THE ADRENAL GLAND
QUIZ #5

Select the **BEST** answer.

1. Cortisol is synthesized and secreted by the adrenal cortex from the zona
   a) Glomerulosa
   b) Fasciculata
   c) Reticularis
   d) Glomerulosa and fasciculata
   e) Reticularis and fasciculata

2. Which of the following regarding the steroid biosynthetic pathway is true?
   a) The major androgen secreted by the adrenal cortex is testosterone
   b) Most adrenal steroids are synthesized from stored cholesterol esters
   c) The rate-limiting enzyme for glucocorticoid synthesis is the 21-hydroxylase enzyme
   d) The mineralocorticoids, even at pharmacologic levels, have no glucocorticoid activity

3. Adrenarche
   a) Only occurs in girls
   b) Is the same as puberty
   c) Occurs upon activation of the enzyme that catalyzes formation of adrenal androgens
   d) Is characterized by conversion of testosterone to estradiol

4. ACTH
   a) Stimulates synthesis and secretion of aldosterone, cortisol and DHEA
   b) Shares an amino acid sequence with MSH
   c) Release is stimulated by darkness
   d) Is cleaved from the prohormone POMC in the intermediate lobe of the pituitary gland

5. Administration of high doses of exogenous glucocorticoids would lead to
   a) Exacerbation of the symptoms of a severe allergic reaction
   b) Atrophy of the zonae fasciculata and reticularis over the long term
   c) Increased muscle mass
   d) Inability to respond to stress
6 Which of the following would be observed in an individual with congenital adrenal hyperplasia?
   a) High ACTH and low cortisol
   b) High ACTH and high cortisol
   c) Low ACTH and low cortisol
   d) Low ACTH and high cortisol

7 Which of the following is true with regard to the diurnal pattern of plasma cortisol secretion?
   a) Exposure to darkness for a week would completely inhibit the diurnal pattern of cortisol secretion
   b) People who work nights have elevated morning cortisol levels
   c) In a person with Cushing's disease, there would be no diurnal pattern of cortisol secretion
   d) During periods of intense stress, there would be no diurnal pattern of cortisol secretion

8 An individual presents with hyperglycemia, hypertension, muscle weakness and backaches. Which of the following cannot also be observed in the same patient?
   a) Hyperpigmentation
   b) Decreased plasma ACTH
   c) Decreased plasma cortisol
   d) No diurnal rhythm
   e) All of the above

9 Rapid withdrawal of long-term exogenous glucocorticoid therapy would result in
   a) Hirsutism
   b) Symptoms of Addison's disease
   c) Easy bruising
   d) Ulcers

10 A patient with Addison's disease might have
    a) Increased ability to withstand stress
    b) Insulin insensitivity
    c) Increased susceptibility to infections
    d) Increased ACTH levels
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Select the BEST answer.

1. Which of the following enzymes is unique to the zona glomerulosa
   a) P450 side-chain cleavage
   b) Aldosterone synthase
   c) 21-hydroxylase
   d) 11-hydroxylase

2. The adrenal cortex
   a) Is a major site for testosterone biosynthesis
   b) Contains chromaffin cells
   c) Has 3 zones, the innermost one of which is the zona fasciculata
   d) Is essential for life

3. ACTH
   a) Increases steroid biosynthesis in the zona glomerulosa and fasciculata
   b) Causes hyperpigmentation whenever it is chronically increased
   c) Is usually lower in the morning than in the evening
   d) Increases aldosterone and cortisol secretion

4. Which of the following is true?
   a) Adrenarche, or the onset of all adrenal hormone secretion, occurs around the age of 8
   b) Adrenal androgens cause the pubertal growth spurt
   c) During stress, diurnal rhythms in plasma cortisol levels can still be observed
   d) POMC is cleaved into ACTH, MSH, γ-lipotropin and β-endorphin in the anterior lobe of the pituitary

5. Cortisol
   a) Suppresses the immune system at pharmacologic levels
   b) Acts within minutes
   c) Circulates mostly unbound, or free
   d) Secretion feeds back to stimulate hypothalamic CRH release
QUESTIONS 6-9: Match the following symptoms with the diseases below.

a) Amenorrhea, hirsutism, virilism and mineralocorticoid deficiency
b) Absence of a diurnal rhythm in ACTH and cortisol, centripetal obesity, and high ACTH
c) Absence of a diurnal rhythm in ACTH and cortisol, centripetal obesity, and low ACTH
d) Hyperpigmentation, hypotension and high ACTH
e) Hyperpigmentation, hypotension and low ACTH

6. Pituitary Cushing's
7. Addison's disease
8. Congenital adrenal hyperplasia
9. Adrenal Cushing's

10. Administration of CRH to a patient with adrenocortical insufficiency caused an increase in ACTH from a low initial level. This finding indicates that the site of the deficiency is the:

   a) Adrenal gland
   b) Pituitary gland
   c) Hypothalamus or higher brain centers
Select the **BEST** answer.

1. Severe damage of both adrenal glands by tuberculosis would cause an Increase in circulating
   a) Aldosterone
   b) ACTH
   c) Cortisol
   d) DHEA

2. All 3 zones of the adrenal cortex can synthesize
   a) DHEA
   b) Progesterone
   c) Aldosterone
   d) Cortisol

3. Which of the following enzymes is found only in the zona glomerulosa
   a) Aromatase
   b) Side-chain cleavage enzyme
   c) Aldosterone synthase
   d) 17-hydroxylase

4. The androgens produced by the adrenal glands
   a) have the same potency as testosterone
   b) Are secreted throughout life, beginning during infancy
   c) Cause the pubertal growth spurt
   d) Are responsible for the appearance of axillary hair

5. Which of the following is true?
   a) Cortisol has metabolic effects that are similar to those of insulin
   b) Cortisol's actions occur within minutes
   c) Pharmacologic levels of cortisol stimulate the immune system
   d) During stress, all actions of cortisol require an increase in circulating levels
QUESTIONS 6-10 Match the following circulating hormone profiles with the diseases below.

a) high ACTH, high cortisol
b) high ACTH, low cortisol
c) low ACTH, high cortisol
d) low ACTH, low cortisol

6. Pituitary Cushing's
7. Addison's disease
8. Cushing's syndrome resulting from an ectopic peptide-secreting tumor
9. Congenital adrenal hyperplasia
10. Adrenal Cushing's
1. Which of the following is synthesized in the zona fasciculata?
   a) Pregnenolone, progesterone, cortisol, aldosterone  
   b) Cholesterol, cortisol, DHEA, testosterone  
   c) Cortisol, aldosterone, DHEA, androstenedione  
   d) Pregnenolone, cortisol, DHEA, epinephrine

2. Biosynthesis of the adrenal steroid hormones begins with cholesterol, that comes from:
   a) Lipid stores found only in the cells of the zona glomerulosa  
   b) Precursors that are converted to cholesterol by the side-chain cleavage enzyme  
   c) Uptake of LDL particles from plasma  
   d) De novo synthesis of cholesterol from cholesterol esters

3. The rate-limiting enzyme for adrenal steroid biosynthesis is:
   a) Aromatase  
   b) 11β-hydroxylase  
   c) 21-hydroxylase  
   d) side-chain cleavage enzyme

4. Cortisol has all of the following actions EXCEPT
   a) At high levels, causes bone breakdown  
   b) Suppresses the immune system at pharmacologic levels  
   c) At high levels, increases protein synthesis  
   d) At physiologic levels, maintains total peripheral resistance, and thereby blood pressure

5. Which of the following is true?
   a) Adrenarche is the initiation of adrenal androgen production  
   b) The adrenal gland secretes testosterone, which is the major source of circulating androgen in females  
   c) Extreme stress will cause a suppression of ACTH because of the negative feedback action of cortisol  
   d) Diurnal rhythms are not affected in disease states  
   e) ACTH is responsible for maintenance of the glomerulosa and fasciculata layers of the adrenal cortex
6. ACTH
   a) Is elevated in individuals with secondary hypocortisolism
   b) Is identical to MSH
   c) Would be increased upon stimulation of the paraventricular nuclei of the hypothalamus
   d) Is a glycoprotein hormone that is synthesized and secreted by the anterior pituitary
   e) Has receptors on the adrenal medullary chromaffin cells

7. Cushing's syndrome may be caused by
   a) an autoimmune disorder that destroys the adrenal gland
   b) a deficiency in the adrenal 21-hydroxylase enzyme
   c) abrupt withdrawal of chronic high doses of synthetic glucocorticoids
   d) a hypersecreting tumor of the corticotrophs
   e) pituitary stalk section

8. A patient with Addison's disease (primary adrenal insufficiency) would have
   a) low plasma cortisol, ACTH and CRH
   b) low plasma cortisol and high ACTH and CRH
   c) low plasma cortisol and ACTH, and high CRH
   d) high plasma cortisol and low ACTH and CRH
   e) high plasma cortisol and ACTH, and low CRH

9. Corticosteroid binding globulin (CBG)
   a) is synthesized and secreted by the adrenal cortex
   b) shortens the half-life of circulating cortisol
   c) is saturated under physiologic conditions
   d) secretion is regulated by ACTH

10. To distinguish between secondary (pituitary) and tertiary (hypothalamic/CNS) causes of hypocortisolism, one should determine the ACTH response to administration of.
   a) CRH
   b) aldosterone
   c) cortisol
   d) dexamethasone, a synthetic glucocorticoid
Select the **BEST** answer.

**THE ADRENAL GLAND**  
Class Quiz

1. The layers of the adrenal cortex from outer to inner are
   
   a) fasciculata, glomerulosa, reticularis  
   b) glomerulosa, reticularis, medulla  
   c) glomerulosa, fasciculata, reticularis  
   d) reticularis, fasciculata, glomerulosa

2. Which of the following is true?
   
   a) The adrenal cortex produces cortisol, aldosterone and the main adrenal androgen, testosterone.  
   b) The major source of adrenal steroids released into the bloodstream is from large stores in intracellular lipid droplets.  
   c) The major precursor utilized in adrenal steroid biosynthesis is acetate.  
   d) Aldosterone and cortisol have overlapping actions because of their structural similarities.

3. The rate-limiting step in the biosynthesis of steroid hormones is conversion of
   
   a) cholesterol ester to cholesterol  
   b) cholesterol to pregnenolone  
   c) cholesterol to progesterone  
   d) pregnenolone to progesterone

4. Congenital adrenal hyperplasia
   
   a) is characterized by increases in cortisol  
   b) is associated with elevated plasma ACTH levels  
   c) causes hyperaldosteronism  
   d) causes infertility in both sexes due to negative feedback by the androgens

5. Elevated glucocorticoid levels could lead to
   
   a) increased resistance to infections  
   b) increased amplitude of the diurnal rhythm in cortisol  
   c) hyperpigmentation  
   d) decreased plasma glucose  
   e) hypertension

6. ACTH
   
   a) is all important physiologic regulator of aldosterone secretion  
   b) activates the inositol triphosphate pathway  
   c) is secreted at a constant level throughout the day  
   d) shares part of its structure with αMSH  
   e) does not affect the size of the cells in the zona fasciculata and zona reticularis
7. Cushing’s syndrome may be caused by
   a) an autoimmune disorder that destroys the adrenal gland
   b) a deficiency in the adrenal 21-hydroxylase enzyme
   c) abrupt withdrawal of chronic high doses of synthetic glucocorticoids
   d) a hypersecreting tumor of the corticotrophs
   e) pituitary stalk section

8. A patient with Addison's disease (primary adrenal insufficiency) would have
   a) low plasma cortisol, ACTH and CRH
   b) low plasma cortisol and ACTH, and high CRH
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   d) high plasma cortisol and low ACTH and CRH
   e) high plasma cortisol and ACTH, and low CRH

9. Corticosteroid binding globulin (CBG)
   a) is synthesized and secreted by the adrenal cortex
   b) shortens the half-life of circulating cortisol
   c) is saturated under physiologic condition
   d) secretion is regulated by ACTH

10. Adrenarche
    a) is the term for the first appearance of significant renal glucocorticoid production in children of both sexes
    b) begins at the same time as puberty
    c) is the stimulus for the growth of pubic and axillary hair
    d) is caused by an increase in the activity of the cytochrome P450scc enzyme that catalyzes the conversion of cholesterol to pregnenolone
1. The reticularis layer of the adrenal cortex synthesizes and secretes which of the following hormones

a) cortisol, aldosterone, and epinephrine  
b) cortisol, androstenedione and aldosterone  
c) cortisol, androstenedione and DHEA  
d) only aldosterone  
e) epinephrine and norepinephrine

2. The major adrenal androgen secreted is

a) testosterone  
b) progesterone  
c) androstenedione  
d) DHEA  
e) pregnenolone

3. The rate-limiting enzyme in the biosynthesis of steroid hormones is

a) cholesterol side chain cleavage enzyme  
b) cholesterol esterase  
c) 17α-hydroxylase cytochrome P450  
d) 11β-hydroxylase cytochrome P450  
e) 21-hydroxylase cytochrome P450

4. In the case of congenital adrenal hyperplasia, which of the following would be observed?

a) low plasma ACTH and cortisol  
b) low plasma ACTH and high plasma cortisol  
c) high plasma ACTH and low plasma cortisol  
d) high plasma ACTH and cortisol

5. Elevated glucocorticold levels could lead to

a) improved immune responses  
b) increased responsiveness to insulin  
c) increased gluconeogenesis  
d) vasodilation  
e) increased ACTH release
6. ACTH
a) is not an important physiologic regulator of aldosterone secretion  
b) activates the Inositol triphosphate pathway  
c) is secreted at a constant level throughout the day  
d) shares part of its structure with aMSH not affect the size of the cells in the zona fasciculata and zona reticularis

7. Cushing's syndrome is characterized by
a) Penisulin resistance  
b) hypotension  
c) hypoglycernia  
d) improved resistance to infections  
e) inability to mobilize triglycerides

8. A patient with Addison's disease (primary adrenal insufficiency) would have
a) low plasma cortisol, ACTH and CRH  
b) low plasma cortisol and ACTH, and high CRH  
c) plasma cortisol and high ACTH and CRH  
d) high plasma cortisol and low ACTH and CRH  
e) high plasma cortisol and ACTH, and low CRH

9. Corticosterold binding globulin (CBG)
  a) is a high capacity, low-affinity cortisol carrier  
  b) is synthesized and secreted by the adrenal cortex  
  c) is not saturated under physiologic conditions  
  d) secretion is regulated by ACTH  
  e) shortens the half-life of circulating cortisol

10. The symptoms of congenital adrenal hyperplasia include
  a) hypercortisolism  
  b) aldosterone deficiency  
  c) decreased ACTH  
  d) delayed puberty in boys  
  e) feminization of males