Evolutionary Adaptations

EQUINE NUTRITION #1

CREATED FOR CANADIAN PONY CLUB EDUCATION

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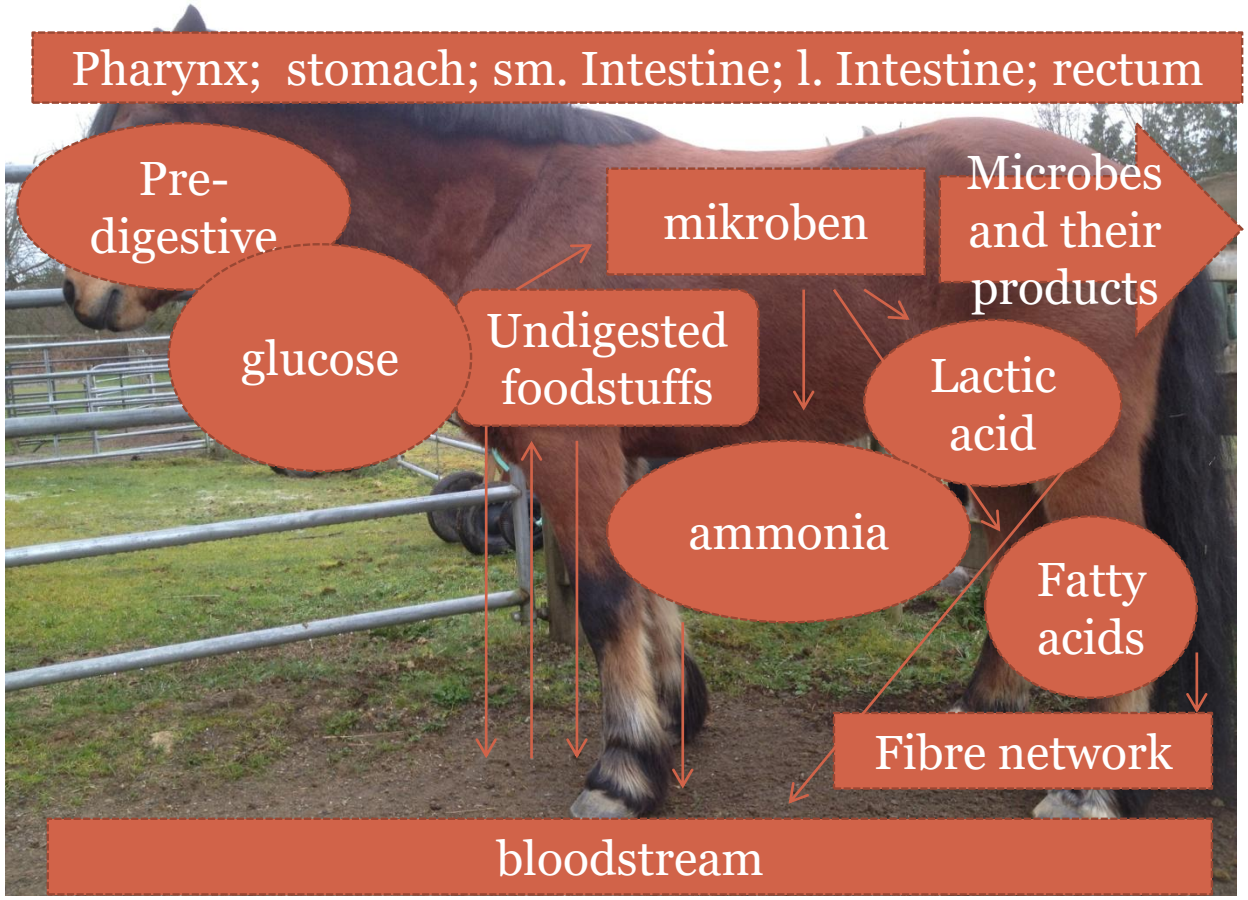
The horse

- Horses are classified as **non-ruminant herbivores**
- They are a **combination** of **simple stomach animals** and **ruminants**
  - A **ruminant** is a **hindgut fermenter**
  - A **non-ruminant** is an animal that **relies on enzymatic digestion via the stomach and small intestine**, with *limited degradation occurring in the large intestine*
    - The horse is half-way between the ruminant and non-ruminant

Enzymatic digestion takes place in the foregut (stomach and small intestine)

Microbial digestion takes place in the hindgut (cecum, small colon, large colon)



Enzymatic and microbial digestion sites

Evolutionary Adaptations

- The 5 toed, dog-sized forest dwelling omnivore evolved into today's Equus
- Climate change lead to:
  - Transition from a forest dwelling to grassland inhabitant
    - This caused a change in forages available for consumption
      - These changes in available forages initiated morphological (body shape) changes
  - New predators and new competitors in the grassland resulted in additional morphological changes

Morphological changes

- Brain advancement occurs first in prey animals
- Eye and ear changes improve survival rates
- Increased neck length allows the animal to graze trees
- Development of a more rigid spine:
  - Allows higher speed, long-range escape strategy
  - Extreme lengthening of limbs increases stride length
  - Transition from 5 toed through 3 toed to present-day single digit ending in a hard hoof
  - Increases in torso size further increase height

Specific changes to the head

- The head lengthens to accommodate dental changes caused by changes in forages being consumed
  - Development of hypsodont (high crown) teeth
  - Introduction of hypselophodonty (ever-growing teeth)
  - Increased number of cusps improve grinding surface
  - Formation of molars into uniform series
  - Development of numerous, large sinus cavities to aid in air exchange and temperature control
    - Allows for high speed escape of predators and long range search for grasslands

Changes to digestive system

- Over time, the horse evolves from an omnivore into a herbivore
  - The cecum enlarges to digest fibre
  - A symbiotic relationship is developed with microbes to aid in fermentation in the hindgut
    - This aids in the further breakdown of fibre

The Horse Today

- Is a social animal and herd animal
- Utilizes a 'fight or flight' response
- Biological and environmental adaptations that are seen:
  - The horse is intended to range up to 80 km/day
  - It is designed to be grazing and chewing almost continually
  - It is designed to ingest food for 16-20 hours a day
  - It ingests foods that are primarily forages
  - It is designed to access varied food types that are:
    - Low in quality
    - High in fibre

Improper feeding can lead to hindgut disturbances, toxic reactions and impactions

Colic and laminitis are both caused primarily by hindgut disturbances

Horse colicking

High intensity, short duration work necessitates changes to feed types

Photo credit: Totem Photographics

History of captivity and feeding

- Domestication first took place about 3000 years ago in west-central Asia
- Grains introduced to supplement the forage diet:
  - Barley was the first grain fed
  - Oats were not domesticated until 1000 BC
  - Bran was commonly fed from the Roman times
  - Corn is a New World (North American) crop (from around 400 years ago)
  - Commercially mixed and prepared grains first appeared just over 100 years ago
  - Pelleted feeds were first introduced in the 1960s
- Recent advances in technology have created processes that:
  - Allow less weather-dependent methods of harvesting forages
  - Allow access to more standard and accessible nutrients

Daily turn out allows horses to eat little and often

Horses living in stalls have a higher rate of digestive disturbances

Feeding programs that don't follow a natural (grass-kept) method

- Any departure from a system where the horse is continually consuming food negatively affects gut function and stability
- Problems can arise, such as:
  - Gastric ulcers
  - Laminitis
  - Colic
  - Azoturia
  - Hindgut acidosis