Animal nutrition
Everyone’s gotta eat

The big picture

- Autotrophy vs. heterotrophy
- Why do we need food?
  - Use as fuel for cellular work
  - Form important molecules
  - Supply essential ‘pre-made’ nutrients

Fuel
- Nearly all ATP derived from oxidation of organic molecules
  - Protein
  - Carbohydrate
  - Fats

Raw Materials
- Raw materials for biosynthesis of carbohydrates, lipids and proteins

Essential Nutrients
- Stuff we can’t synthesize
  - Vitamins
  - Essential Amino Acids
  - Minerals

Essential amino acids
- Humans cannot synthesize 8 of the 20 AA’s needed to make proteins; also difficult to store
- Can lead to protein deficiency, especially in infants
- Best sources of AA’s?
  - Meat, eggs, cheese
- What if animal protein is not available?
Essential amino acids

- The eight essential amino acids for adult humans:
  - Tryptophan
  - Methionine
  - Valine
  - Threonine
  - Phenylalanine
  - Leucine
  - Isoleucine
  - Lysine

- Beans and other legumes

- Corn and other grains

Vitamins

- Organic molecules required in very small amounts
- 13 are essential to humans
- Solubility
  - Water: B-complex, C
  - Fat: A, D, E
  - Influences overdosage concerns

Essential nutrients

- Animals missing essential nutrients in their diet are malnourished (vs. undernourished—not enough calories)
- Minerals: simple inorganic nutrients required in small amounts

You Are What You Eat?

- Most animals digest (break down) what they eat and use the components to resynthesize the macromolecules they need.
- Why not just absorb whole proteins?

You’re not really what you eat: different feeding modes

- Saprophytes
- Herbivores
- Carnivores
- Omnivores
- Parasites
Stages of feeding

- Ingestion
  - Initial introduction of food to digestive system

- Digestion
  - Break down molecules into units small enough to absorb, mechanically and chemically (hydrolysis)

- Absorption
  - Active or passive transport

- Elimination
  - of undigested material
  - Not "excretion," which has a different meaning in physiology

Food processing overview

Ingestion adaptations

- Diet vs. dentition

Fig. 41.20

Digestion in humans

Digestion in the stomach

- Storage and preliminary digestion
- Gastric juice has a pH of 2
- Pepsin hydrolyzes protein
- Result: acid chyme
Digestion in the duodenum

- A whole lot of digestion going on

Digestion

- What, with what, where, how?
- Why don’t you digest yourself?

Stages of feeding

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Small intestine structure

- Increasing surface area for what?

Absorption in the large intestine

- Water recovery, minerals, vitamin K

Digestion adaptations

- Diet vs. alimentary canal

Fig. 41.16

Fig. 41.19

Fig. 41.18

Fig. 41.20

Fig. 41.21
Rumination

- Ruminant digestion

Fig. 41.22

Rumination involves the reentry of cud, which is regurgitated and mixed with saliva before being re-swallowed and digested further. This process is facilitated by the presence of symbiotic prokaryotes and protists within the digestive system, aiding in the absorption of nutrients such as H$_2$O.