

# ENDOCRINE & REPRODUCTIVE SYSTEMS

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CERTIFICATION LEVEL 2 TRAINING –  
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# THE ENDOCRINE & REPRODUCTIVE SYSTEMS - AGENDA



INTRODUCTION



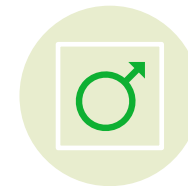
OVERVIEW OF  
ENDOCRINE SYSTEM



PRINCIPLES OF  
THERAPY -  
ENDOCRINE SYSTEM  
BY ORGAN



OVERVIEW OF  
REPRODUCTIVE  
SYSTEM



REPRODUCTIVE  
SYSTEM PRINCIPLES  
OF THERAPY



NEOPLASIA



QUESTIONS?

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- The endocrine system encompasses a group of tissues that release hormones into circulation for travel to and action on distant targets.
  - An endocrine tissue is typically a ductless gland (eg, pituitary, thyroid) that releases its hormones into capillaries that permeate the tissue. These glands are richly supplied with blood.
  - Non-typical endocrine tissues also contribute important hormones to circulation, eg: erythropoietin from the kidney, insulin-like growth factor from the liver, and leptin from fat.
  - New hormones continue to be discovered. Some act only on a single tissue, whereas others have effects on virtually all cells of the body.
  - The effects of hormones on their targets are varied—from enhancement of nutrient uptake to altering cell division and differentiation, among many others.
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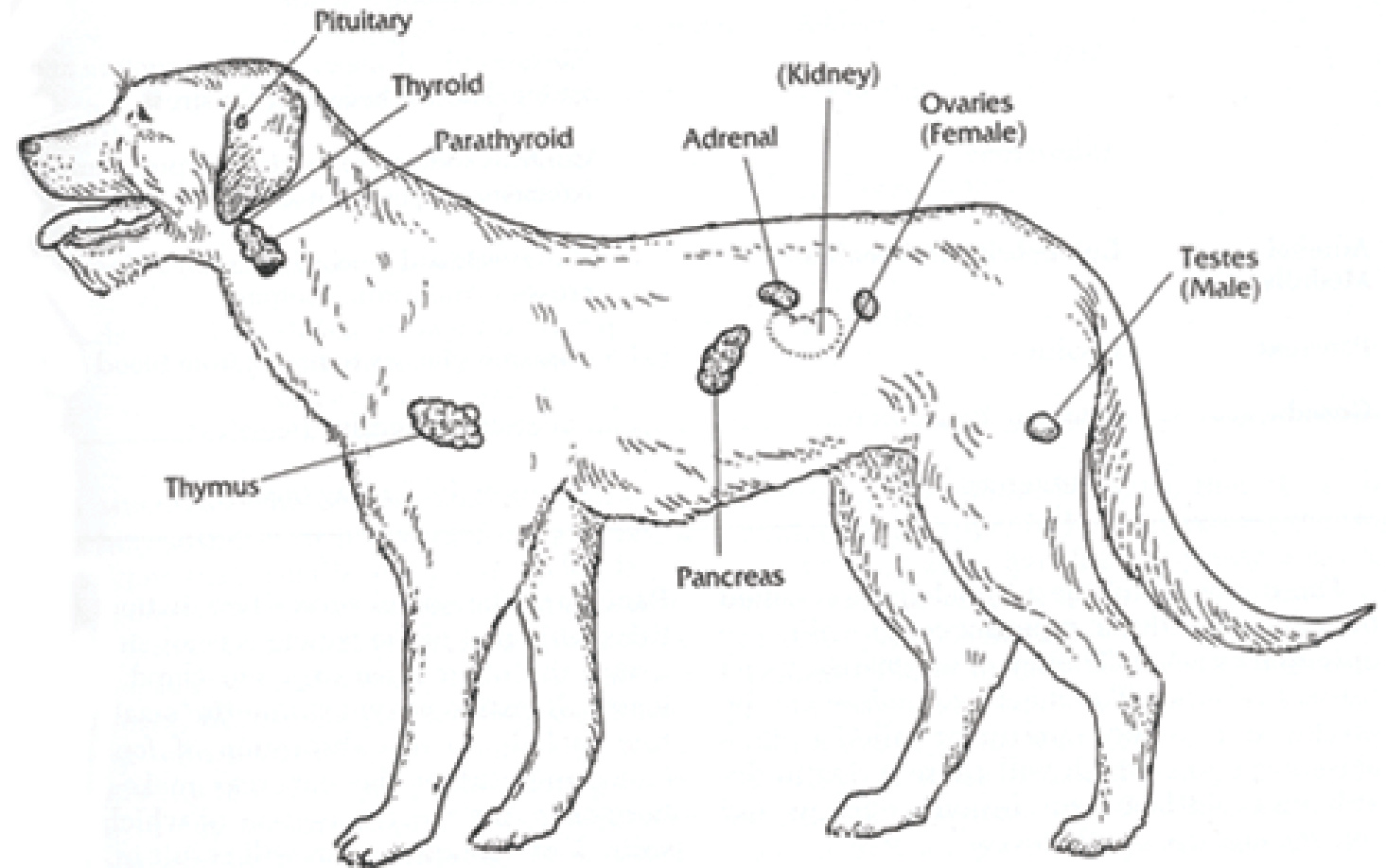
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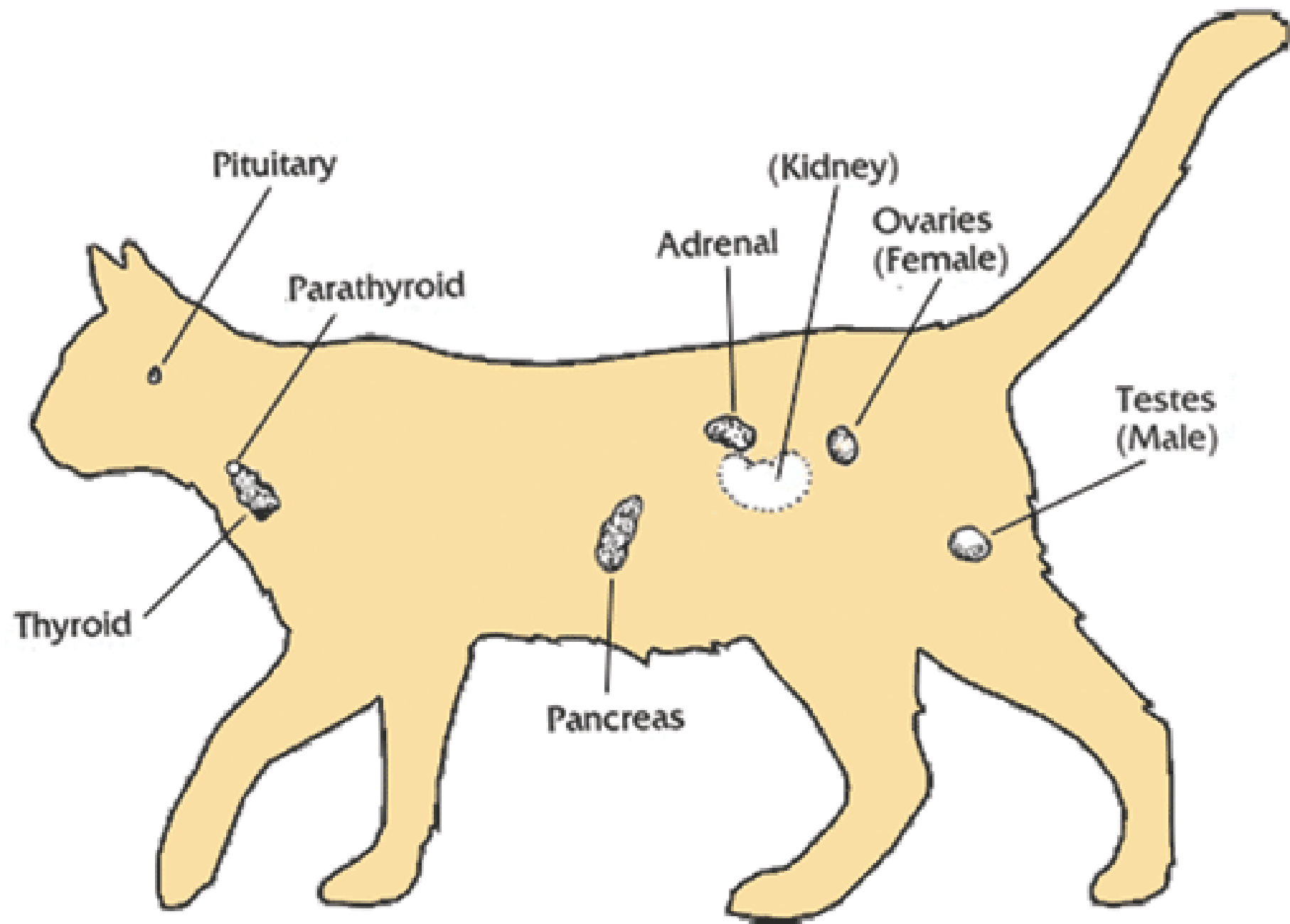
# THE ENDOCRINE SYSTEM - INTRODUCTION

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# OVERVIEW OF THE ENDOCRINE SYSTEM

- Hormones are chemical messengers that have many different functions
- Hormones travel throughout the body via the bloodstream.
- Their effects vary widely and all are important for life.
- Examples – insulin (diabetes), thyroid hormone (hypo/hyperthyroidism), cortisol (Cushing's/ Addison's)
- Humans are similar to Cat and dog endocrine glands – function and structure
- Endocrine Glands: Pituitary gland, thyroid gland, parathyroid glands, pancreas, adrenal glands, ovaries, and testes
- Hormonal pathways maintain homeostasis





Pituitary

(Kidney)

Parathyroid

Adrenal

Ovaries  
(Female)

Testes  
(Male)

Thyroid

Pancreas

## Overview of Major Chemical Classes of Hormones



Hormone type	How they are made	Amount stored in endocrine cells	Mechanism of action	Identical structure between species?	Examples
Protein/polypeptide	Gene transcription/translation	High	Cell surface receptor	Variable; some yes, some no	ACTH, insulin
Steroid	Conversion from cholesterol	Low	Intracellular receptors	Yes	Estrogen, cortisol
Modified amino acids	Modification of 1 or 2 amino acids (tyrosine)	High Moderate	Intracellular receptors Cell surface receptors	Yes Yes	Thyroxine Catecholamines

- Most classic hormones are categorized as protein/ polypeptides, steroids, or modified amino acids
- Hormones vary significantly in their mechanism of action and blood half-life
- Receptors of for hormones are located in different regions of cells



# REGULATION OF ENDOCRINE SYSTEMS

- Secretion of hormones is regulated by a system of sensing elements that detect need for both increased and decreased secretion – they are unique for each hormone
- Hormones are secreted more or less when there are challenges such as chronic stress, disease, or a change in nutrition.
- Causes of Endocrine disease: many causes – Hormones can be over or under produced, receptors can malfunction, normal pathways for hormone removal can be disrupted. Symptoms may be related with the endocrine tissue itself, the hormone or a secondary action on the hormone secretion or action (poor communication.)
- The most common cause in animals or endocrine disease are:
  - Hormonal overproduction associated with a tumor or hyperplastic tissue manufacturing excess hormone
  - Hormonal deficiency due to destruction of the endocrine tissue source

Endocrine System Involved	Site of Disease Origin	Hypofunction	Hyperfunction
Adrenal	Adrenal (primary)	<u>Primary hypoadrenocorticism</u> Addison disease, loss of cortisol and aldosterone Occasional in dogs or cats	Functional adrenal tumor Occasional in dogs, common in ferrets but involves secretion of excessive sex steroids
Adrenal	Pituitary (secondary)	Secondary hypoadrenocorticism low cortisol only Very occasional in dogs or cats	<u>Pituitary-dependent hyperadrenocorticism</u> Cushing disease Common in dogs
Thyroid	Thyroid (primary)	<u>Primary hypothyroidism</u> Common in dogs	Hyperthyroidism Very common in cats
Thyroid	Pituitary (secondary)	<u>Secondary hypothyroidism</u> Low TSH Rare in dogs or cats	Secondary hyperthyroidism High TSH Very rare in dogs or cats
Parathyroid	Parathyroid (primary)	<u>Primary hypoparathyroidism</u> Low PTH Rare in dogs or cats	<u>Primary hyperparathyroidism</u> High PTH Occasional in dogs or cats
Parathyroid	Kidney or diet (secondary)	Not seen	<u>Secondary hyperparathyroidism</u> Sometimes associated with kidney disease in dogs or cats
Pancreas	Pancreas (primary)	<u>Diabetes mellitus type 1</u> Low insulin Common in dogs	Insulinoma High insulin Occasional in dogs, common in ferrets
Pancreas	Multiple sites, including pancreas	<u>Diabetes mellitus type 2</u> Normal or high insulin Common in cats	Not seen

TSH, thyroid-stimulating hormone. PTH, parathyroid hormone.

## KEY POINTS



- Diseases involving hormone excess or deficiency in are common in animals
- The most common endocrine diseases in dogs are Cushing disease, hypothyroidism, and Diabetes mellitus
- The most common endocrine diseases in cats are hyperthyroidism and diabetes mellitus
- The most common endocrine diseases in horses are Cushing disease (PPID), Metabolic syndrome (EMS), Insulin Resistance (IR) and Hypothyroidism
- Always discuss stress reduction in the home and decreasing environmental toxic load in all of these cases!

# PITUITARY

- The pituitary gland is located near the center and bottom of the brain. It produces a number of critical hormones that control many parts of the body, including several other endocrine glands. Because of its central role, the pituitary gland is often referred to as the “**master gland.**”
- Clinically, the most important of these hormones include growth hormone (GH), adrenocorticotropin (ACTH), thyroid-stimulating hormone (TSH), oxytocin, and antidiuretic hormone (ADH). Because the pituitary gland produces so many hormones, pituitary disease, most commonly pituitary tumors, may result in a variety of different conditions. The signs and symptoms of the disease depend on which pituitary hormones are affected.
- **Cushing’s** – excess cortisol – can be pituitary dependent or Adrenal tumors
  - Symptoms: increased thirst and urination, increase appetite, heat intolerance, lethargy, pot belly, panting obesity, weakness, thin skin, hair loss or failure to shed out, bruising, calcinosis cutis (mineral deposits in the skin), recurrent UTIs or other infections
  - **Oils: Antitumorals, oils that naturally lower cortisol (Lavender, Myrrh, Frankincense, Bergamot), Basil, Cedarwood, Patchouli, Melissa, Fennel, Clary Sage, Sandalwood, Vetiver, Ginger, Ylang Ylang, Geranium, Lemon**
- **Diabetes Insipidus** – the pituitary is responsible for maintaining the correct level of fluid in the body – problems with ADH (Pituitary doesn’t produce enough or kidneys do not respond appropriately) leads to this.
  - Symptoms: Large volume of urination. Large volume of water consumed. Urine very dilute.
  - **Oils: Antitumorals, Anti-inflammatory oils, Black Pepper, Rosemary, Geranium, Juniper Berry**

# THYROID

- The thyroid gland is a two-lobed gland in the neck, located in front of the breathing airway (trachea). It produces two iodine-containing hormones, thyroxine (also called T4) and triiodothyronine (T3). In general, the thyroid hormones regulate metabolic rate, or the speed at which body processes “run.”
- Thyroid disorders result from too little or too much T3 or T4. Symptoms of hypothyroidism (too little hormone) include decreased energy, lethargy, weight gain, dry skin, and hair loss. In young animals, hypothyroidism most commonly leads to stunted growth and dwarfism. Hyperthyroidism (too much hormone) is common in cats. Common clinical signs include weight loss despite an increased appetite, nervousness, excitability, vomiting after eating, and increased thirst and urination.
- **Hypothyroidism:** Myrrh, Lemongrass, Clove, Peppermint, Frankincense
- **Hyperthyroidism:** Myrrh, Lemongrass, Frankincense, Chamomile, Balsam Fir
- Other oils that may help (secondary): Lavender, Geranium, Cedarwood, Spearmint, Pine oils, Sandalwood, Wintergreen, Chamomile, Lemon, Ginger, Cilantro, Black Pepper

# PARATHYROIDS

- The parathyroid glands are four small glands located adjacent or within the thyroid gland. These glands secrete parathyroid hormone (PTH). PTH helps maintain normal calcium and phosphorous levels in the body and is necessary for proper bone development.
- If the parathyroids are removed during a thyroid operation, the blood PTH will fall (hypoparathyroidism). The blood calcium will then become dangerously low (hypocalcemia), causing neuromuscular signs of muscle spasms or twitches, tetany, or seizures.
  - Oils: Rosemary & Thyme (<https://www.hindawi.com/journals/jnme/2019/1431384/>), Melissa, Anti-convulsants
- A tumor of one of the parathyroid glands may cause the secretion or release too much PTH (hyperparathyroidism). The blood calcium will then become too high (**hypercalcemia**), causing increased thirst and urination, muscle weakness, and fatigue
  - Oils: Turmeric (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3373826/>), Ginger, Chamomile, Lavender, Frankincense, Peppermint, Lemon, Melissa, Antitumorals

# PANCREAS

- The pancreas is an oblong, flattened gland located in the abdomen, adjacent to the stomach and small intestine. While it secretes digestive juices to aid in digestion, its **endocrine** function is to maintain healthy glucose (blood sugar) levels. If blood sugar is too high, such as after a meal, the pancreas secretes **insulin**. Insulin moves the sugar from the blood into the cells of the body, where it is used for energy. If blood sugar is too low, the pancreas releases glucagon. Glucagon releases sugar, stored in the liver as glycogen, back into the bloodstream.
- **Diabetes**, an imbalance of blood sugar levels, is the major disorder of the pancreas. Diabetes occurs when the pancreas does not produce enough insulin or the body is resistant to the insulin in the blood. Without enough insulin to keep glucose moving through the metabolic process, the blood glucose level rises too high.
  - Oils: Cinnamon (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2901047/> ), Lemongrass, Fennel, Copaiba, Grapefruit, Coriander (<https://onlinelibrary.wiley.com/doi/abs/10.1002/ptr.2642> ), Geranium, Helichrysum ([https://www.liebertpub.com/doi/abs/10.1089/jmf.2014.0088?rfr\\_dat=cr\\_pub%3Dpubmed&url\\_ver=Z39.88-2003&rfr\\_id=ori%3Arid%3Acrossref.org&journalCode=jmf](https://www.liebertpub.com/doi/abs/10.1089/jmf.2014.0088?rfr_dat=cr_pub%3Dpubmed&url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org&journalCode=jmf) ), Melissa (<https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1041.4222&rep=rep1&type=pdf> ), Clove ([https://www.jstage.jst.go.jp/article/jos/64/7/64\\_ess14274/article](https://www.jstage.jst.go.jp/article/jos/64/7/64_ess14274/article) ), Black Pepper (for hypertension associated with Diabetes - <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3856121/pdf/APS2013-926047.pdf> ), Lavender (<https://lipidworld.biomedcentral.com/articles/10.1186/1476-511X-12-189> ), Basil
- A condition called **hyperinsulinism** is caused by too much insulin and leads to hypoglycemia (low blood sugar). This is most commonly seen when owners inadvertently overdose their diabetic dogs or cats with insulin. Less commonly, an **insulinoma** (insulin-secreting pancreatic tumor) will cause hypoglycemia. Symptoms of low blood sugar include anxiety, weakness, and seizures
  - Give food/ syrup on gums.
  - Oils: Anticonvulsants, Antitumorals, Antiinflammatory oils

# ADRENALS

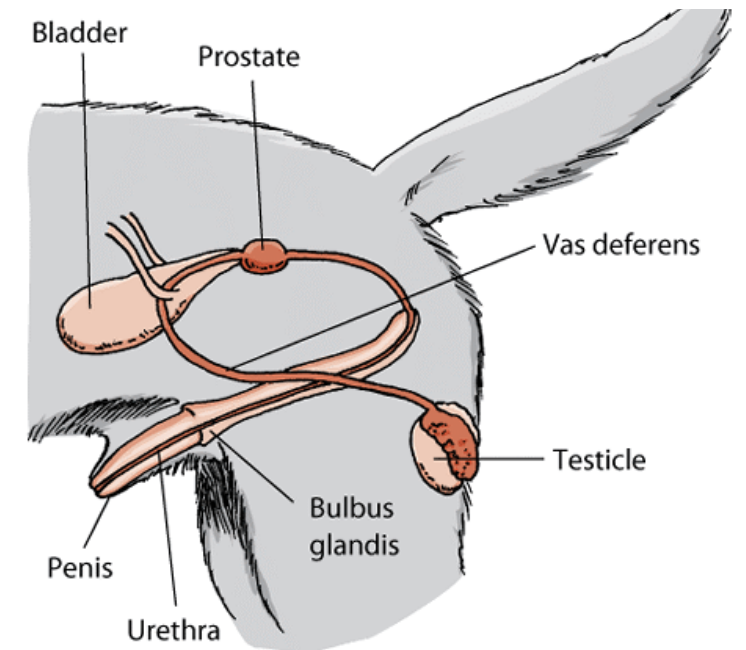
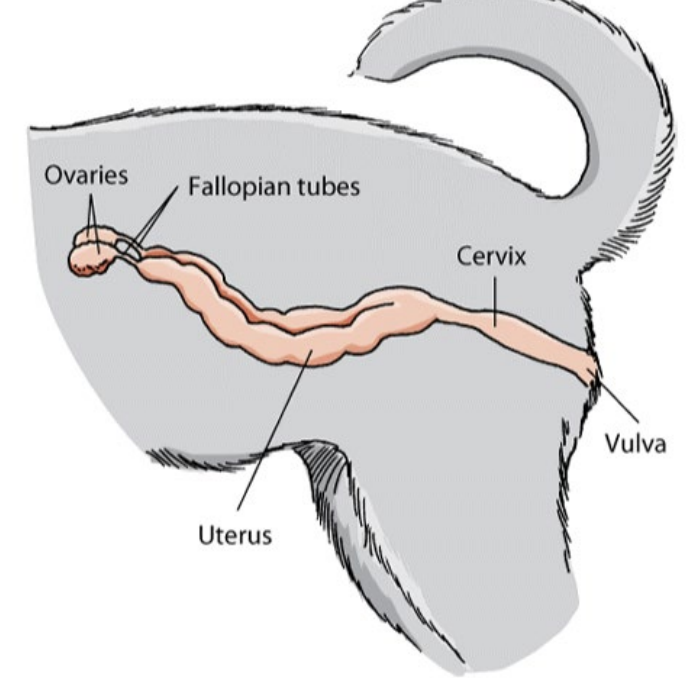
- The two adrenal glands are located on the top of each kidney. The adrenal glands essentially contain two separate endocrine organs. The outer portion or core of the adrenal gland is called the adrenal cortex. The inner portion of the gland is called the adrenal medulla. The hormones of the adrenal cortex are essential for life and the hormones of the adrenal medulla are not.
- The adrenal cortex produces glucocorticoids (e.g., cortisol) that help the body control blood sugar, increase the burning of protein and fat, and respond to stressful stimuli, such as fever, major illness, and injury. The mineralocorticoids (e.g., aldosterone) control blood volume and help to regulate blood pressure by helping the kidneys hold on to sodium and water. Cushing's syndrome (too much cortisol) and Addison's disease (too little cortisol) are the two most common adrenal cortex disorders. Symptoms of Cushing's syndrome generally include an increase in thirst and urination, enlarged abdomen, and hair loss on the trunk. Symptoms of Addison's disease include poor appetite, weight loss, weakness, and vomiting.
  - **Addison's:** Antitumoral Oils, Spikenard, Roman Chamomile, Geranium, Pine oils, Spruce Oils, Clary Sage, Clove, Basil, Rosemary
- The adrenal medulla produces epinephrine (adrenaline), which increases heart rate, opens airways to improve oxygen intake, and increases blood flow to muscles. The adrenal medulla usually secretes epinephrine when one is scared, excited, or under stress. The adrenal medulla also secretes norepinephrine, but this hormone is more related to maintaining normal activities as opposed to emergency reactions. Tumors of the adrenal medulla (called pheochromocytoma) may produce increased thirst and urination, increased heart rate, and restlessness
  - Antitumoral oils, Black Spruce, Lavender, Frankincense, Copaiba, Sandalwood, Chamomile, Bergamot, Ylang Ylang, Cary Sage, Geranium, Vanilla, Basil

# THE GONADS

- Both sexes have a pair of gonads (ovaries or testes). However, in birds the right ovary does not develop; only the left ovary and oviduct are present in adult females. The main functions of the gonads are gametogenesis (production of sperm or eggs) and steroidogenesis (biosynthesis of steroid hormones from cholesterol). Both functions are regulated primarily by hormones released by the anterior pituitary gland under the influence of the hypothalamus. Hypothalamic control of the pituitary is mediated by a peptide, gonadotropin-releasing hormone (GnRH); the secretion and release of GnRH are governed by CNS stimuli and, through a feedback mechanism, by hormones produced by other endocrine organs such as the gonads, pituitary, thyroid, and adrenal glands.
- Testes: Unneutered male animals have twin reproductive glands, called testes, which produce the hormone testosterone. Testosterone helps the young male develop and then maintain his sexual traits
- Ovaries: The female reproductive glands, the ovaries, produce estrogen and progesterone. These hormones are responsible for developing and maintaining female sexual traits, as well as maintaining a pregnancy. Along with certain pituitary hormones (i.e., luteinizing hormone [LH] and follicle-stimulating hormone [FSH]), they control the estrus cycle.

# THE REPRODUCTIVE SYSTEM - INTRODUCTION

- The reproductive system provides the mechanism for the recombination of genetic material that allows for change and adaptation. Manipulation of this system in breeding management programs allows the rapid and dramatic alteration of the conformation and productivity of domestic animals.
- The reproductive system is incredibly complex in both its anatomy and physiology, and all aspects must be considered when resolving reproductive problems. The differences in the reproductive system between the sexes and among species are extensive.
- Both sexes have primary sex organs and primary regulatory centers.
- The pituitary gland and the hypothalamus are the primary regulatory centers; thus, the regulatory function is neuroendocrine in nature.



## Features of the Reproductive Cycle



Species	Age at Puberty	Cycle Type and Length (Range)	Duration of Estrus	Best Time to Breed	First Estrus After Parturition	Comments
Cattle	10-12 months, usually first bred ~14-15 mo	Polyestrous all year; 21 days (18-24)	18 hours (6-24)	Insemination from midestrus until 6 hr after end of estrus	20-60 days	Ovulation 10-12 hours after end of estrus.
Sheep	6-9 months	Seasonally polyestrous, early fall to winter; 17 days (14-20)	24-36 hours	18-20 hr after onset of estrus	Next fall	Ovulation near end of estrus.
Goat	5-7 months	Seasonally polyestrous, early fall to late winter; 21 days	24-48 hours	Daily during estrus	Next fall	Many intersexes born in hornless strains.
Pig	6-7 months	Polyestrous all year; 21 days (19-23)	40-60 hours	Daily during estrus	4-10 days after weaning	Ovulation usually ~40 hours after beginning of estrus.
Horse	10-24 months	Seasonally polyestrous, early spring through summer; ~21 days (19-23)	5-7 days	Last few days of estrus, just before ovulation; should be bred at 2-day intervals	4-14 (9) days	Ovulation usually 1-2 days before end of estrus. Double ovulation occurs in ~20% of estrous periods, but twins rarely progress to term.
Alpaca	12-18 months	Polyestrous all year in North America; Not applicable	Up to 36 days	When a large, viable follicle is present	Fertile within 15-20 days	Alpacas are induced ovulators.
Dog	6-24 months; earlier in smaller breeds, later in larger breeds	Monestrous all year; 6-7 mo	9 days (3-21)	Second day after ovulation	4-5 months	Proestrous bleeding 7-10 days. Ovulation usually 1-3 days after onset of estrus. Ova shed before first polar body has been extruded (primary oocyte).



# GESTATION PERIODS & INCUBATION PERIODS FOR VARIOUS SPECIES

- Gestation Periods: <https://www.merckvetmanual.com/multimedia/table/approximate-gestation-periods>
- Incubation Periods: <https://www.merckvetmanual.com/multimedia/table/approximate-incubation-periods>

# INFORMATION HELPFUL TO OBTAIN WITH THE REPRODUCTIVE SYSTEM

- Complete history including
  - Current medications and supplements
  - Appetite
  - Diet (any recent changes?)
  - Changes in body weight
  - Previous illness or injury
  - Changes in behavior
  - Reproductive status
- Physical Exam | Observations
  - Stress in the home?
  - Recent changes?
- Veterinary Testing
  - Bloodwork
  - Ultrasound
  - Endoscopy
  - Veterinary examination
  - Cytology
  - Reproductive tests
  - Etc.

# SYMPTOMS POINTING TO REPRODUCTIVE SYSTEM INVOLVEMENT

- Infertility
  - Failure to Cycle
  - Abnormal Estrous cycle
  - Failure to conceive
  - Prenatal or perinatal death (failure to maintain pregnancy)
  - Aberration of libido
  - Abnormal production, transport or storage of sperm
  - Physical problems resulting in inability or reluctance to mate
- Behavior Changes
- Decreased performance
- Change in urination/ blood in urine
- Fever
- Discharge
- Straining
- Prolapse
- Swelling/ Heat/ Redness
- Etc.

# REPRODUCTIVE DISEASES

- Bacterial – Antibacterial Oils
- Viral – Antiviral Oils
- Fungal – Antifungal Oils
- Cystic Ovary Disease – Clary Sage, Frankincense, Cypress, Geranium, Lemongrass
- Mastitis (inflammation of the mammary gland) – Antimicrobial oils, Anti-inflammatory oils, Lavender, Geranium
- Metritis, Endometritis, Pyometra, Retained Placenta, Prolapses, Dystocia – Veterinarian!
- False Pregnancy (Pseudopregnancy) – Clary Sage, Geranium, Vetiver, Ylang Ylang, Fennel, Sedative oils
- Vaginitis | Juvenile Vaginitis – Antimicrobial oils, Anti-inflammatory oils

# NEOPLASIA

- Mammary Tumors – most frequent in intact females (Canine/ feline) – 0.5% risk if spayed prior to first estrus cycle, 1 estrus cycle – 8% chance, after that risk is the same as intact females, although surgical removal of tumors dogs spayed less than 2 years of age lived 45% longer than those spayed after 2 years of age.
- Prostate
  - Prostatic Hyperplasia found in most intact males over 6 years of age (dogs)
  - Inflammation of the prostate (prostatitis) – may result in bacterial abscesses
  - Cancer – Carcinoma – Very aggressive, no treatment
- Multi-modal treatment often necessary
- Palliative care
- Essential Oils: Anti-Cancer/ Anti-Tumoral oils; Anti-inflammatory oils; Analgesia (pain relief) oils

**QUESTIONS?**

