

STUDY GUIDE FOR EXAMINATION PREPARATION

Disclaimer – This study guide is not composed of “old” examination questions but is the creation of one member of the examining committee. Questions in this study guide are not necessarily in the format required for questions submitted with the Examination Application. This guide does not attempt to cover all aspects of theriogenology that may be questioned in a given examination.

NORMAL FEMALE REPRODUCTIVE ANATOMY AND PHYSIOLOGY

- 1) Fill in the chart describing estrus.

	AVERAGE LENGTH OF ESTROUS CYCLE	LENGTH OF STANDING HEAT	TIME OF OVULATION COMPARED TO STANDING HEAT
Cow			
Mare			
Ewe			
Doe (goat)			
Bitch			
Queen			
Sow			
Llama			

- 2) Stages of the bovine estrous cycle: List them and for each list what is the dominant structure on the ovary, what is the primary hormone released, and what are the physical and behavioral changes exhibited. What is different about the cat?
- 3) Name five species that are induced ovulators.
- 4) What is the length of the estrous cycle in large primates (e.g. gorillas)?
- 5) What effect does progesterone have on LH and FSH secretion? What effect does estradiol have?
- 6) What is the correlation between peak concentrations of estrogen in serum and heat behavior in the cow? In the bitch?
- 7) What is the significance of a skyhook vulva in pigs?

- 8) What initiates luteal regression at the end of diestrus?
- 9) What is unique about the female reproductive tract in rabbits?
- 10) Name five species that cycle seasonally, describe daylength for the time of year when they cycle and describe ways to manipulate the cycle so as to allow out-of-season breeding.
- 11) In the llama, in which uterine horn does pregnancy occur? Which ovary is functional? In the chicken, which uterine horn and ovary are active?
- 12) Fill in the chart describing onset of puberty.

	AGE AT ONSET OF PUBERTY (MOS)
Cow	
Mare	
Ewe	
Doe (goat)	
Doe (rabbit)	
Sow	
Bitch	
Queen	
Llama	
Hamster	

Describe factors that affect puberty onset in the above species.

NORMAL MALE REPRODUCTIVE ANATOMY AND PHYSIOLOGY

1) Fill in the chart describing time of puberty onset.

	AGE AT ONSET OF PUBERTY (MOS)
Bull	
Stallion	
Ram	
Buck	
Boar	
Dog	
Tom	

Describe some factors that affect puberty onset in these species.

2) What are the accessory sex glands of the:

Bull

Stallion

Boar

Dog

Ram

Buck

Tom

3) Fill in the following chart about semen quality.

	TOTAL # OF SPERM PER EJACULATE	SEASONAL?
Bull		
Stallion		
Ram		
Buck		
Boar		
Dog		
Cat		

4) The number of days in the spermatogenic cycle for the following species is:

Bull

Stallion

Boar

Ram

Dog

5) What is the most common cause of testicular hypoplasia in bucks?

What is the most common cause of epididymitis in rams?

6) What are the hormones secreted by the interstitial cells and Sertoli cells of the testes?
What are the functions of these hormones?

7) What is ABP? From where is it secreted? What is its function?

8) Describe measurement of testosterone in serum.

- 9) What are spermiogenesis, spermatocytogenesis and spermatogenesis?
- 10) Describe the interior architecture of the testis. What is the basal compartment? What forms the adluminal compartment and what is its significance?
- 11) Describe formation of spermatozoa from a spermatogonium with names of cell types and chromosome numbers (n vs 2n).
- 12) What are cellular associations?

BOVINE THERIOGENOLOGY TOPICS

- 1) Describe fremitus of the uterine artery as an aid in pregnancy diagnosis.
- 2) For each, list causative organism, route of transmission and testing / sample collection:
 - Bovine tuberculosis
 - Bovine brucellosis
 - Bovine campylobacteriosis
 - Bovine venereal trichomoniasis
 - Leptospirosis
 - Infectious pustular vulvovaginitis / balanoposthitis
- 3) Name nine things correlated with scrotal circumference.
- 4) What is desired calving interval? How many estrous cycles after calving do you have to achieve pregnancy? What is the primary sign of estrus? What are secondary signs? Describe three heat detection aids.
- 5) Describe estrus synchronization with prostaglandin and with progesterone in cattle.
- 6) Describe pregnancy termination in cattle with prostaglandin alone and with prostaglandin plus dexamethasone.
- 7) Discuss hydroamnion and hydriallantois.
- 8) Retained fetal membranes: List the definition, causes and treatment options.
- 9) Discuss causes of post-partum anestrus in cattle.
- 10) Discuss hormonal induction of lactation.

EQUINE THERIOGENOLOGY TOPICS

- 1) Discuss pros and cons of pasture mating, hand breeding, and artificial insemination in horses.
- 2) Discuss photoperiod manipulation of the equine estrous cycle.
- 3) Discuss twinning in mares.
- 4) Why are different drugs used at different stages of pregnancy to terminate pregnancy in mares?
- 5) Describe five infectious and five non-infectious causes of abortion in mares.
- 6) Describe endometrial biopsy categories and what they mean.
- 7) Discuss neonatal isoerythrolysis.
- 8) What is CEM? Discuss its clinical signs and treatment.
- 9) List maternal and fetal causes of dystocia in mares.
- 10) What are the significance and treatment of retained fetal membranes in mares?

REPRODUCTIVE PATHOLOGY

<http://www.vetmed.ufl.edu/path/teach/vem5162>

<http://w3.vet.cornell.edu/nst>

CYTOGENETICS

- 1) Describe the structure of DNA. How does RNA differ from DNA?
- 2) How does DNA become a protein?
- 3) Define diploid and haploid cells.
- 4) What are the differences between mitosis and meiosis?
- 5) Define the following terms:

Aneuploid

Monosomic

Trisomic

6) Define the diagram the following:

Deletion

Translocation - What is a Robertsonian translocation and what is its significance?

Inversion

7) Differentiate chimeras and mosaics.

8) Describe three inherited morphologic defects of spermatozoa in cattle.

9) Describe heritable XX sex reversal, as described in American Cocker Spaniels.

10) Define true hermaphrodites, and male and female pseudohermaphrodites.

FERTILIZATION

1) What is the difference between a primary and a secondary oocyte? Which species ovulate which types?

2) Could spermatozoa aspirated from the testes fertilize ova? Why or why not?

3) Describe attachment of spermatozoa to the zona pellucida.

4) What is the function of the acrosome?

5) How is polyspermy prevented?

6) Describe fusion of the nuclear material from the female and male gametes.

7) Define zygote, morula, blastocyst and hatched blastocyst.

8) What is parthenogenesis?

9) What are monozygotic, dizygotic and conjoined twins?

10) Fill out the following chart:

SPECIES	DAY OF IMPLANTATION
Bovine	
Equine	
Porcine	
Ovine	
Canine	
Human	

PREGNANCY WASTAGE

- 1) What is the definition of early embryonic death? What differentiates early embryonic death from abortion?
- 2) At what stage of embryonic development is loss most likely to occur in cattle? In horses?
- 3) List five non-infectious causes of early embryonic death in swine?
- 4) Can you use time of return to service as an indicator of litter size in swine? Why or why not?
- 5) Describe ways to differentiate a maternal cause of early embryonic death from a fetal cause in a litter-bearing species.
- 6) Discuss the Rhesus antigen during pregnancy in women and how it may be a cause of embryonic death.
- 7) List five infectious causes of early embryonic death and the species in which the disease occurs.
- 8) How common is early embryonic death in women? Is thermal stress a cause of pregnancy loss in women as it is in swine?

FEMALE INFERTILITY

- 1) Define primary anestrus and secondary anestrus.
- 2) Describe non-pathologic causes of anestrus - what is the physiologic mechanism behind lactational anestrus? Seasonal anestrus?
- 3) List pathologic causes of anestrus.
- 4) What are causes of ovulatory failure?
- 5) What are causes of fertilization failure?
- 6) What is the most common cause of infertility in bitches?
- 7) What are repeat breeders?

ESTRUS SYNCHRONIZATION

- 1) Cattle - Describe four estrus synchronization programs using prostaglandin F₂alpha.
- 2) Cattle - Describe estrus synchronization using progesterone.
- 3) Small ruminants - Describe estrus synchronization using progesterone.
- 4) Horses - Describe estrus synchronization using prostaglandin F₂alpha.
- 5) Horses - Describe estrus synchronization using progesterone.
- 6) Llamas - Is estrus synchronization practiced in llamas? Why or why not? What protocols are commonly used?
- 7) Small animals - Is estrus synchronization practiced in dogs or cats? Why or why not? What protocols are commonly used?
- 8) What is the “dormitory effect”?

UROGENITAL SURGERY

Be familiar with the following procedures:

- 1) Caslick’s vulvar suture technique
- 2) Cesarean section

- 3) Penile amputation
- 4) Ovariectomy
- 5) Surgical insemination
- 6) Surgical techniques in embryo transfer
- 7) Episioplasty
- 8) Castration
- 9) Ovariohysterectomy
- 10) Marsupialization / drain placement for prostatic disease
- 11) Minchev's method for vaginal prolapse in cattle
- 12) Buhner's vulvar suture technique
- 13) Surgical repair techniques for urine pooling in mares

SMALL RUMINANT THERIOGENOLOGY TOPICS

- 1) What is the "buck effect"?
- 2) How is artificial lighting used to manipulate estrus in small ruminants?
- 3) What is the clinical manifestation of perivulvar ectopic mammary tissue in goats?
- 4) Define "cloudburst".
- 5) What is the link between polledness and intersex in goats?
- 6) Describe habitual abortion in Angora goats.
- 7) Are sheep-goat hybrids viable and fertile?
- 8) Describe two techniques used to increase ovulation rate in sheep?
- 9) For each, list the pathogen, route of exposure, clinical presentation, diagnosis and treatment:

Q fever

Border disease

- 10) Discuss pros and cons of artificial insemination in sheep.
- 11) What are common causes of epididymitis in young rams?
- 12) What is “pizzle rot”?

REPRODUCTIVE ANOMALIES

Describe the following:

- 1) Schistosomus reflexus
- 2) Amorphus globosus
- 3) Cyclopia
- 4) “Bulldog” calves (chondrodysplasia)
- 5) Perosomus elumbis
- 6) Perosomus horridus
- 7) Fetal anasarca
- 8) Arthrogyriposis
- 9) Hydrocephalus
- 10) Freemartinism
- 11) Male and female pseudohermaphrodites
- 12) True hermaphrodite
- 13) Lateral hermaphrodite

REPRODUCTIVE MANAGEMENT TECHNOLOGIES

- 1) For the following, define it and describe how this measure can be used to define problems or improve performance in a herd:
 - Calving interval
 - Calving to conception interval

■ Average days in milk

- 2) List and discuss three measures of heat detection efficiency.
- 3) List and discuss three measures of insemination success.
- 4) Fill in the following table:

STATISTIC	TARGET	PT AT WHICH TO TAKE ACTION
Calving interval		
Calving to conception interval		
Estimated % heat detection		
Days in milk at first service		
Services per conception		
First service conception rate		

- 5) Can gonadotropin releasing hormone (GnRH) be used to alter interval from calving to first estrus and, if so, how?

REPRODUCTIVE PHARMACOLOGY

- 1) Describe clearance and excretion of steroid hormones.
- 2) List two reasons why oral treatment of cattle with chloramphenicol is not recommended.
- 3) For each drug or drug class, identify bacteriostatic versus bacteriocidal:

	BACTERIOSTATIC?	BACTERIOCIDAL?
Tetracycline		
Cephalosporins		
Penicillins		
Chloramphenicol		
Sulfonamides		
Aminoglycosides		

Why is it not recommended to use bacteriostatic and bacteriocidal drugs in combination?

- 4) Why are tetracyclines preferred over penicillins for treatment of mycoplasma infections?
- 5) Are antibiotics absorbed into the systemic circulation after intrauterine infusion?
- 6) How might intrauterine infusion of antibiotics alter the estrous cycle?
- 7) Does uptake and distribution of antibiotics vary with stage of the estrous cycle in cows? Mares?
- 8) Why is oxytocin's effect on myometrial contractility greater post-partum?
- 9) What are the side-effects of progestogen therapy in cats?
- 10) List and describe five clinical uses of gonadotropin releasing hormone (GnRH).

NUTRITION

- 1) What is the nutritional basis of the negative correlation between high milk production and poor fertility?
- 2) Is body condition associated with fertility in young and mature bulls?
- 3) Discuss pregnancy toxemia in small ruminants? Does it occur in other species?
- 4) Define “flushing”.
- 5) Describe use of nutrition as a way to decrease twin conceptuses in mares.
- 6) What is the reproductive effect of decreased dietary taurine in cats?
- 7) What is “nursing sickness” in ferrets?

CANINE AND FELINE THERIOGENOLOGY TOPICS

- 1) Describe use of measurement of serum progesterone for breeding management in dogs.
- 2) Describe three ways to induce ovulation in cats.
- 3) Describe the pathogenesis, clinical signs, diagnosis and treatment of feline ovarian remnant syndrome.
- 4) Compare mammary neoplasia in dogs and cats.
- 5) For each, give the common signalment, clinical signs, appearance on ultrasound, characteristics of tissue aspirates examined microscopically, and preferred treatment:
 - Benign prostatic hypertrophy / hyperplasia (BPH)
 - Prostatitis
 - Prostatic neoplasia
- 6) How does conception rate vary with type of semen used for artificial insemination in dogs (fresh semen versus chilled versus frozen)?
- 7) For each, describe the mode of action, treatment regimen, efficacy and side-effects, when used for pregnancy termination in dogs:
 - Estradiol cypionate

- Prostaglandin F2alpha
 - Mifepristone
 - Bromocriptine
 - Epostane
 - Dexamethasone
 - Cabergoline
- 8) Compare the pros and cons of progestogens and androgens for estrus suppression in dogs. In cats?
 - 9) Describe the pathogenesis of canine pyometra?
 - 10) Describe normal testicular descent and pathogenesis of cryptorchidism. Is cryptorchidism hereditary in dogs?
 - 11) For canine vaginal prolapse, what are the pathogenesis, clinical presentation and recommended treatment.
 - 12) Describe five tests used for diagnosis of canine brucellosis, including a general idea of their sensitivity and specificity.

ABORTION

- 1) Describe the pathogenesis of Toxoplasma gondii as an abortifacient agent in cats and other species.
- 2) List five plants that cause abortion, in any species.
- 3) What are the clinical signs and the recommended vaccine schedule for equine herpesvirus I?
- 4) List five toxins that cause abortion, in any species.
- 5) For Brucella abortus, describe clinical presentation, diagnosis, treatment and control measures.
- 6) What is the most common infectious cause of abortion in goats?
- 7) Discuss hypoluteoidism in dogs.
- 8) Describe the pathogenesis of erysipelas as an abortifacient in pigs.

9) For each, describe clinical presentation, diagnosis, treatment and control measures.

- IBR
- BVD
- Blue tongue
- Foothill abortion
- Trichomoniasis
- Aspergillosis

10) Name five non-infectious causes of abortion, in any species (and don't give me your five plants or toxins).

REPRODUCTIVE TOXICOLOGY

- 1) What are phytoestrogens and what are the effects of these compounds on sheep?
- 2) What are the clinical manifestations of fescue toxicosis in mares?
- 3) List five drugs that alter spermatogenesis and describe their mode of action.
- 4) What is the pathogenesis of carbon monoxide (CO) induced abortion in sows?

AVIAN AND AQUATIC THERIOGENOLOGY TOPICS

- 1) What are the parts of the oviduct of the chicken and what is the function of each part?
- 2) What is the most common environmental cause of fish die-off in commercial hatcheries?
- 3) In bait fish, what is the clinical manifestation of infection with Pleistophora ovariae?
- 4) Fungal infection of egg masses is a common problem in closely managed aquaria. With what can eggs be treated safely to control fungal growth?
- 5) Describe clinical signs, diagnosis and treatment of egg binding in caged birds. Is oxytocin a useful treatment?
- 6) Describe sexing of caged birds.
- 7) Differentiate male anatomy of poultry from that of domestic mammals.

- 8) What are post-ovulatory follicles in chickens and what is their function?
- 9) What are the effects of estrogen in chickens?
- 10) What is the connection between molting and egg laying in chickens?

PREGNANCY DIAGNOSIS AND MATERNAL RECOGNITION OF PREGNANCY

- 1) For the following species, what substance is considered to be the factor that stops release of prostaglandin, lysis of the CL and loss of the pregnancy?
 - Sheep
 - Pigs
 - Cattle
 - Horse
- 2) Complete the following table concerning pregnancy diagnosis in the dog:

TEST	DAYS OF PREGNANCY WHEN FIRST ACCURATE	OVERALL ACCURACY / LITTER SIZE / VIABILITY
Abdominal palpation		
Abdominal ultrasound (B mode)		
Abdominal radiographs		
Progesterone assay		
Relaxin assay		

- 3) Describe what you feel on rectal palpation of the cow and mare at the following months of gestation:

	MARE	COW
2 MONTHS		
5 MONTHS		

- 4) When is the earliest number of days after mating that the embryonic vesicle is visible by B mode ultrasonography in the:
- Mare (transrectal)
 - Cow (transrectal)
 - Ewe and doe (transabdominal)
 - Sow (transabdominal)
- 5) Describe how measurement of progesterone in milk or serum can be used for pregnancy diagnosis in dairy cattle.
- 6) Discuss the apparent conundrum of pregnancy - why doesn't the dam expel the antigenically foreign fetus?

EMBRYOLOGY AND TERATOLOGY

- 1) For each type of placentation, describe the placenta and tell in which species it occurs.

Maternal attachment:

- Diffuse (microcotyledonary)
- Cotyledonary
- Zonary
- Discoidal

Layers of attachment:

- Epitheliochorial

- Syndesmochorial
- Endotheliochorial
- Hemochorial

Loss at parturition:

- Deciduate (conjoined)
- Adeciduate (apposed)

2) Define the following terms:

- Blastocyst
- Trophoblast
- Inner cell mass
- Implantation
- Yolk sac
- Amnion
- Allantois

3) For each tissue type, state whether it arises from ectoderm, mesoderm, or endoderm.

- Glandular tissue
- Muscle
- Lining of GI tract
- Hair
- Heart and blood vessels
- Liver
- Nervous system
- Connective tissue

4) What is the indifferent gonad?

5) What are the unique aspects of fetal circulation?

6) Describe the following congenital defects:

- Hydrocephalus
- Arnold-Chiari malformation in cattle
- Combined immunodeficiency in Arab horses
- Porcine stress syndrome
- Deafness in dogs

7) Teratogens - List five for each category.

- Nutritional deficiencies
- Endocrine factors
- Drugs
- Plants
- Viruses

8) What structures arise from the:

- Paramesonephric ducts
- Urogenital sinus (female)
- Genital fold
- Mesonephric ducts
- Urogenital sinus (male)
- Genital tubercle

PARTURITION

1) What is waxing?

2) Describe how fetal stress is hypothesized to precipitate the onset of parturition.

3) What is Ferguson's reflex?

4) Describe uterine contractions in the pig during parturition.

- 5) Discuss induction of parturition with:
 - Dexamethasone in cattle
 - Prostaglandins in small ruminants
 - Oxytocin in mares
 - Prostaglandins in pigs
- 6) Describe change in position of the foal during parturition.
- 7) Describe normal fetal presentation in small animals.

DYSTOCIA AND OBSTETRICS

- 1) Define the following terms:
 - Presentation
 - Posture
 - Position
- 2) List eight maternal and eight fetal factors causative of dystocia.
- 3) Describe resolution of a dystocia in a heifer carrying a large, live bull calf with the head back.
- 4) Describe resolution of a dystocia in a cow carrying a “dog-sitting” calf.
- 5) Describe the use of a de-torsion rod.
- 6) Describe performance of epidural anesthesia in a mare during dystocia.
- 7) List some advantages and disadvantages of fetotomy.
- 8) Is a right or left flank approach preferred for standing C-sections in cattle?
- 9) What is en-bloc ovariohysterectomy and how is it used to treat dystocia in small animals?
- 10) Discuss appropriate use of oxytocin in bitches for dystocia.

SWINE THERIOGENOLOGY TOPICS

- 1) List five factors affecting onset of puberty in gilts.
- 2) Discuss use of prostaglandin to short-cycle sows.
- 3) Describe rectal palpation, ultrasound (A mode, Doppler and B mode), vaginal biopsy and measurement of plasma estrone sulfate for pregnancy diagnosis in pigs.
- 4) What are some signs of impending parturition in pigs?
- 5) Fill in the following table:

DISEASE	ORGAN-ISM	SIGNS	DIAGNOSIS	THERAPY	CONTROL
Parvovirus					
Leptospirosis					
Brucellosis					
Pseudorabies					
Erysipelas					

- 6) What does the acronym PRRS stand for? Describe clinical signs, transmission, diagnosis and control of PRRS.
- 7) What does the acronym SMEDI stand for, and what are the SMEDI viruses in swine?

8) Fill in the following table:

	TARGET
Litters / sow / year	
Pigs / sow / year	
Stillbirths (%)	
Number of live pigs / litter	
Weaning to service interval (days)	
Abortions (%)	
Number of pigs weaned / litter	
Number pigs marketed / sow / year	

ARTIFICIAL INSEMINATION

- 1) Describe semen collection in stallions.
- 2) In dogs, what are conception rates with natural service, AI with fresh semen, AI with chilled semen, and AI with frozen semen?
- 3) Describe three methods for intrauterine insemination in dogs.
- 4) What are the primary functions of semen extender?
- 5) Describe freezing of semen in straws.
- 6) Describe insemination of cows.

7) Fill out the following table, regarding AI in horses:

ASSOCIATION	RULES CONCERNING AI
Thoroughbred association	
Quarter horse association	
Standardbred association	

8) What is unique about AI in pigs?

9) Fill out the following table:

	TYPE OF SEMEN COLLECTION ROUTINELY USED FOR AI	NUMBER OF SPERMATOZOA IN ONE INSEMINATION DOSE
Dog		
Boar		
Stallion		
Bull		
Ram		
Tom cat		

10) Why do many spermatozoa die during the freezing and thawing process?

EMBRYO TRANSFER

- 1) Define embryo transfer.
- 2) List five advantages of embryo transfer.
- 3) Outline two superovulation regimens for use in cattle.
- 4) Describe one surgical and one non-surgical embryo collection technique.

- 5) Describe one surgical and one non-surgical embryo transfer technique into the recipient.
- 6) Hypothesize why superovulation generally is not successful in the mare and bitch.
- 7) For embryo transfer in swine, describe number and placement of surgically implanted embryos.
- 8) Fill in the following table:

	TRANSMISSIBLE IN OR ON EMBRYO?
Bovine leukosis virus	
Blue tongue	
IBR	
BVD	
<u>Brucella abortus</u>	
<u>Mycobacterium tuberculosis</u>	
Porcine parvovirus	
Pseudorabies	

Can disease transmission be controlled by washing and/or freezing embryos?

- 9) Embryo transfer has been performed successfully in domestic cats. What are the advantages of this research?

IN VITRO FERTILIZATION, NUCLEAR TRANSFER, ETC.

- 1) Define in vitro fertilization (IVF).
- 2) Are newly ejaculated spermatozoa capable of fertilization? If not, describe what measures can be taken to make them capable of fertilization.
- 3) In which species have the following techniques been successful?

	IN VITRO	CLEAVAGE IN	VIABLE YOUNG

	FERTILIZATION	VITRO	BORN AFTER ET
Mouse			
Cat			
Cow			
Pig			
Rabbit			
Human			
Sheep			
Horse			

- 4) What are transgenic animals and what is their purpose?
- 5) What is cloning?
- 6) What was unique about Dolly, the sheep cloned in Scotland?

PHYSIOLOGY OF GESTATION

- 1) Describe serum concentrations of progesterone, estrogen, relaxin, and prolactin during pregnancy in the bitch.
- 2) Define superfecundation and superfetation.
- 3) Describe the hormonal control of mammary development and lactation.
- 4) What is placental lactogen?
- 5) What are the effects of progesterone during pregnancy?
- 6) Describe the corpora lutea of pregnancy in the mare.
- 7) Describe changes in hematocrit during pregnancy in bitches.
- 8) Which of the following species are dependent on the CL throughout pregnancy?

	DEPENDENT ON CL THROUGHOUT?
Horse	
Cow	
Dog	
Sheep	
Pig	
Cat	

9) What is hCG and from where is it produced?

10) Describe the cause and uses of the pre-parturient drop in rectal temperature in bitches.

EXOTIC AND LAB ANIMAL THERIOGENOLOGY TOPICS

1) Describe hyperestrogenism in ferrets.

2) Describe estrus and follicular dynamics in llamas.

3) What is “dribble” ejaculation and in what species is it known to occur?

4) What are male and female ferrets called? Male and female rabbits?

5) Please complete the following table:

SPECIES	LATIN NAME	ESTRUS CYCLE LENGTH	PUBERTY AGE - FEMALE	PUBERTY AGE - MALE	GESTA-TION LENGTH	LITTER SIZE
Rabbit						
Mouse						
Hamster						
Rat						

Gerbil						
Guinea pig						

- 6) Name two species of laboratory animals that may exhibit prolonged gestation if nursing a litter concurrently.
- 7) Why must guinea pigs be bred before 7 months of age?
- 8) In many exotic animals, steroid concentrations in feces are measured to assess the estrous cycle and to diagnose pregnancy. What are some disadvantages of this technique? What fecal steroids are measured for pregnancy diagnosis?
- 9) What is embryonic diapause? Name three species in which it occurs.
- 10) Differentiate milk of marine mammals from that of land mammals.
- 11) Are the following species induced or spontaneous ovulators?

	INDUCED OR SPONTANEOUS?
Coyote	
Jaguar	
Gerbil	
Guinea pig	
Hamster	
Ferret	
Rabbit	
Lion	
13-lined ground squirrel	
Giant fruit bat	
Mink	
Puma	

Tiger	
Chimpanzee	

12) For the ostrich, please list:

- Side of female reproductive tract that is active
- Age at sexual maturity
- Seasonality
- External signs of breeding readiness in male
- Hatchery protocol