

BIO 459: Endocrinology
Fall 2009
Midterm Exam 1

NAME _____
Last 4 digits of ID number _____

MULTIPLE CHOICE QUESTIONS (3 pts each) (circle the answer)

1. Which of the following are good reasons to study endocrinology?
 - a) **to learn about causes of human disease**
 - b) **to understand how humans and other animals maintain homeostasis**
 - c) **to understand how Barry Bonds can hit a baseball so far**
 - d) **all of the above**

2. Hormones may be divided into the following classes:
 - a) aromatics, polypeptides, and steroids
 - b) **amines, polypeptides, and steroids**
 - c) amines, aromatics, and polypeptides
 - d) aromatases, phospholipids and steroids
 - e) amines, phospholipids and steroids

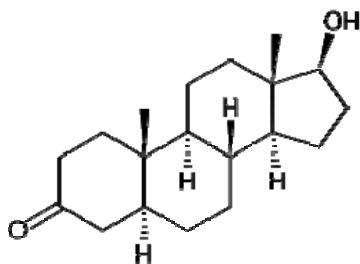
3. The pituitary gland:
 - a) consists entirely of nerve tracts containing axons from neurosecretory cells
 - b) contains a region called the anterior lobe which secretes arginine vasopressin (AVP) and oxytocin
 - c) is derived completely from an invagination of oral epithelium called Rathke's pouch
 - d) **has an anterior lobe that contains specialized corticotrope cells that synthesize and release adrenocorticotropin hormone (ACTH)**

4. Which of the following hormones is non-polar and lipid soluble?
 - a) progesterone
 - b) thyrotropin
 - c) serotonin
 - d) triiodothyronine
 - e) a and b
 - f) b and d
 - g) **a and d**

5. Steroid hormones:
 - a) are derived from cholesterol
 - b) are modified within a tissue by enzymatic activity
 - c) have only membrane-bound receptors
 - d) **a and b are true**
 - e) a and c are true

6. Somatotrope cells produce and secrete which of the following hormones:
- prolactin
 - luteinizing hormone (LH)
 - thyrotropin (TSH)
 - growth hormone (GH)**
 - a and c
 - a and d
7. Berthold's first experiment in chickens:
- showed that crowing in roosters occurs before puberty if castration is performed immediately after the chick hatches
 - showed that comb formation, crowing and fighting with other males was dependent upon testicular hormone secretion**
 - showed that testicular implantation of a testis from one male chicken to another could not support normal behavioral function in the recipient of the transplanted testis
 - showed that behavioral differences between young male chickens and adult roosters were dependent on normal pituitary function
8. Which of the following is a type of tropic hormone?
- vasopressin (AVP)
 - gonadotropin-releasing hormone (GnRH)
 - follicle-stimulating hormone**
 - somatostatin
9. Which of the following tissues is the main target for follicle-stimulating hormone (FSH) produced by the anterior pituitary?
- thyroid gland
 - adrenal glands
 - gonads**
 - heart
 - liver
10. Which of the following is **NOT** a function of the mammalian neurohypophysial hormone oxytocin (OT)?
- regulate affiliative behaviors (e.g. maternal care)
 - regulate myometrium muscle contractions during labor
 - regulate arterial/venous pressure during hemorrhage**
 - regulate milk letdown during nursing
11. Which of the following is a type of steroid hormone?
- prolactin
 - pro-opiomelanocortin
 - growth hormone
 - progesterone**
 - pregnenolone

12. Given the structure of the chemical below, which major group of hormones does this chemical belong to?



- a) **steroid hormones**
 b) amine hormones
 c) polypeptide hormones
 d) fatty acid derivative hormones
13. A patient has a mutation in the gene encoding the hormone thyrotropin (TSH) that causes this hormone to be non-functional. Which of the following clinical symptoms would you expect this patient to show?
- a) reduced plasma testosterone levels
 b) elevated plasma T3 levels
 c) difficulty in maintaining osmotic homeostasis
 d) reduced pituitary pro-opiomelanocortin (POMC) levels
 e) **reduced plasma T4 levels**
14. Which of the following would you expect to be an associated symptom in a human patient showing abnormally high plasma levels of cortisol?
- a) low levels of gene expression for prolactin in the pituitary gland
 b) elevated adrenocorticotropic (ACTH) production from the pituitary
 c) elevated follicle-stimulating hormone (FSH) production from the pituitary
 d) **low corticotrophin-releasing hormone (CRH) production in the hypothalamus**
 e) elevated aldosterone production from the adrenal glands
15. Which of the following endocrine glands is **NOT** part of the peripheral endocrine system?
- a) thyroid gland
 b) testis
 c) **pituitary gland**
 d) gastrointestinal tract
 d) pancreas

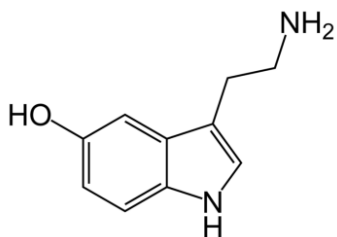
16. While conducting your honors thesis at UNCW, you identify a new gene that appears to have an ERE in its promoter region. This gene is most likely regulated by which of the following classes of hormones?

- a) thyroid hormones
- b) steroid hormones**
- c) fatty acid derivatives
- d) polypeptides
- e) amine derivatives

17. Which of the following is a type of polypeptide hormone?

- a) epinephrine
- b) thyrotropin (TSH)**
- c) serotonin (5-HT)
- d) testosterone

18. Given the structure of the chemical below, which major group of hormones does this chemical belong to?



- a) steroid hormones
- b) amine hormones**
- c) polypeptide hormones
- d) fatty acid derivative hormones

19. Which of the following is considered the 'rate-limiting step' in steroidogenesis?

- a) cholesterol intake in the diet
- b) transport of cholesterol across the inner mitochondria membrane by StAR**
- c) steroid degradation in the liver
- d) the density of androgen steroid receptors in the target tissue

TRUE/FALSE QUESTIONS (3 pts each) (circle the answer)

20. The same cell could produce a hormone with autocrine, paracrine and endocrine activity.

- a) True**
- b) False

21. Berthold's experiment demonstrated that normal testicular function is dependent on an intact neural connection to the testis.
- a) True
 - b) False**
22. Which of the following statements concerning hormones is FALSE?
- a) A single endocrine gland may produce multiple hormones.
 - b) A single target cells may be influenced by more than one hormone.
 - c) A single hormone can influence only one time of target cell.**
 - d) The same hormone may be secreted by more than one endocrine gland.
23. Over evolutionary time, the chemical structure of steroid hormones has evolved more rapidly than other types of hormones because the structure of steroids is encoded by genes.
- a) True
 - b) False**

APPLICATION QUESTIONS

24. Bose and coworkers (J. Clinical Endocrinol. Metabol. 85:3636-3639 [2000]) examined six infants expressing mutant and non-function StAR (Steroidogenic Acute Regulatory) protein. Which of the following statements correctly describe physiological consequences of StAR deficiency?
- a) Plasma osmolality will be higher than normal in infants with StAR deficiency.
 - b) Synthesis of pro-opiomelanocortin (POMC) in corticotrope cells will be higher than normal in infants with StAR deficiency.
 - c) Conversion of cholesterol to pregnenolone will be lower than normal in infants with StAR deficiency.**
 - d) Plasma levels of tri-iodothyronine (T3) will be elevated above normal levels in infants with StAR deficiency.
 - e) Synthesis of follicle-stimulating hormone (FSH) in the ovary will be lower than normal in infants with StAR deficiency.

25. Engell et al. (*Neurotoxicology and Teratology* 28: 103-110 [2006]) explored how perinatal exposure to the estrogenic chemical methoxychlor (MXC) affected behavior. The authors found that female mice treated with MXC had abnormal social behaviors and showed elevated aggression toward their male mice mates relative to control (unexposed) mice. Based on this result, which of the following might you also expect to see in the MXC-treated mice?
- a) MXC females have elevated follicle-stimulating hormone (FSH) secretion from the adenohypophysis, leading to reductions in estrogen synthesis in the ovary
 - b) MXC females have reduced oxytocin (OT) receptor abundance in the brain, relative to control females**
 - c) MXC females have difficulty maintaining hydromineral balance following osmotic challenge due to altered steroidogenesis
 - d) MXC females show heightened ACTH secretion from the neurohypophysis following exposure to a stressful stimulus (e.g. electric shock)
26. Goji and coworkers (*J. Clinical Endocrinol. Metabol.* 83:3205-3209 [1998]) examined two Japanese girls expressing mutant and non-functional aquaporin 2 (AQP2) channels. Which of the following statements correctly describe the physiological effects of AQP2 deficiency?
- a) Synthesis of pro-vasopressin (pro-AVP) mRNAs in the hypothalamus will be increased in the girls with AQP2 deficiency.**
 - b) Urine osmolarity will be higher than normal in the girls with AQP2 deficiency.
 - c) Urine volume will be lower than normal in the girls with AQP2 deficiency.
 - d) Plasma levels of vasopressin (AVP) will be decreased in patients with AQP2 deficiency.
27. Manchado et al (*Gen. Comp. Endocrinol.* 155:447-455 [2008]) examined regulation of the hypothalamic-pituitary-thyroid axis in the Senegalese sole (*Solea senegalensis*) (a fish species) in response to an injection of thyroxine (T₄). Which of the following physiological effects would be predicted to occur in sole injected with T₄?
- a) Plasma dihydrotestosterone (DHT) levels should increase
 - b) Pituitary thyrotropin (TSH) production should decrease**
 - c) Gonadal testosterone production should increase
 - d) Hypothalamic thyrotropin-releasing hormone (TRH) levels should increase

SHORT ANSWER QUESTIONS

28. List two of the main functions of the hormone vasopressin (AVP) in mammals (4 pts):

Any two (2) of the following:

- 1) Osmoregulation / maintain hydromineral balance**
- 2) Vasopressor effect (vasoconstriction following a drop in blood pressure)**
- 3) Regulate aggression and affiliative/sociosexual behaviors**

29. List three differences between hormonal communication and neural communication (6 pts):

Any three (3) of the following:

	<u>Neural communication</u>	<u>Hormonal communication</u>
Anatomical arrangement	A “wired” system; specific structural arrangement between neurons and their target cells	A “wireless” system; endocrine organs widely dispersed and not structurally related to one another or to their target cells
Type of chemical messenger	Neurotransmitters released into the synaptic cleft	Hormones
Distance of action of chemical messenger	Very short distance (diffuses across synaptic cleft)	Long (systemic) or short (i.e., autocrine, paracrine)
Means of specificity of action on target cell	Dependent on close anatomical relationship between neurons and their target cells	Dependent on specificity of target cell binding and responsiveness to particular hormone
Speed of response	Rapid (milliseconds)	Slow (minutes to hours)
Duration of action	Brief (milliseconds)	Long (minutes to months)

30. Briefly describe two problems with the classical definition of hormones and the endocrine system (6 pts):

Any two (2) of the following:

- 1) **Hormones are not necessarily produced by ductless glands – hormones can be secreted by small groups of cells or even by individual cells**
- 2) **Secretion of an endocrine gland or cell is not unihormonal – multiple active chemicals are produced by a cell.**
- 3) **Most hormones have multiple production sites, rather than being produced by only a single endocrine gland.**
- 4) **Hormones are not only secreted into the bloodstream - they are not always blood-borne. They can be released into lymph or extracellular fluids.**
- 5) **Hormone action cannot be stereotyped. It varies according to the state of the target site. This may be determined by the receptors expressed in the target cell.**
- 6) **Hormones do not always act on distant target sites. They can have paracrine or autocrine effects.**

31. One of the main ways that the endocrine system regulates the effects of a given hormone is by controlling the amount of that hormone produced/secreted. In 2 or 3 sentences, briefly describe one of the other ways that the endocrine system regulates the effects of a hormone in blood circulation (3 pts):

The effects of a given hormone can be regulated either during transport (e.g. binding/transport proteins) or at the level of the target tissue itself (e.g. receptors, conversion enzymes). The endocrine system can regulate the amount and type of binding proteins present in general blood circulation, which will influence the transport of hormones from their gland of synthesis to target tissues. Likewise, the capacity of a tissue to respond to a given hormone in circulation can be regulated at the levels of the target tissue by up- or down-regulating the type and density of receptors present in that tissue.