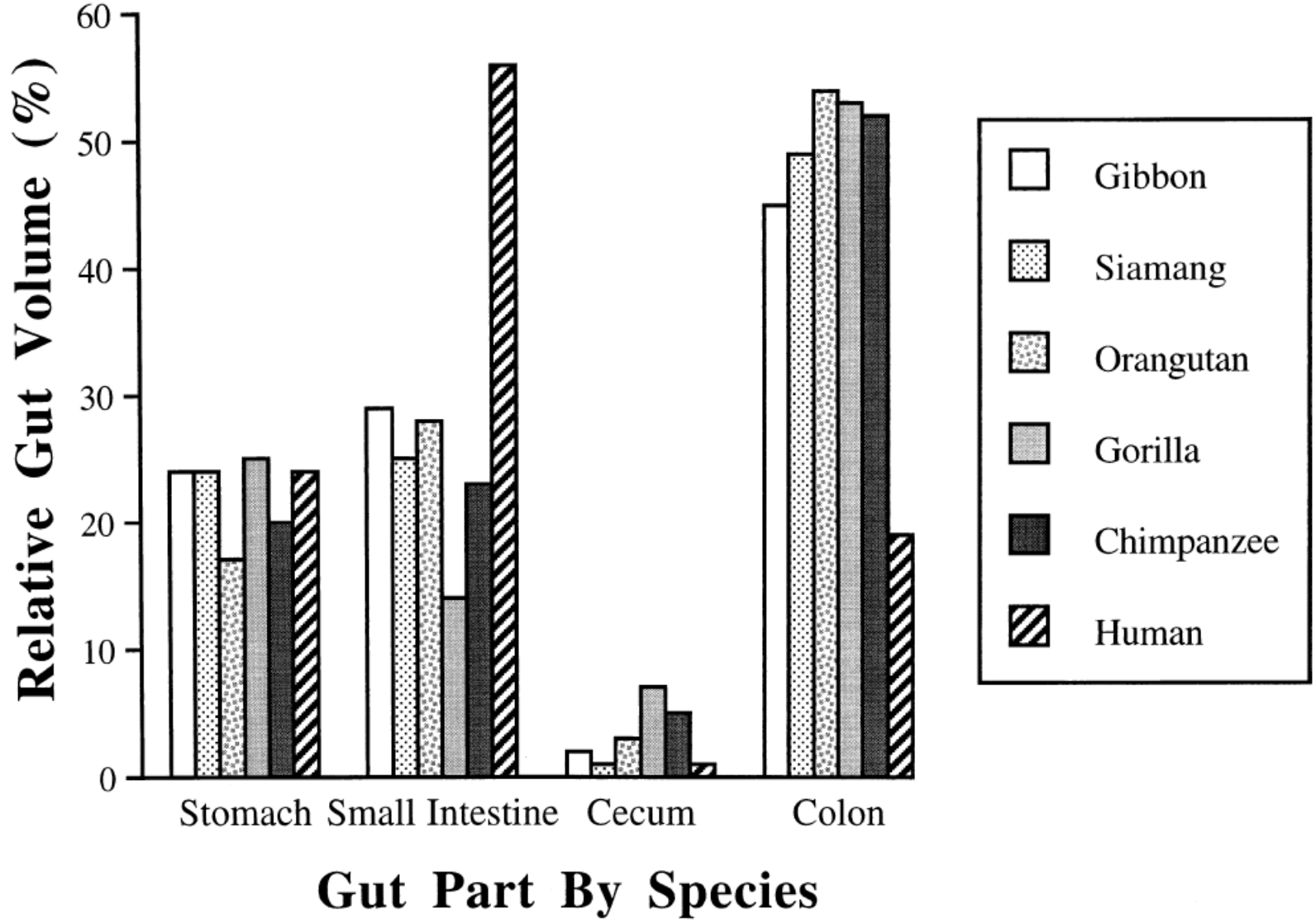
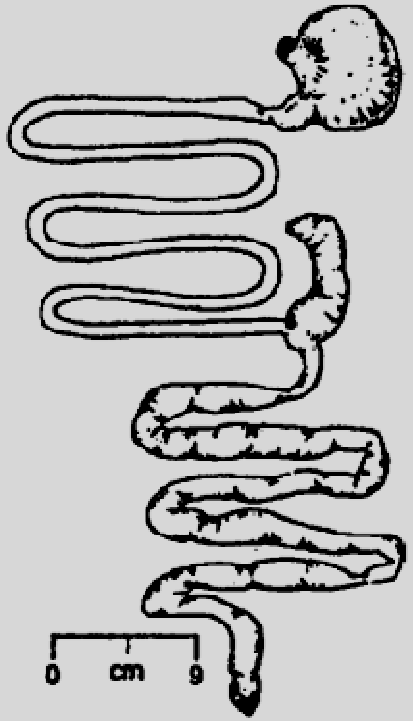
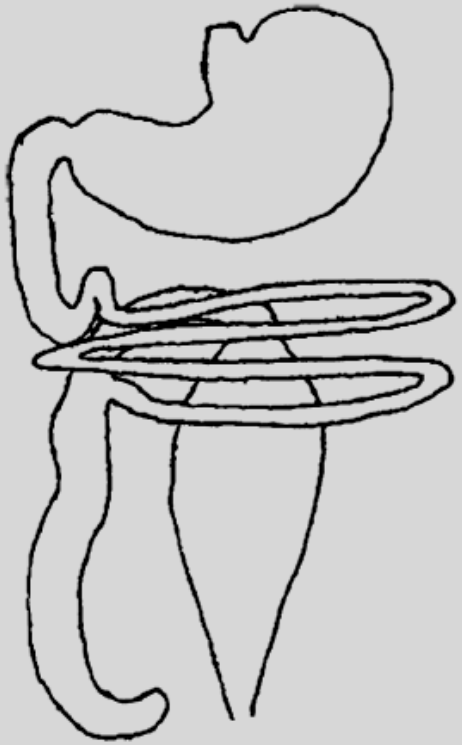
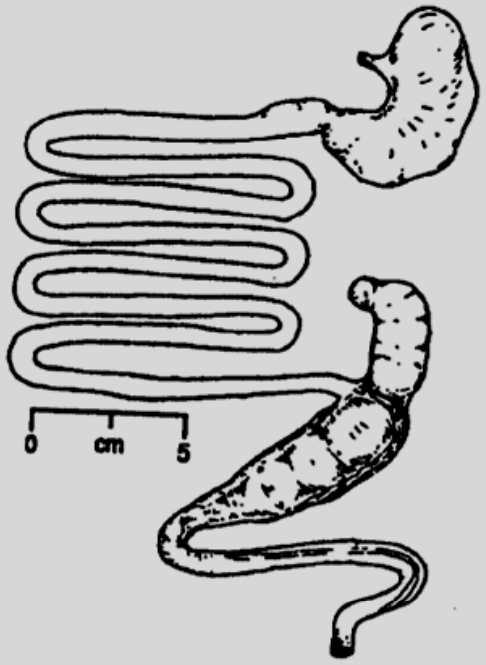


FIG. 1. Relative gut volume proportions for some hominoid primate species (percentage of total volume): gibbon (*Hylobates pileatus*); siamang (*Hylobates syndactylus*); chimpanzee (*Pan troglodytes*); gorilla (*Gorilla gorilla*); orangutan (*Pongo pygmaeus*); human (*Homo sapiens*). See Milton[27] for sources of raw data. All calculations of relative volume by K. Milton.



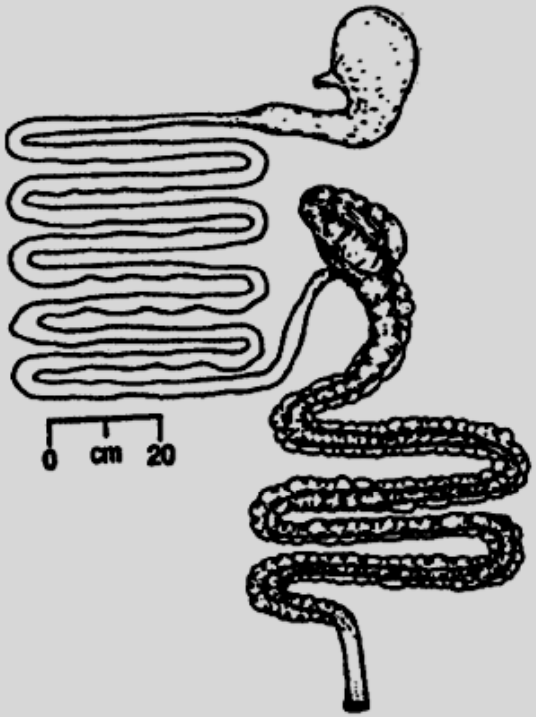




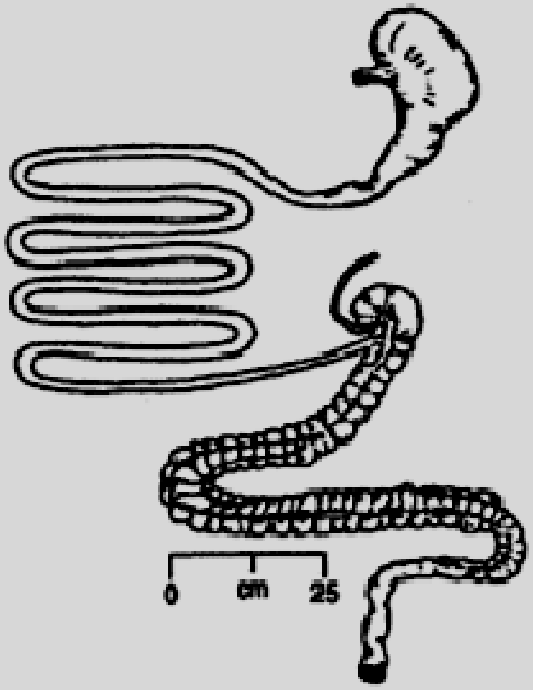
Bushbaby

Tarsier

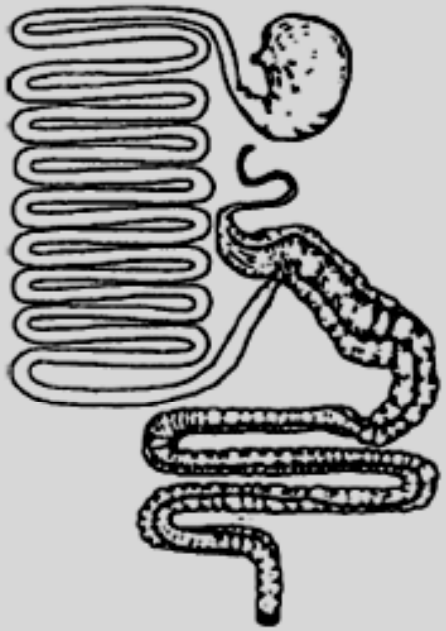
Night Monkey



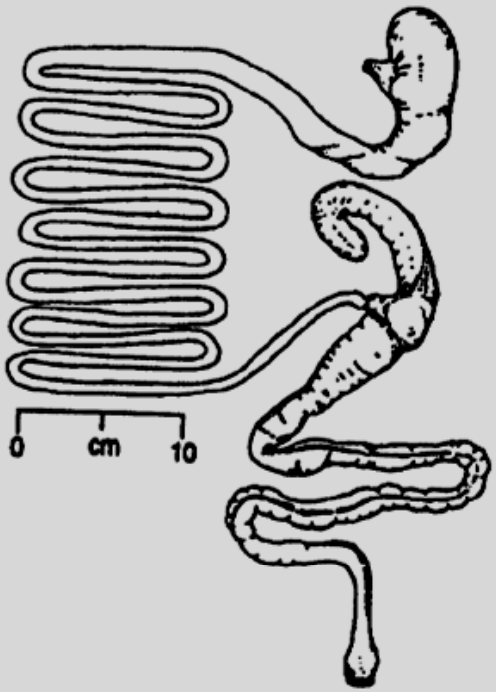
Baboon

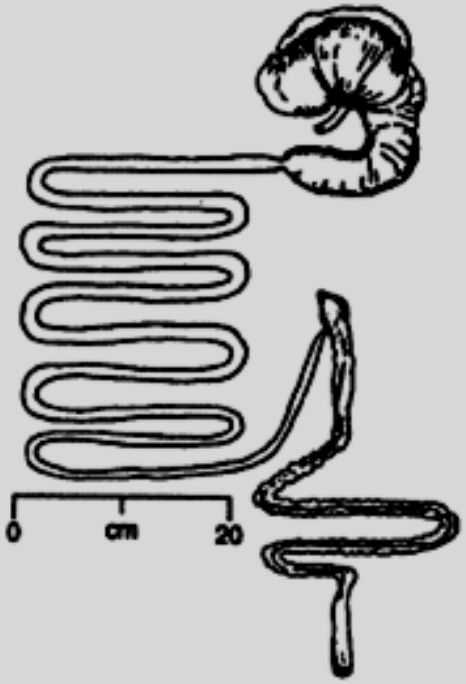


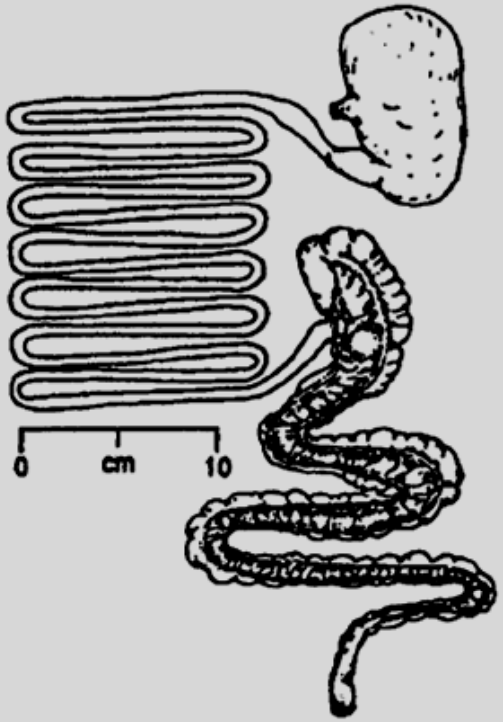
Chimpanzee



Orangutan

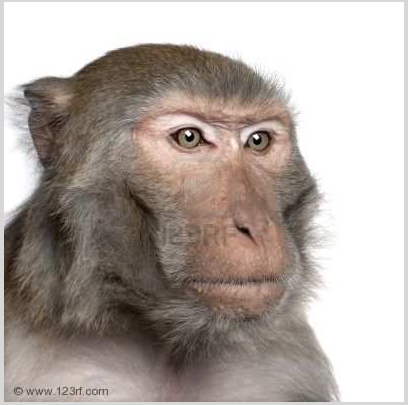




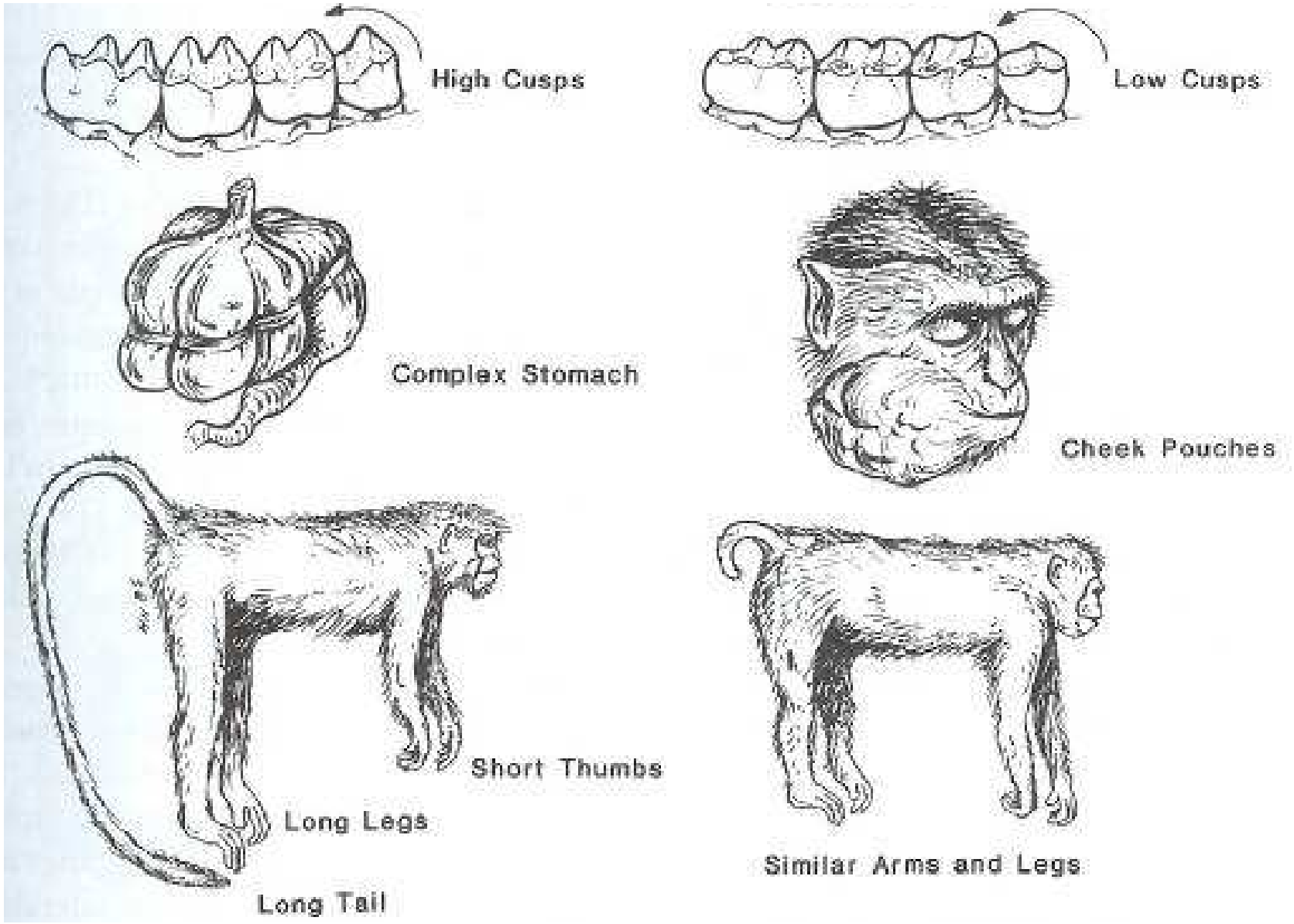


Wooly Monkey

Colobus Monkey



Macaque

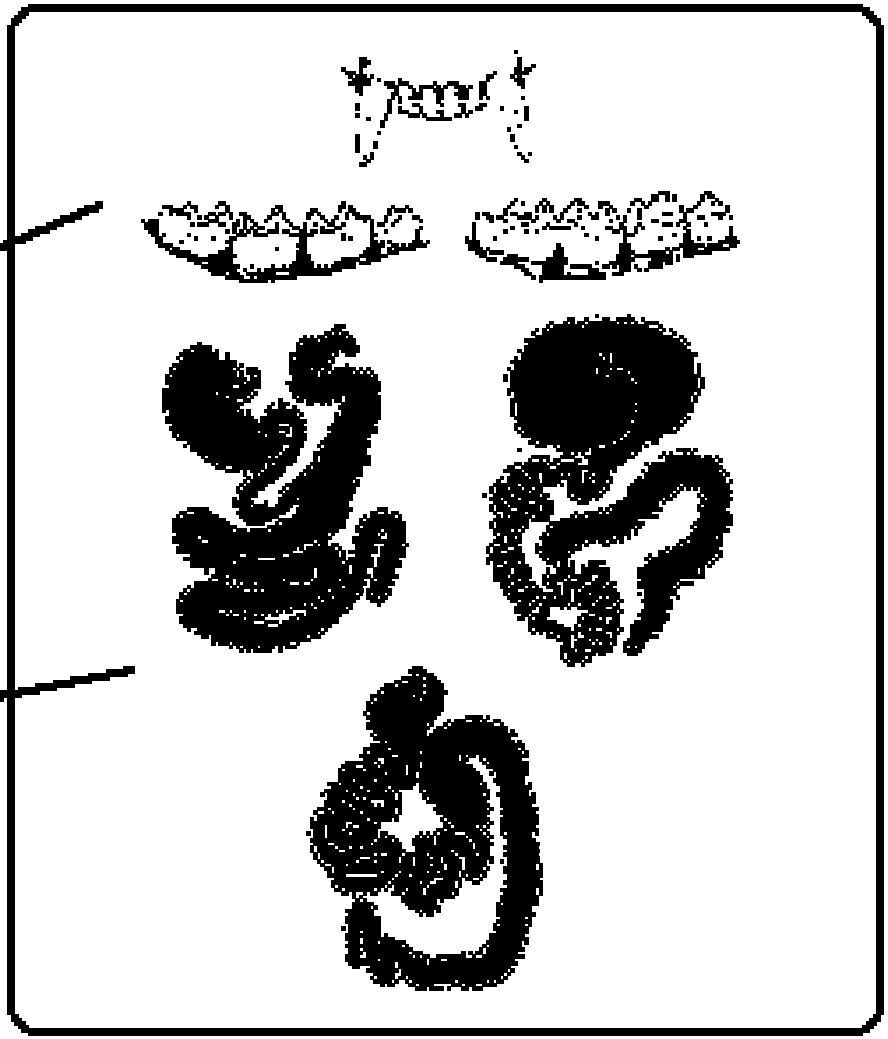


Colobines **Cercopithecines**

LEAF EATERS

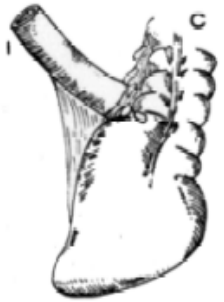
SMALL INCISORS AND
DEVELOPED MOLAR CRESTS
FOR SHEARING/GRINDING

COMPLEX STOMACH OR
ENLARGED LARGE INTESTINE



PRIMATE CECA

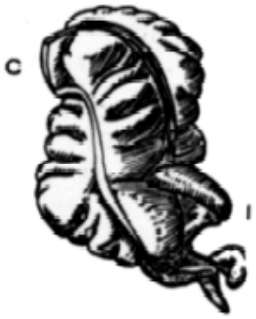
Ruffed Lemur
(Lemur variegatus)



Mona Monkey
(Cercopithecus mona)

Black-handed Spider Monkey
(Ateles geoffroyi)

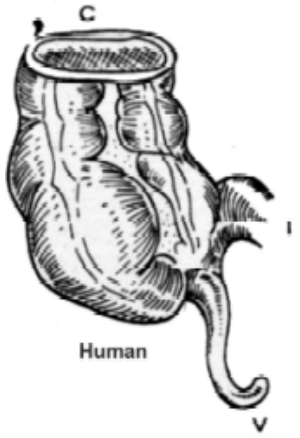
Guinea Baboon
(Papio papio)



White-handed Gibbon
(Hylobates lar)

Gorilla
(Gorilla gorilla)

Chimpanzee
(Pan troglodytes)



Human

Food Digestion

- Folivores:

  the foods require fermentation in a large stomach or the large intestine/colon

- Faunivores:

  gut structure → simple globular stomach, small intestine, short conical cecum, and simple smooth-walled colon

How much food does a primate need?

Depends on:

- Basal metabolic rate (BMR)
- Activity
- Growing stage
- Reproduction stage

  Pregnancy: up to a 25% increase in caloric intake; lactation: up to a 50% increase in caloric intake

Basal Metabolic Rate (BMR)

- BMR: the minimum calorific requirement needed to sustain life in a resting individual
- Generally accepted to be 290 kJ/kg b ~ d y
- Depends on
  - body size
  - home range
  - vulnerability to predation
  - position in their group's dominance hierarchy

BMR

- Larger animals require more energy to maintain their bodies than smaller ones → higher BMR
- Larger bodies are more efficient because their larger bodies conserve heat better
- Although a larger animal needs *more calories in total, it needs fewer calories per pound of body weight than a smaller animal*
- Smaller animal has to eat more relative to its body weight → concentrate on foods with a high caloric payoff per pound or per volume of food

Lack of Food May Lead to:

- Changes in diet
- Changes in feeding behavior
- Lowered reproductive output
- Migrate to other site
- Heavy mortality