

Unit B: Animal Anatomy & Physiology

Essential Standard 4.00: Understand reproductive and digestive physiology.

Objective 4.01

- Understand reproductive physiology.

Female Livestock Reproductive Physiology

□ Estrous Cycle

- length of the animal's reproductive cycle from one estrus to the next
- cattle and swine
 - 21 days

Female Livestock Reproductive Physiology

□ Estrus

- period of receptivity to the male
- Cow
 - about 16-18 hours
- Sow
 - about 2 days

Female Livestock Reproductive Physiology

- Signs of heat
 - Cattle
 - swelling of the vulva
 - frequent urination
 - nervousness or restlessness
 - mounting other animals
 - letting other animals mount
 - The best indication that a cow is ready to breed is when she stands when mounted

Female Livestock Reproductive Physiology

- Swine
 - restless activity
 - swelling of the vulva
 - discharge from the vulva
 - frequent urination
 - occasional loud grunting

Female Livestock Reproductive Physiology

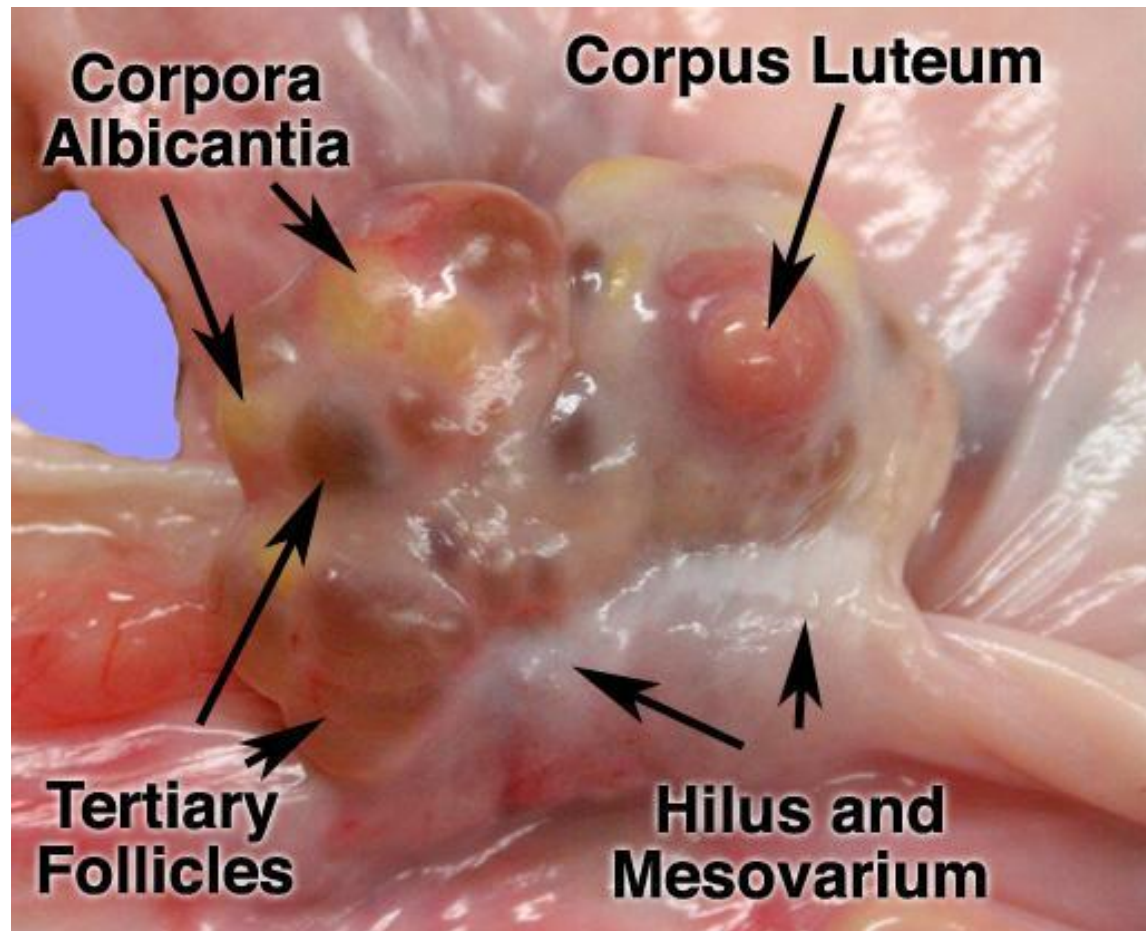
- Ovulation
 - release of ova (egg) from ovary
 - beginning (day 1) of female's cycle

Female Livestock Reproductive Physiology

□ Ovaries

- produce ova
- produces estrogen and progesterone
 - Number of young that animals give birth to at one time is indication of number of eggs released or ovulated
 - Sows- 10-15
 - Cows- 1

Female Livestock Reproductive Physiology



http://www.ansci.wisc.edu/jjp1/ansci_repro/lab/lab1/pig_2010/ovary.htm

Female Livestock Reproductive Physiology

- Each ovary houses hundreds of follicles where ova develop
 - The largest follicle is usually the one that is ready for ovulation
 - Forms the corpus luteum shortly after ovulation
 - releases hormone progesterone
 - If sperm are not present, the corpus luteum does not persist

Female Livestock Reproductive Physiology

- Estrogen- released by cells lining the follicle
 - Transported in the blood stream and causes numerous reactions in the animal's body:
 - Increases sensitivity in the uterus
 - Aids in the transport of semen
 - Mucus secretion in the cervix to lubricate the vagina
 - Signals signs of heat displayed by the animal

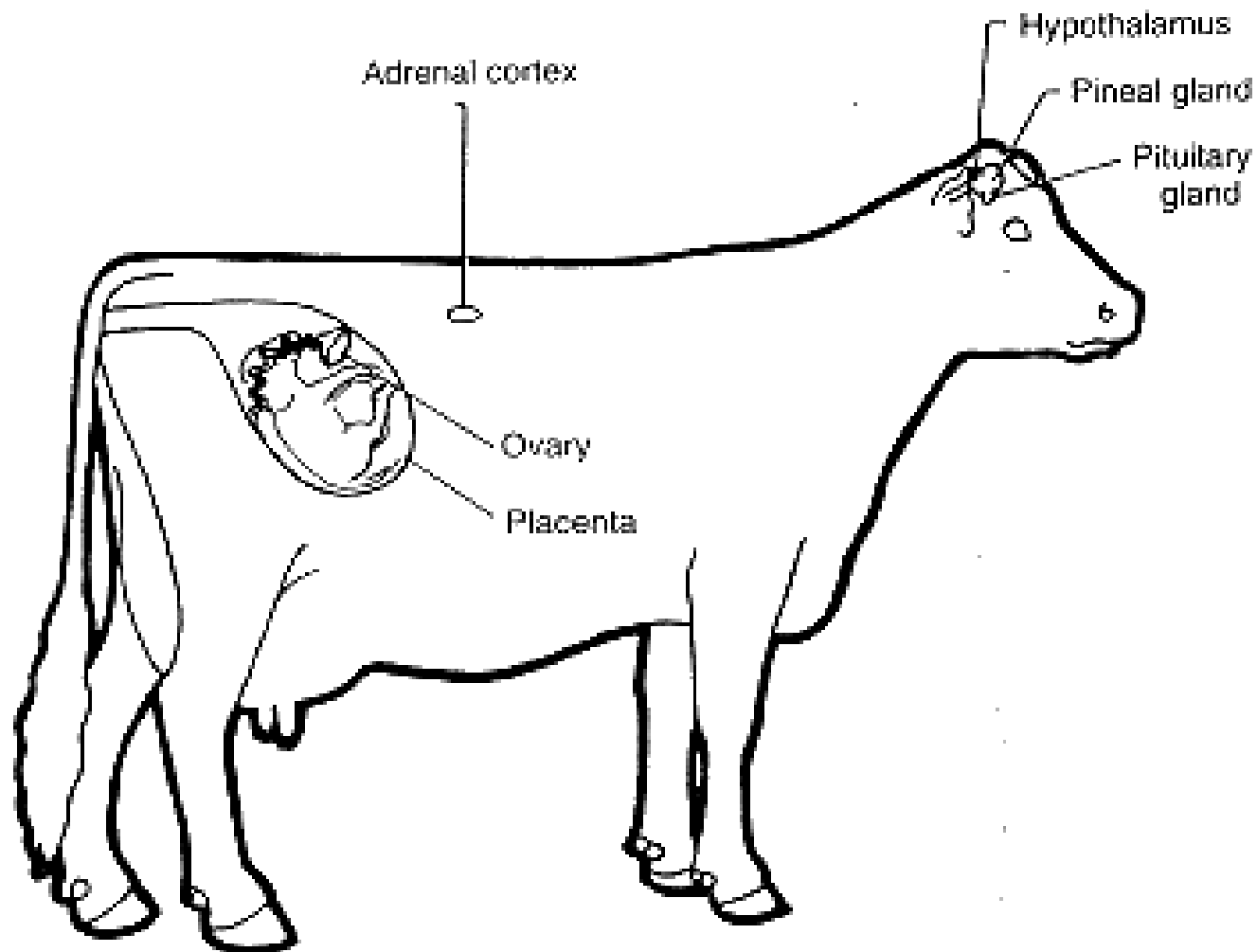
Female Livestock Reproductive Physiology

- Progesterone- produced 5-6 days after ovulation and released by cells in the corpus luteum
 - If fertilization occurred, progesterone:
 - Stops other eggs from forming and prevents estrus while animal is pregnant
 - Regulates production of follicle stimulating hormone (FSH) and lutenizing hormone (LH)
 - Allows egg to implant in the uterus
 - Maintains pregnancy
 - Encourages development of mammary glands

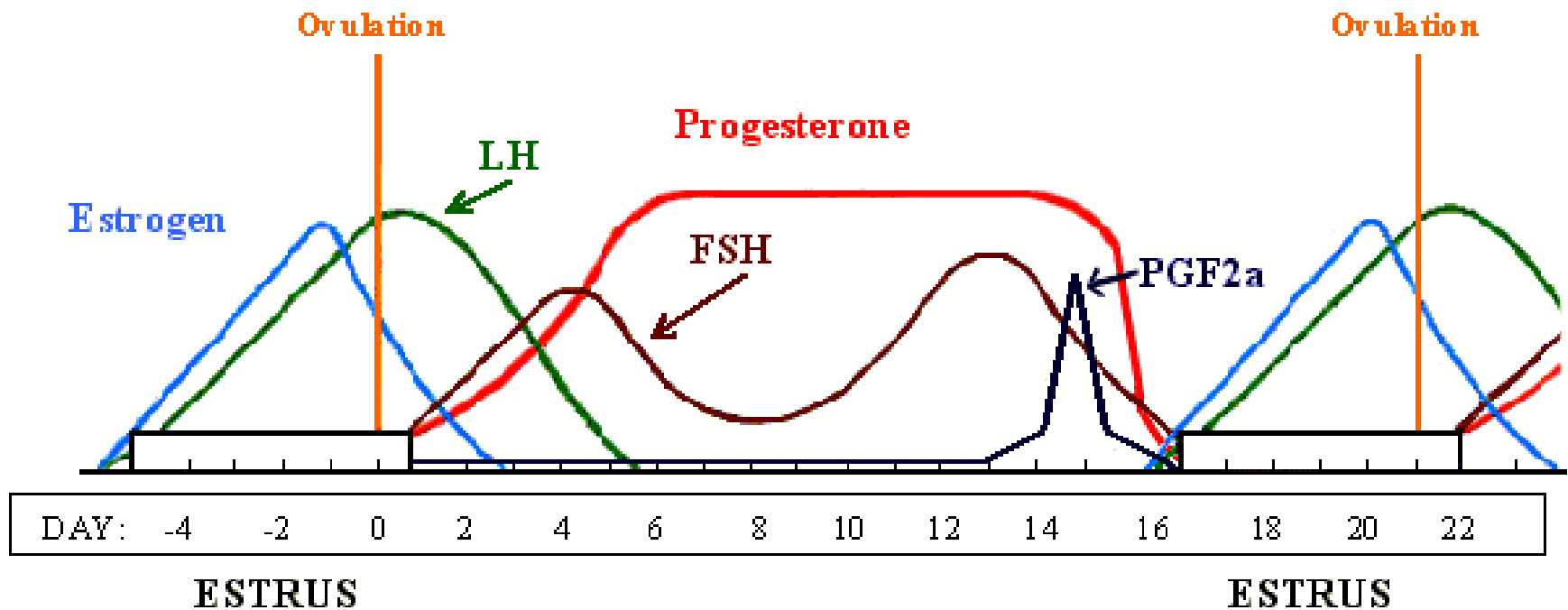
Female Livestock Reproductive Physiology

- If fertilization does not occur because sperm were not present or the body did not recognize the pregnancy, between day 15-16 the hormone prostaglandin:
 - Stops production of progesterone
 - Corpus luteum regression
 - Stimulates increase release of follicle stimulating hormone (FSH) and lutenizing hormone (LH) from the pituitary gland in the brain and the animal will continue the estrous cycle in preparation for the next heat and ovulation.
 - FSH stimulates growth of follicles
 - LH stimulates estrogen production which brings animal back into estrus

Female Livestock Reproductive Physiology



Female Livestock Reproductive Physiology



CURRENT
OVARIAN
ACTIVITY:

Ovulating
Follicle

Developing
CL

Maintained
CL

Regressing
CL

Ovulating
Follicle

© Equine-Reproduction.com

Embryo and Fetal Development

1. Day 1-2- spermatozoa travel into reproductive tract and ova is released and travels from ovary to oviduct through the infundibulum so fertilization can occur
2. The fertilized ovum is now referred to as a zygote and travels towards the uterus during the first 4-5 days of the estrous cycle. Uterine fluids surround the zygote.
3. The animal's body sends chemical signals to maintain levels of progesterone and retain the corpus luteum

Embryo and Fetal Development

4. The zygote continues to float freely in the uterus and develop membranes that become the placenta
5. Placental attachment occurs around day 30 in the cow and the embryo continues to develop for the remainder of the gestation period
6. Near the end of gestation, the corpus luteum reduces production of progesterone which causes an increase in estrogen production
7. Estrogen along with other hormones stimulates contractions which begins the birthing process

Parturition

□ Occurs in 3 phases

■ Preparatory Stage

- females prepares to give birth
 - Shows signs of restlessness, raising tail, separation from other animals and mucus discharge.
 - Mild uterine contractions may be observed
 - Fetus rotates to birthing position
 - Cervix begins to dilate and the some part of fetus enters birth canal depending on fetal presentation (front legs, rear legs, etc.)
 - Some fetal membranes may be visible when examining vulva

Parturition

- Expulsion Stage
 - fetus is expelled
 - Uterus increases frequency and force of contractions
 - Fetus is in birth canal and delivery should occur quickly.
 - Presentation of fetus varies between species:
 - Cattle- front feet, nose, head, shoulders, body, hips and back legs
 - Swine- no set presentation
 - Dystocia- an abnormal or difficult birth
 - Causes:
 - Animals that do not enter the birth canal in a normal presentation
 - Selection of animals with larger frame size than the female can manage

Parturition



- Cleaning Stage
 - expelling afterbirth
 - Retention of afterbirth will lead to infection and potentially death of the mother
 - After proper cleaning the uterus shrinks back to normal size (involution) and animal begins to cycle again

Objective 4.02

- Understand digestive physiology.

Digestive System Physiology

Terminology

□ Enzymes

- organic catalyst substances that speed up the digestive process

□ Rumination

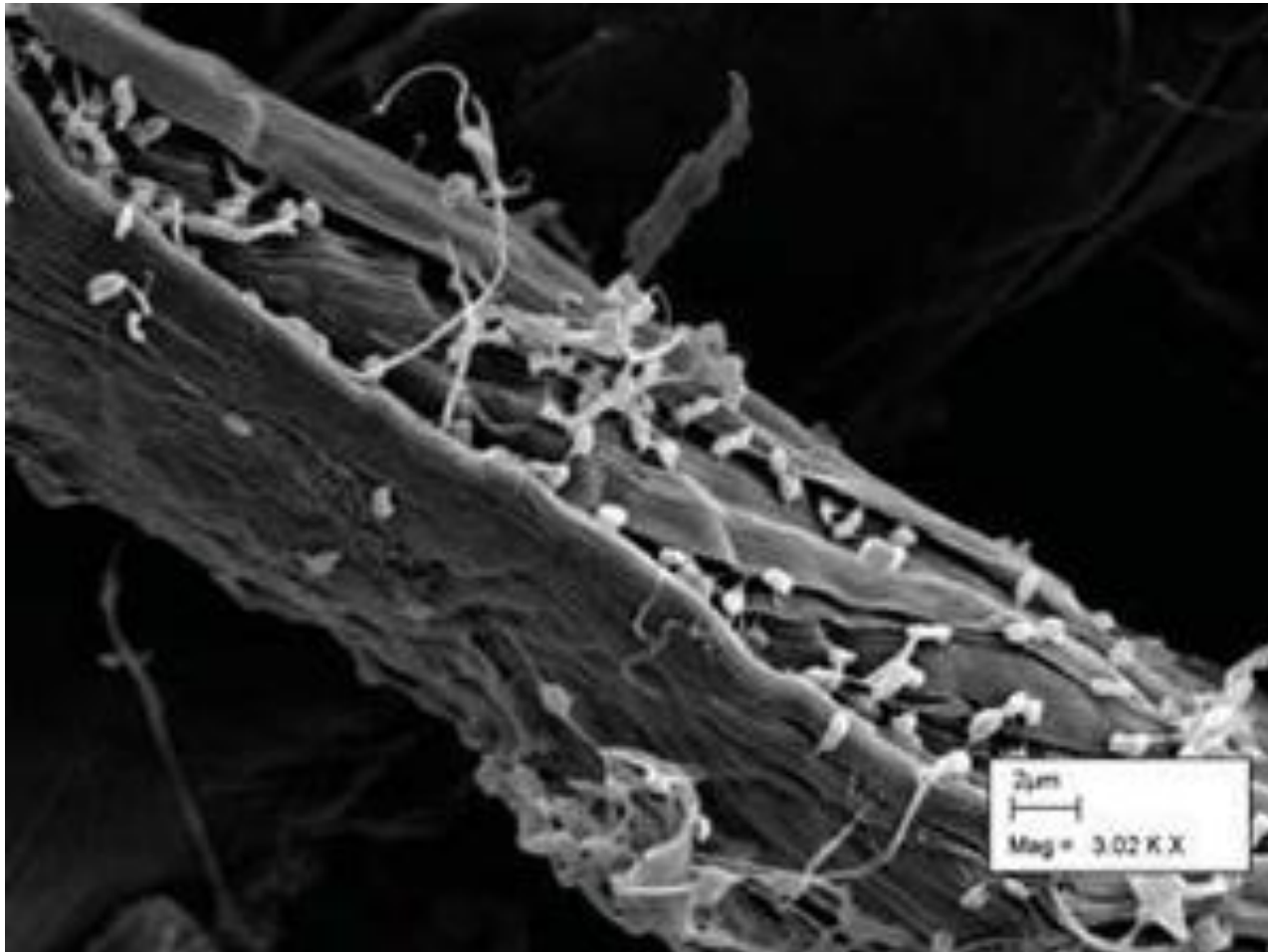
- process of forcing food back up the esophagus to be chewed again
- Occurs only in ruminant animals
 - “chewing the cud”

Digestive System Physiology

Terminology

- Bacteria and Protozoa
 - one-celled organisms
 - found in the rumen and reticulum and aid in digestion
- Amino Acids
 - compounds that are the building blocks of protein
 - contain carbon, hydrogen, oxygen and nitrogen
 - essential for growth and maintenance of cells

Digestive System Physiology Terminology



Bacterium attacking a plant fiber. Photo by Lydia Joubert. USDA publication

Digestive System Physiology

Terminology

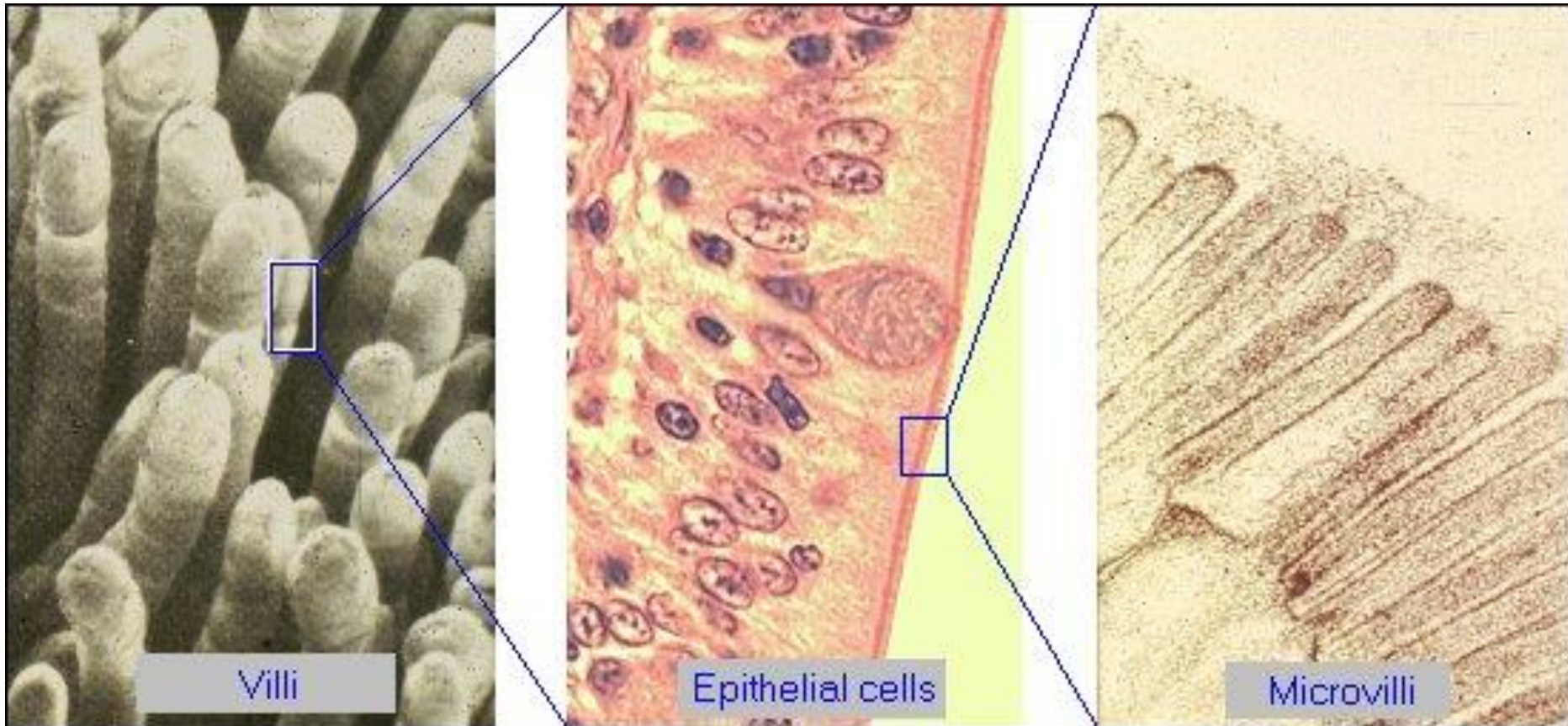
□ Villi

- small finger-like projections in the intestinal wall
- increase the surface area
- aid in digestive absorption

□ Gastric Juice

- liquid that contains water, mucus, hydrochloric acid and digestive enzymes
- secreted by glands

Digestive System Physiology Terminology



Digestive System Physiology

Terminology

□ Chyme

- partially digested feed that is acidic, semi fluid, gray, and pulpy
- produced in stomach and sent to small intestine

□ Prehension

- process of grasping feed with lips tongue and/or teeth

Digestive System Physiology

- Mouth, Teeth Tongue and Salivary Glands
 - Mouth and teeth masticate (chew) food to increase surface area of food particles
 - Saliva in mouth stimulates taste and softens and lubricates food
 - also contains salivary amylase and maltase enzymes to help change some starch to maltose (malt sugar)

Digestive System Physiology

- Mouth, Teeth Tongue and Salivary Glands
 - Ruminants swallow food rapidly without chewing food adequately
 - They then ruminate feed
 - Tongue guides feed to esophagus and can also aid in prehension for some species

Digestive System Physiology

□ Esophagus

- carries food from mouth to stomach through a series of muscular waves or contractions

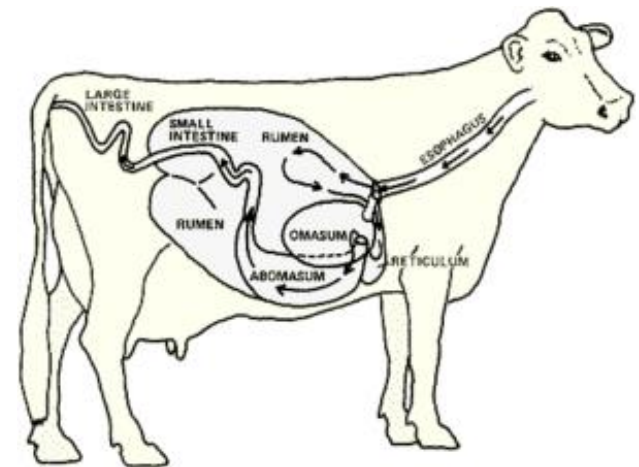
Digestive System Physiology

- Rumen and Reticulum
 - Responsible for breaking down forages
 - Ruminants will lie down to initiate rumination
 - 5-7 hours per day
 - Contain microbes that convert low quality protein from forages into amino acids

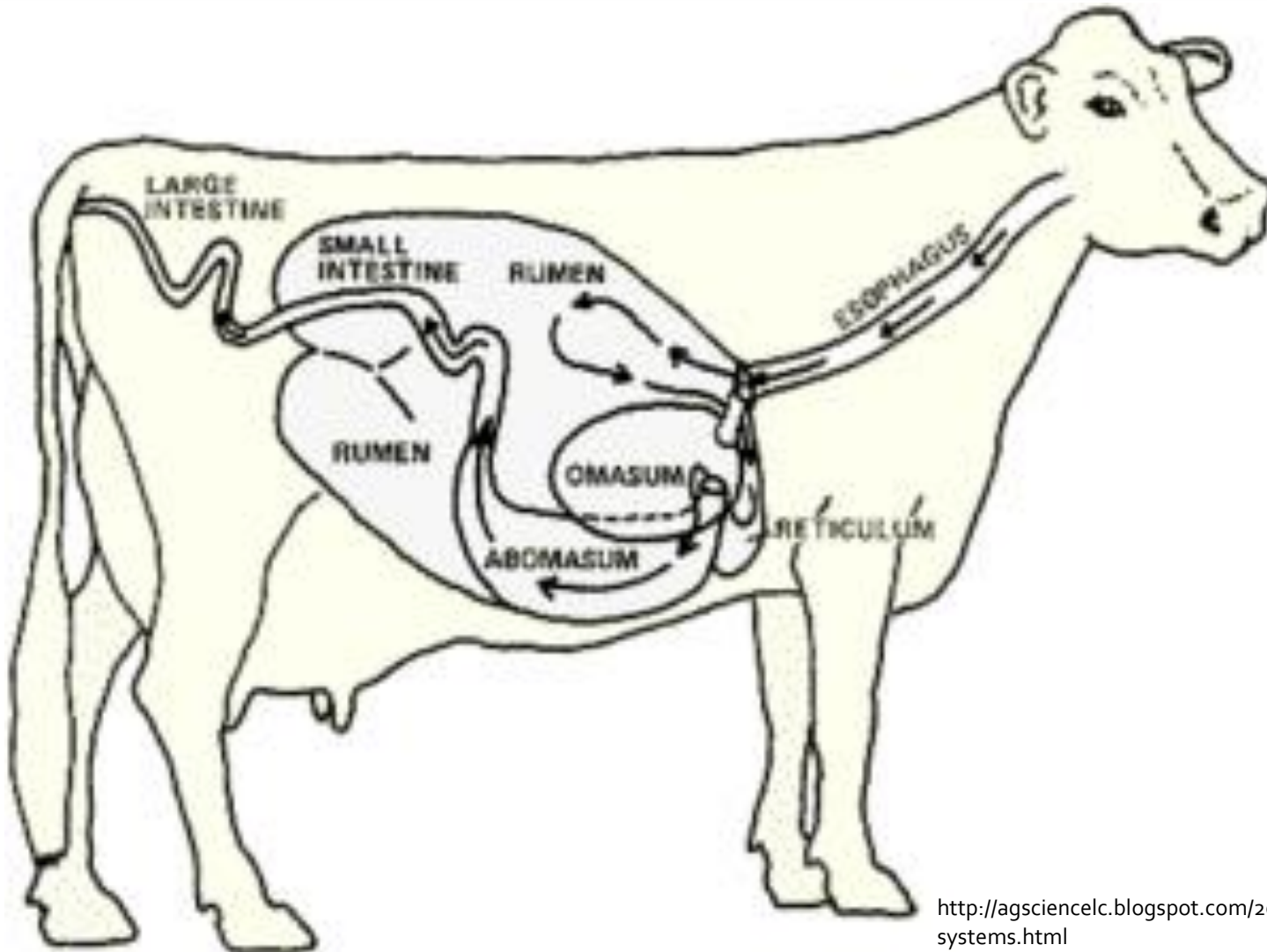
Digestive System Physiology

□ Rumen and Reticulum

- Large amounts of gas are produced in rumen (30-50 liters per hour)
 - must be belched or expelled to prevent ruminants from bloating



Digestive System Physiology



Digestive System Physiology

□ Rumen and Reticulum

- Cattle often swallow foreign objects such as nails or wire because they eat rapidly and do not use lips to discriminate among food particles
 - Hardware disease
 - common term for animals that become ill from foreign objects
 - Prevented by inserting small magnet into reticulum
 - Holds foreign objects to prevent them from penetrating the heart

Digestive System Physiology

□ Omasum

- Very little digestive action occurs in omasum
- Feed is primarily ground and squeezed
- Liquid is removed

Digestive System Physiology

- Stomach, Abomasum and Proventriculus
 - breaks down finer feed particles
 - Gastric juices secreted when feed enters stomach/abomasum/proventriculus
 - Contain hydrochloric acid which stops action of salivary amylase
 - Contain additional enzymes that break down feed
 - Pepsin- acts on proteins
 - Gastric lipase- acts on fats

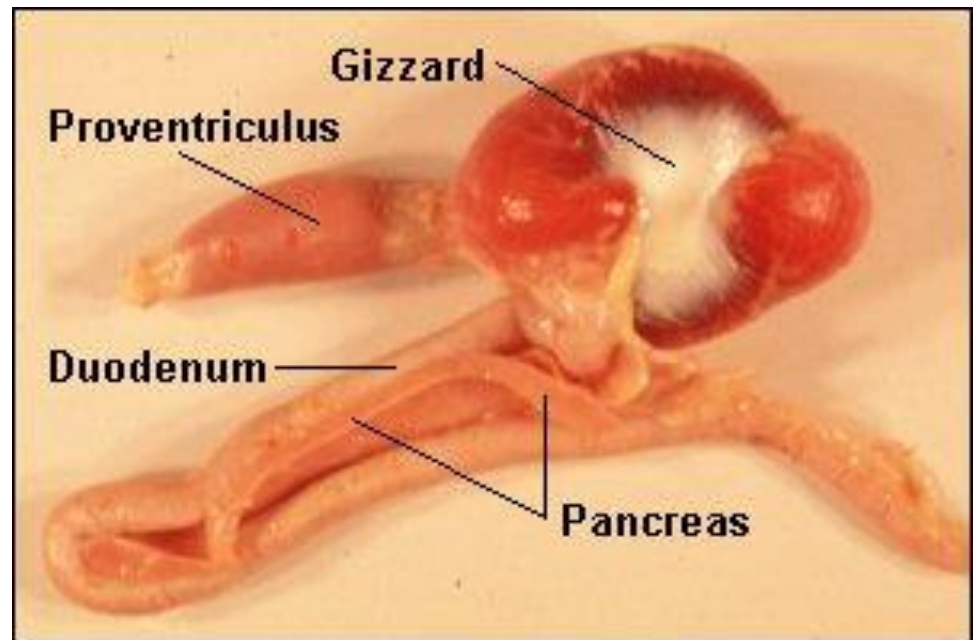
Digestive System Physiology

- Stomach, Abomasum and Proventriculus
 - Muscular walls help churn and squeeze feed forcing liquids into small intestine
 - Gastric juices then continue to break down remaining or new feed
 - Very little feed gets “processed” in the proventriculus because poultry swallow food whole

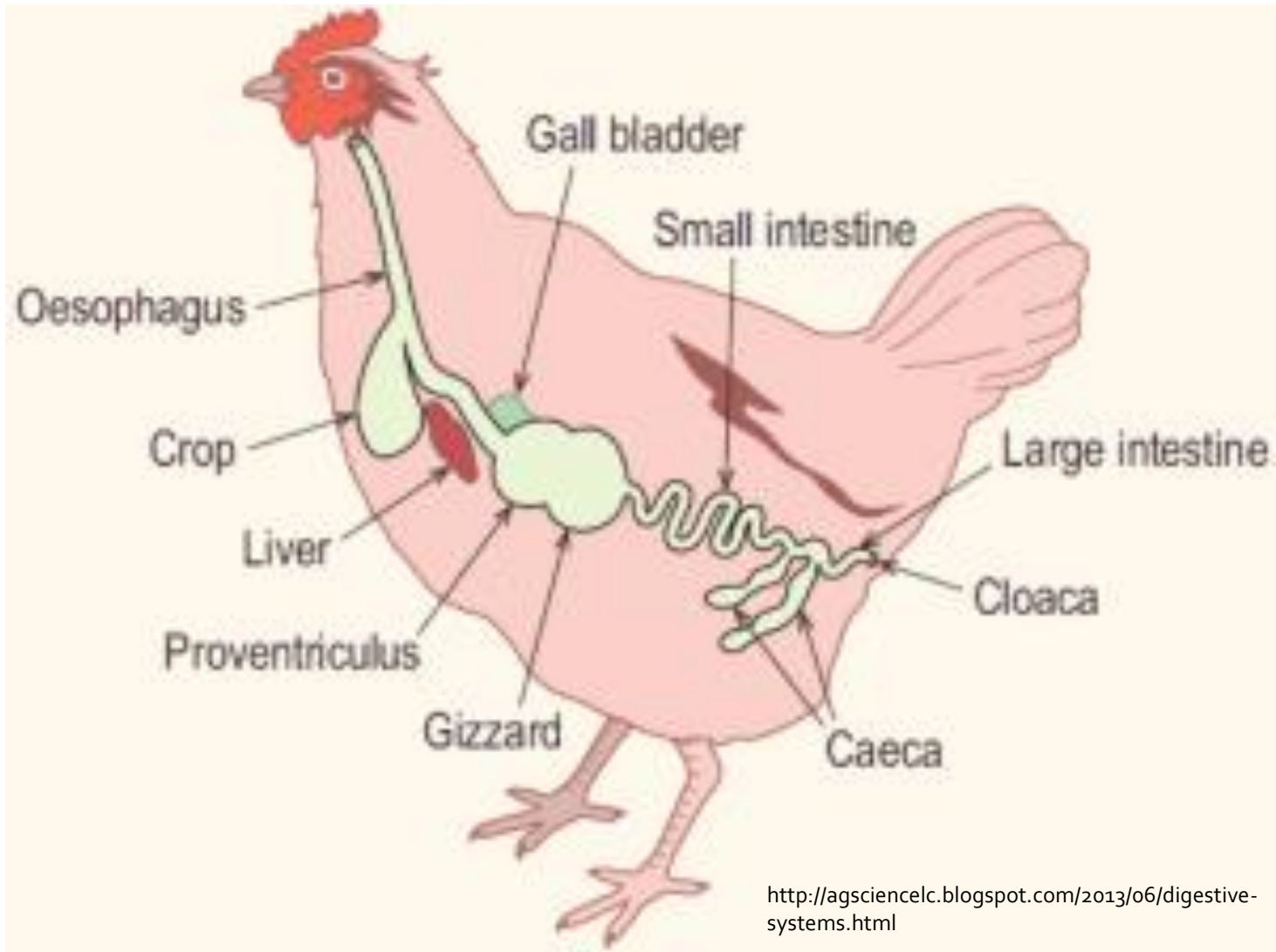
Digestive System Physiology

□ Gizzard

- Muscular contractions and grit/gravel break down feed
- Digestive juices from proventriculus continue to act on feed



Digestive System Physiology



Digestive System Physiology

□ Small Intestine

- Primary site of nutrient absorption for nonruminants and ruminants
- Villi line intestinal wall to increase surface area and aid in absorption of nutrients

Digestive System Physiology

□ Small Intestine

- Chyme mixed with pancreatic juices, intestinal juices and bile
 - Pancreatic Juice
 - Trypsin- enzyme that breaks down remaining proteins.
 - Pancreatic amylase- changes starch that was not processed by salivary amylase into maltose.
 - Lipase- acts on fats to convert them into fatty acids.

Digestive System Physiology

□ Small Intestine

- Intestinal Juice
 - Secreted by intestinal wall
 - Secretes several enzymes that break down proteins and sugars
- Bile
 - Produced by the liver
 - Stored in the gall bladder
 - Yellowish green fluid
 - Acts on fats and fatty acids

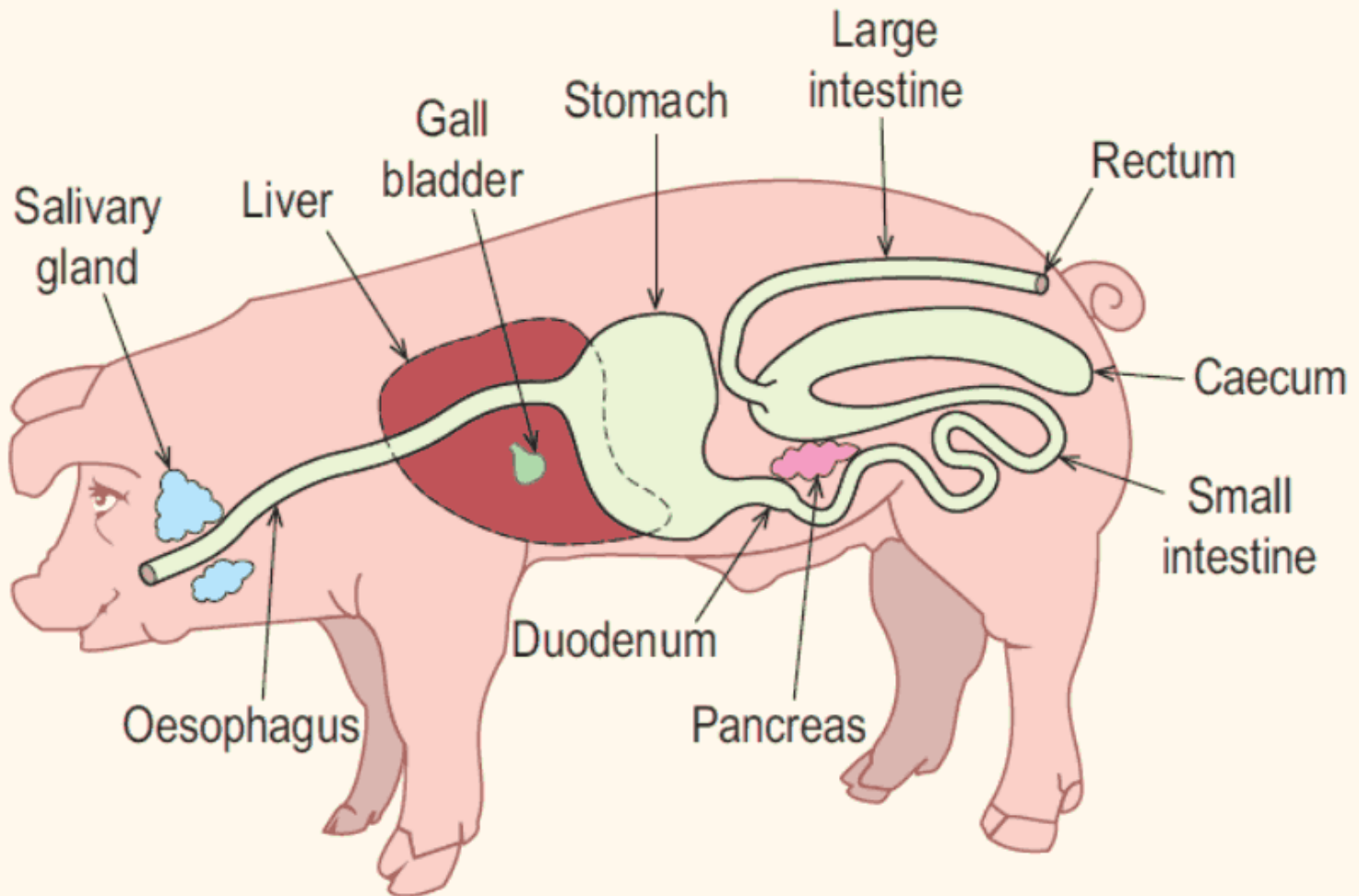
Digestive System Physiology

□ Cecum

- Bacterial action breaks down roughage for horses
- Serves little function for other nonruminants and ruminants

Digestive System Physiology

<http://agsciencelc.blogspot.com/2013/06/digestive-systems.html>



Digestive System Physiology

□ Large Intestine

- Primary site of water absorption and formation of feces
- Some enzymatic and microbial digestion occurs on any remaining feed