THE SYSTEMS OF THE HORSE

Prepared for
Pony Club National Examiners

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INTRODUCTION

The purpose of this handbook is to explain the body systems of the horse, their function and their relationships to specific disease states. I have taken each system and explained it in terms that a typical high school student should have studied in school. However, in order to adequately evaluate a candidate’s knowledge, the examiner must possess more than a basic understanding. Therefore I have included extra detail in certain areas. Phrases in [] are for your use only. Then if you have a very solicitous candidate, you will know if he/she is correct in their answers.

The systems are in outline form and are followed by the disease that pertains to that particular system. I have taken the information from several texts, including Equine Medicine & Surgery, Lameness in Horses, Anatomy of Domestic Animals, and Dissection of the Horse. Guyton’s Physiology and “The Compendium on the Continuing Education.” Occasionally one source differed with another, but I have tried to use the most current feelings. This was especially true on attempting to explain why and how laminitis occurs. I tried to keep explanations of endotoxins and histamine responses simple (it wasn’t easy) just in case a candidate should inquire.

In the back of this handbook is a chart that allows at a glance the disease, what system is involved, its cause, the signs a horse would show and the treatment. For those examiners giving prep clinics, it might help to have candidates draw a similar chart. Hopefully, this handbook will remove some of the mystery associated with this area of testing.

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THE CIRCULATORY SYSTEM

I. Function
A. To pump blood throughout the body allowing RED BLOOD CELLS to deliver oxygen and nutrients to the cells in exchange for carbon dioxide and cell waste.

1. HEMOGLOBIN is the red blood cell and is the oxygen carrier.

II. HEART – the muscular pump
A. The heart has four chambers:

1. The LEFT ATRIA accepts oxygenated blood from the lungs via the pulmonary vein and injects this blood into the left ventricle.

2. The LEFT VENTRICLE then ejects this blood to the body through the left aorta

3. The RIGHT ATRIA delivers un-oxygenated blood from the body and injects it into the right ventricle

4. The RIGHT VENTRICLE ejects this blood through the pulmonary artery to the lungs for oxygenation.

III. ARTERIES take blood away from the heart.
A. VEINS return blood from the body to the heart.

B. CAPILLARIES are one cell think vessels where the exchange of gases and nutrients. Wastes take place.

IV. ORDER OF FLOW beginning with oxygenated blood from the lungs to the heart via the pulmonary vein.
A. Left atria
B. Left ventricle
C. Aorta, which gradually reduces in size to become
D. Arteries
E. Capillaries which upon increasing in size become

F. Veins
G. Right atria
H. Right ventricle
I. Lung via the pulmonary artery, become s oxygenated and the cycle starts over.

NOTE: While this seems very complicated, it really isn’t if you think of it as a continuous cycle. See the diagram for help in visualizing this (Fig. 1)

LYMPHATICS

Quite often the lymph system is included with the circulatory system. The lymph system is not listed is not listed on the HA standard but must be mentioned in order to discuss strangles. This system is composed of lymph nodes which are special filtration organs located at various areas in the body. A certain node will drain a specific area (for example, those under the jaw will drain the head and upper neck). Quite often lymph vessels run parallel to the veins. The lymph fluid itself flows through collecting ducts which eventually enter the jugular and great veins of the heart.

POINTS TO REMEMBER
The heart is a muscle and like all muscles must be kept toned to work efficiently. A fit heart beats fewer
times per minute to eject the same amount of blood that an inefficient heart does. That is why athletes have a lower heart rate. Since the heart muscle can only rest in between beats, the fewer beats per minute allows more rest (this is not to be confused with a sluggish heart that struggles with every beat). Like all muscles, the heart must be brought into condition slowly (as in interval training). Each heart beat ejects blood from the heart and into the aorta (which is an artery). Therefore if an artery is cut, the wound spurts blood with each beat. A vein will have a continuous flow of blood from the wound.

**DISEASES**

**EQUINE INFECTIOUS ANEMIA** is caused by a virus that is blood borne and spread by biting insects. It can also be spread by needles and instruments used in surgery but the most natural mode is by horse flies. The virus lives in the white blood cell and cannot live outside the body. The disease may appear 3 ways: the **acute form** will appear as weakness, depression (both of these are due to the anemia), fever (105 degrees and higher), and swelling of the legs. The **chronic form** will be seen as poor keepers with sporadic episodes. The **asymptomatic form** will test positive with the Coggins test but show no symptoms after recovery from the initial attack. Note: the test for EIA is the Coggins test. How many of you have heard someone say their horse was positive for Coggins when it was actually positive for EIA? Currently there is not vaccine available and protection depends on prevention of exposure. Test all new horses and keep new horses isolated until status is know.

**RESPIRATORY SYSTEM**

I. **FUNCTION**

A. To bring oxygen into the lungs in exchange for carbon dioxide.

II. The **NOSTRIL** is the external opening through which air enters before going through the sinuses where the air is warmed and large foreign particles are filtered.

III. The **LARYNX** (pronounced lar-inks, nor lar-nex) is composed of bones and cartilage and is located at the root of the tongue and soft palate. It houses the vocal folds (voice box) and the **EPIGLOTTIS** which is a flap that prevents the inhalation of foreign particles.

IV. The **TRACHEA** (also called the windpipe) is a cartilage column that transmits air from the larynx to the lungs. It resembles a tree and its branches in that it starts large and then divides to form smaller branches. The first division forms the two **BRONCHUS** with one going to each lung. This is the first time that air actually enters the **LUNG**. The bronchus divides to dorrn **BRONCHIOLES** which then keep dividing and becoming narrower until reaching the alveoli.
V. The **ALVEOLI** are little sacs that are one cell thick. Due to their close proximity to capillaries, it is here that the actual exchange of gases takes place.

VI. THE FLOW OF AIR
A. The nostrils and sinuses
B. Larynx
C. Trachea
D. Bronchus
E. Bronchiole
F. Alveoli (Fig. 2)

**POINTS TO REMEMBER**
When discussing the signs of a sick horse, the candidate may mention a nasal discharge. A clear discharge can be quite normal, especially when the horse first begins to work on a chilly morning. A pus discharge will mean disease which usually originates in the nostril or sinuses. If the discharge is from only one nostril, it usually means that a foreign body is caught (such as twigs or such) or there is a bad tooth on the side of the discharge (the roots of several of the upper teeth are close to the sinuses and infection from the tooth can be spread). If the discharge is from both nostrils, you can probably have a generalized infection (such as strangles).

A **cough** is forceful expulsion of air to clear the respiratory tree of some foreign material. This includes excess mucus which the body produces with some diseases.

**DISEASES**

**INFLUENZA** is a disease known to be caused by two distinct forms of a virus. All age horses can be affected but it is principally seen in the younger horse. The two viruses produce clinically identical diseases. It is spread by inhalation, direct contact, or ingestion of the virus. Equine influenza strikes suddenly with fever, loss of appetite, depression and respiratory signs. A thin watery nasal discharge becomes thick and yellowish. The lymph nodes of the head and neck may enlarge making it difficult to distinguish from strangles. Usual complications are due to a secondary bacterial infection and may show as laryngitis (inflammation of the larynx), pneumonia, and digestive disturbances. If adequate rest is not provided, illness will be prolonged. Antibiotic therapy will help with the secondary bacterial infections but there are ineffective against the virus itself. Vaccination is available and should be given as 2 does the first year and at least annually thereafter. In the face of an outbreak, all horses should be re-vaccinated.

**RHINOPNEUMONITIS** is an equine respiratory disease caused by a herpes virus. It is acute and highly contagious; the virus may incubate 2-10 days before signs are apparent. Pregnant mares may abort. The virus can survive 4-7 weeks when dried in horse hair or on burlap. It is present in nasal discharge, saliva, blood, and possible in the manure during acute periods. It is abundant in all tissues and fluids of the aborted fetus. Recovered animals may continue to seed the virus of a period of time. Natural immunity as a result of infection is short-lived and requires a minimum of 3 doses the first year in a young horse and at least annually thereafter unless the horse is in a high risk group (such as showing). Then vaccination must be given more frequently. Pregnant mares should be vaccinated during the 5th, 7th, and 9th month of pregnancy. The virus is spread through contact and inhalation. Signs begin as a “cold” with fever, depression, cough, ad nasal congestion. Some animals may develop a form of pneumonia.

**STRANGLES** is a bacterial disease caused by a Strept infection (Streptococcus equi). The most common mode of transmission is through contact with infected horses and from contaminated equipment and feed troughs. It is generally an upper respiratory disease affecting the nose, sinuses, and lymph nodes of the head and neck. Signs include fever, increased respiratory rate, a very purulent (pus) discharge form the nostrils, loss of appetite, and swelling of the glands. The swollen nodes may abscess and rupture. While young animals are most susceptible, older animals who have not been previously exposed or
whose resistance has decrease my contract the disease. During an outbreak, strict sanitary measures are required to prevent spread of the infection. Complete rest is essential and affected animals must be isolated. A vaccine is available. “Bastard Strangles” is when the disease does not remain isolated but spreads to other lymph nodes throughout the body. This occurs more frequently if the horse is treated with penicillin before the abscesses drain.

HEAVES is a form of emphysema and affects the alveoli. The horse has difficulty exhaling, chronic coughing, unthriftiness, and often lack of stamina. There may be some nasal discharge; Signs are exaggerated by exercise, confinement to dusty stables, and feeding hay. A “heave lines” may form due to the increased expiratory effort causing a hypertrophy (enlargement) of the abdominal oblique muscle. A marked springing of the rib cage during inhalation may be seen. The exact cause is unknown. Many feel it is caused by allergy but others feel the primary problem is degenerative changes of the alveolar sacs which then prevent normal flow of air. Treatment consists of providing relief from possible sources such as avoiding dust as much as possible, not feeding hay, and avoiding exercise during periods of attacks. Acute attacks may be treated with steroids; antibiotics may be needed if there is concurrent bacterial infection. Attacks may occur sporadically and often are increased during hot, humid weather.

ROARING is a condition produced by a partial paralysis of the vocal folds located in the larynx. There are 2 vocal folds, a right and a left side. Roaring occurs when one side is paralyzed. This allows the affected side to swing into the air current passing through the larynx on inspiration. This forms a partial blockage and produces the characteristic “roar”. Correction is surgical.

URINARY SYSTEM

I. FUNCTION
A. To filter the blood to 1) return all necessary electrolytes, proteins, and minerals to the system, 2) acts as a buffer in maintaining proper pH (amount of acidity) of the blood, and 3) eliminate wastes and excess water in the form of urine.

II. KIDNEY
A. Normally there are 2 kidneys, but some individuals may be born with only one.
B. The nephron is the working unit of the kidney. It is a system of composed of capillaries and tubules and it is here that the filtration takes place. Each kidney has million of nephrons.

III. URETER (pronounced you-re-ter or your-e-ter)
A. The tube that takes the newly formed urine to the urinary bladder.
B. Each kidney has a ureter.

IV. URINARY BLADDER
A. Stores the urine until excreted

V. URETHRA (pronounced your-re-thra)
A. The tube that takes the urine from the urinary bladder to the outside.
B. In the male horse, it goes through the penis. In the female horse, the external opening is within the vulva.

VI. ORDER OF FLOW
A. Kidney
B. Ureter
C. Urinary Bladder
D. Urethra (Fig. 3)

POINTS TO REMEMBER
Everyone knows the kidney excretes wastes, but don’t forget it is equally important to save “the good stuff”. Otherwise the body would be in a constant state of depletion. It seems to be the common misunder-
standing that the kidney picks up waste from the large intestine. The kidney only works by filtering the blood. [The kidney has a tremendous ability to compensate. Those individuals born with only one kidney or those who have lost partial kidney function are prime examples. The remaining nephrons work overtime to maintain the same normal body state. In fact the work so well, that in renal disease, 75% of the kidney must be non-functional that by the blood chemistry reveals a problem. This often means that by the time the animal shows a problem, it is working with only 25% normal function.]

**DISEASES**

AZOTURIA is an excellent example of the filtering capability of the kidney. It is a metabolic condition that occurs when muscle cells are damaged by the release of large amounts of lactic acid. The release of small amounts of lactic acid is normal and the body’s buffering system (including the kidney) usually has no problem metabolizing and excreting it. However, when there is a fault with carbohydrate metabolism, the system gets overwhelmed. Muscle cells are particularly affected and begin to release myoglobin (the complex that gives muscle its color and carries some oxygen) which the blood the pricks up. The kidney must filter the myoglobin from the blood and excrete it in the urine. This is why the urine from horses suffering from azoturia appears so dark. [Just to help understand the myoglobin affect a bit better—have you ever wondered why chickens have dark meat and light meat? The answer I is myoglobin. The chicken no longer is a flying bird so the muscles of flight (the breast and wings) have little myoglobin. The legs and thighs are used a lot so there is a lot of myoglobin in those muscles. Wild duck, on the other hand, is almost 100% dark meat.]

**MUSCULOSKELETAL SYSTEM**

This is actually two systems in one and it is impossible to discuss one without mentioning the other.

**SKELETAL SYSTEM**

1. **FUNCTION**
   A. To give the body shape
   B. To protect the heart and lungs (ribs) and brain (skull)
   C. To work in conjunction with muscles to allow movement
   D. To produce blood cells in the bone marrow.
II. AXIAL BONES
A. Skull
B. Vertebral column
   1. Vertebral formula
      a. 7 cervical (neck) vertebrae (the first is called the ATLAS and the second is the AXIS)
      b. 18 thoracic (chest)
      c. 6 lumbar
      d. 5 sacral (these are fused together)
      e. 15-21 coccygeal (tail)
C. Ribs
   1. 18 in number

III. APPENDICULAR BONES
A. Those of the limbs (appendages)

IV. LIGAMENTS—hold bones to bones

MUSCULAR SYSTEM
I. FUNCTION
A. To allow movement
   1. Muscles can work only by contraction
B. Muscles are composed of 3 types of muscle fibers.
   1. SKELETAL which is the type we are usually concerned about. Theses make up the muscles that are used for movement, such as the legs/
   2. SMOOTH muscles form the internal organs such as in the stomach and intestines
   3. CARDIAC- a special muscle that forms the heart
C. The skeletal muscles are attached to bones by TENDONS.

POINTS TO REMEMBER
While bones may look hard and brittle, they are actually living tissues. The marrow is where blood cells are formed and mature before being released in to the circulation. The outside of the bone is covered with periostem which is a tissue that is alive and not one to be taken lightly. Much of the bones nourishment comes through the blood supply to the periosteum. If the periostem becomes inflames, excess bone growth may develop. As seen in bucked shins. Bone and joint surfaces should be smooth. Inflammation can lead to new bone growth which if located in a joint (arthritis) is extremely painful and could lead to permanent lameness.

DISEASES
SKELETAL SYSTEM – SEE CONFORMATION AND LAMENESS BOOK

LAMINITIS is actually a multi-system disease but the end result is seen on the foot with separation of the laminae and rotation of the coffin bone. Therefore it is usually mentioned when discussing the skeletal system

All candidates will be able to list several possible causes, such as over feeding of grains, improper cooling-out, mares that retain felt membranes, road founder due to concussion to the foot, ingestion of too much cold water, etc. But the question that has plagued horsemen for years is why does it occur? Research has shown that all the above possible causes (except possible road founder) usually come back to 2 basic common denominators: endotoxic or a histamine response. [If candidate should ask how these responses occur, it will be up to the examiner to give an answer and the easiest way will be to explain:

Endotoxins are a structural component of some of the normal bacteria [Gram-negative] that live in the horse's gut. It does have toxic (poisonous) capabilities and must be restricted to the intestinal lumen. Under normal circumstances, the horse is able to contain the endotoxin but if the protective barrier is overcome by a sudden increase in endotoxins, problems follow. Endotoxins are commonly associated with severe gastrointestinal problems and carbohydrate overload (grain founder). Endotoxins affect the blood vessels and one result is congestion of blood in the laminae.
Another effect is edema and together they can cause the separation of the laminae. It usually takes 12-18 hours after over-eating before the toxic effects become noticeable. The so-called laminitis vaccine was actually designed to offset the effects of endotoxins. However, since this is not the only cause of laminitis, many horses still develop the condition.

Anybody who has ever suffered an allergic reaction, even the swelling and itching associated with poison ivy or a bee sting, knows what a histamine response is. Histamines cause the arterioles (little arteries) to rapidly dilate and the veins to constrict which results in fluid leaking from the vessels into the surrounding tissues (edema). When this occurs in the laminae, separation develops. Antihistamines are given to arrest the histamine response as quickly as possible with the hopes of preventing further damage.

It is probably sufficient to say that the candidate should understand that laminitis has a direct affect on the circulation in the foot which results in swelling and separation of the lamina. They should also know that once this occurs, the pulls of the deep digital flexor tendon has a stronger effect and therefore can cause rotation of the coffin bone. They should also realize there is no one factor that is always to blame.

**MUSCULAR SYSTEM**

**AZOTURIA – SEE PREVIOUS DISCUSSION**

TYING UP is considered by some to be a mild form of azoturia while others claim it is a separate entity. About the only major difference, besides severity, is that tying up occurs during exercise (muscular exertion) while azoturia usually occurs in horses after a day off from work but no compensation made in the carbohydrate level of their feed for their off day. Myoglobin is usually not noticed in the urine of horses with moderate tying up syndrome, but may be if severe.

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**THE SYSTEMS OF THE HORSE**

![Diagram of neurons and synapse]

**NERVOUS SYSTEM**

I. **FUNCTION**
   A. Provides the control functions of the body by receiving, sorting, and transmitting nerve impulses

II. **THREE BRANCHES**
   A. **CENTRAL NERVOUS SYSTEM**
      1. Brain
      2. Spinal cord
   B. **PERIPHERAL NERVES**
      1. Nerves to skin and muscles
   C. **AUTONOMIC NERVOUS SYSTEM**
      1. That portion of the nervous system that controls the visceral (internal organs) functions of the body
      a. It allows the heart to beat, lungs to breathe, etc. without need to of our conscious awareness.
      b. Sympathetic system and parasympathetic system (the old “fright/flight” system.)

(Fig. 4)

**POINTS TO REMEMBER**

The nervous system is a difficult concept for many but the HA candidate should at least be aware of its importance. In trying to keep to a basic level, the candidate (and examiner) should know that there are
basic nerve cells which have fibers called **axons**. The nervous system is comparable to a relay system and the junction between neurons (nerve cells) is called a **synapse**. The information exchanged between neurons or between a neuron and a muscle is via chemicals. Some chemicals stimulate muscles, others must inhibit or else there would be a constant state of spasms. [The importance of this becomes obvious when dealing with pesticides. A chemical called **acetylcholine** (as-cet-il-col-ine) stimulates muscles. Another chemical called cholinesterase prevents the constant release of acetylcholine. Many pesticides are cholinesterase **inhibitors** which blocks the release of cholinesterase. The end result is spasms or seizures due to the constant flow of acetylcholine. Be sure to read the labels of all pesticides (also flea and tick dips used on dogs) used around the barn and home for this information. The combining of various flu sprays; use with the deworming product dichlorvos; or used with some tranquilizers could have similar consequences. When changing from one brand of fly spray to another, be sure to allow several days in between or read the label for any product warnings.]

### DISEASES

**TETANUS** is caused by a bacteria and produces spasmodic (sudden uncontrollable) contractions of muscles. Sil is the natural habitat of the bacteria, but contrary to popular opinion has no specific predisposition for horses or their manure. Most common route of infection is through a puncture wound since the bacterium does not require oxygen for growth. The toxin produced affects the central and peripheral nervous systems. Quite often the owner thinks there is a problem with the horse's eyes because the 3d eyelid is protruding. Shortly thereafter, the signs are more generalized, such as stiff ears, the tail becomes stiff and extended, the limbs become fixed in extension, and there may be contractions of limb muscles. Outcome is frequently fatal. Tetanus is preventable by giving antitoxin at the time of injury to animals not previously vaccinated, and by giving tetanus toxoid at the time of injury to those who have.

Many people include tetanus toxoid with their horse's annual vaccinations.

**EQUINE ENCEPHALOMYELITIS** is known as “sleeping sickness”/ This viral infection affects the central nervous system (the brain). There are 3 forms: Eastern Equine Encephalomyelitis (EE), Western (WEE), and Venezuelan Equine Encephalomyelitis (VEE). EEE is spread when an infected mosquito bites a bird and the virus is allowed to grow. Then another mosquito bites the infected bird, picks up the virus and then bites a horse. EEE has a high mortality rate. WEE has a lower mortality rate but is of public health importance because man can contract the disease. All 3 forms have similar signs, including depression, head pressing against buildings or fences, drooping of the lower lip, fever (esp. EEE), staggering and in coordination. Outcome is poor, especially for VEE & EEE.

**RABIES** is another viral disease affecting the central nervous system. Transmission is usually via bite wounds (for those who like to go in caves, bat manure is a potential source). Wildlife is an important reservoir. Incubation ranges from 3 weeks to 3 months in horses. The earliest signs are increase excitability and viciousness. Some animals will tear at the bite wound and site. The virus acts on the nervous system to paralyze the muscles of respiration and death insures. [The rabies has nothing to do with fearing water. The foam often seen around the mouth is due to paralysis causing an inability to swallow.]

Vaccination is advised if rabies is prevalent in your area.
DIGESTIVE SYSTEM

The digestive system has been covered most thoroughly in the “The Introduction the Equine Nutrition”. It will be covered here with its relationship to disease in mind.

I. Function
   A. To take in food, metabolizes it in to a utilizable form, and excrete the waste

II. Mouth
   A. Teeth tear the food (as in grazing) and being the mechanical breakdown (by chewing)
   B. Saliva is added to moisten the food and to add amylase (which breaks down starches)

III. PHARYNX (pronounced phar-rinks)
   A. The area between the hard palate (roof of the mouth) and the opening to the esophagus

IV. ESOPHAGUS
   A. The muscular tube that connects the pharynx to the stomach
   B. Is uni-directional due to peristalsis

V. Stomach
   A. A. The hollow organ that accepts the food, mixes hydrochloric acid to further the chemical breakdown, and churns the mixture to a liquid form.
   B. Functions beast when it is about 2/3 full

VI. SMALL INTESTINE
   A. THREE AREAS
      1. DOUDENUM immediately follows the stomach
         a. The LIVER and PANCREAS both secrete enzymes into the duodenum
      b. This changes the liquid food from an acid concentration to a basic form and the added enzymes further the breakdown of proteins, fats, and starches
   2. JEJUNUM (jay-ju-num)
      a. The majority of proteins are absorbed into the body
   3. ILEUM

VII. CECUM
   A. In the horse is a large pouch containing bacteria capable of digesting plant fiber

VII. LARGE INTESTINE
   A. THREE AREAS
      1. Large colon
         a. Final area of digestion and absorption of nutrients.
      2. Small colon
         a. Absorbs water
         b. Feces forms
      3. Rectum
         a. Holds fecal material until passed from body.

POINTS TO REMEMBER

The digestive system is usually referred to when speaking of parasites, but it should be remembered that they affect the other systems as well. Ascarids will migrate through the lungs and cause “verminous pneumonia.” Stronglyes will migrate to the mesenteric artery and the horse will appear in colic when the aneurysm, is in a blood vessel.

The manure that is produced can give a good idea of how the entire digestive tract is working. Whole grain usually means the teeth are bad and can’t chew.
properly. Diarrhea can be due to many causes including parasites, lack of digestive enzymes, and bacterial infection in the gut, and even just a bad case of nerves. While a candidate may not always know the reason for diarrhea, they should know to recognize changes in the horse’s bowl habits.

**DISEASES**

**COLIC** is probably the best know illness to the horse. The causes are numerous: parasites, poor food quality, lack of water, ingestion of sand or other foreign matter, gas build-up, a twisted gut to name just a few. The signs of colic and the fact that it can be a medical emergency are well known.

**CHOKE** generally refers to an esophageal obstruction. The offending object is frequently grain (as seen in greedy eaters). Some horses have been known to choke on hay while others have choked on pellets. Worn teeth that can’t properly chew hay have been a factor in some horses. Some horses are prone to having repeat attacks. The affected horse appears distressed and many arch the neck and draw the chin towards its chest. Saliva and/or grain may be seen in the nostrils. Veterinary help should be summoned.

**REPRODUCTIVE SYSTEM**

**I. FUNCTION**

A. Propagation of the species

**II. MALE SYSTEM**

A. Testes (or testicles)
   1. Normally there are 2 located in the scrotal sac
   2. Teste(s) may be retained in the abdomen or caught in inguinal canal. These horses are referred to as **cryptorchid**
   3. Produce testosterone (the male hormone) and sperm
   4. Castration involves the removal of both testes and is usually preformed when make is a yearling.

   a. May be preformed at other times at owner’s discretion

B. Sperm leaves the testicle through the spermatic cord and is delivered to the urethra (located within the penis) for ejaculation

C. The equine penis telescopes in on itself (for easy storage) within the sheath
   1. Smegma (also referred to as beans) is debris that accumulates in the folds. This has to be removed periodically. Some horses will act lame due to the discomfort associated with smegma.
   2. Acepromazine will relax the penis (this facilitates cleaning and is also a sign if the horse has been tranquilized). This drug has been known to cause penile paralysis.

**III. FEMALE SYSTEM**

A. Ovaries
   1. Normally there are 2 ovaries, a right & a left
   2. Produce eggs and the female hormones estrogen and progesterone

2. Estrus cycle
   a. Begins when the pituitary gland signals the release of the hormone Follicle Stimulating Hormone (FSH). The ovary then develops an egg in a follicle for release. The ovary produces an increased amount of estrogen which will stimulate the eggs release (ovulation). Where the follicle opened to allow the egg to pass is now called the corpus lueteum (CL). The CL secretes progesterone which will continue for a few days if the mare does not get bred, or will continue for months if the mare does no get pregnant.
   b. If the mare does not get pregnant, the progesterone level will drop off and the cycle will start over beginning with FSH.
   c. The estrus cycle averages 21-24 days but the actual time of estrus (when the mare can conceive) is only about 3-5 days.
**THE SYSTEMS OF THE HORSE**

d. Mares are seasonally polyestrus which means they will go through many cycles during a season.

e. Increase number of daylight hours beginning late winter of early spring stimulates FSH production

B. UTERUS
   1. The organ where the embryo will implant and the foal will grow

C. VAGINA
   1. The passage from the uterus to the vulva (the external opening).

D. GESTATION (length of pregnancy) averages 335 days.

**POINTS TO REMEMBER**

It’s not necessary to remember all about the rise and fall of the female hormones, but it is especially helpful if you have a mare who suffers “PMS” or you have a mare that you have on a heavy show schedule (and she schedules her cycle accordingly). Owners who are having to give their mares hormones to either keep them from cycling (such as Regumate) or who are trying to encourage ovulation should have some awareness of which hormone they are using and why. Some mares have begun cycling by their second year and some have still been having foals while in their twenties.

The testicles actually form in the abdomen of the make fetus. Both testicles should pass through the inguinal ring and descend into the scrotal sac. Occasionally one or both may stay in the abdomen or settle in the inguinal canal. This causes a problem with castration because if both testicles are not removed, the horse will still be a stallion and act as such.