



# GENITOURINARY SYSTEM


SUBJECT : Guyton  
LEC NO. : Final  
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وَقُلْ رَبِّ زِدْنِي عِلْمًا

الي محطوط عليه إشارة صح بس هي الاسئلة الداخلة معنا  
وبتلاقوا الإجابات مع الشرح آخر اشياء

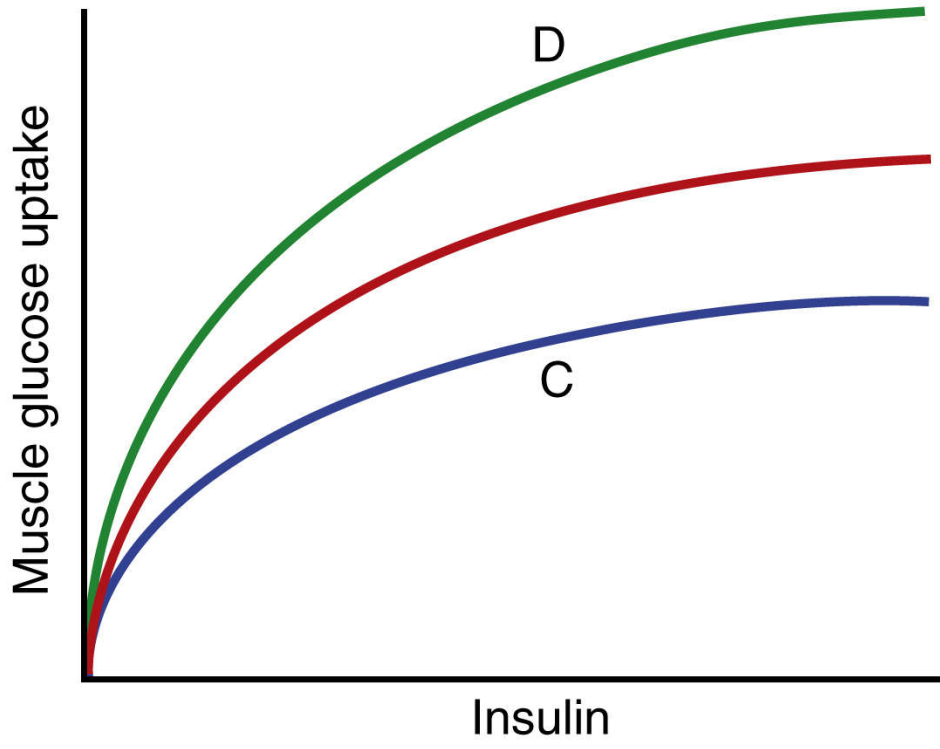
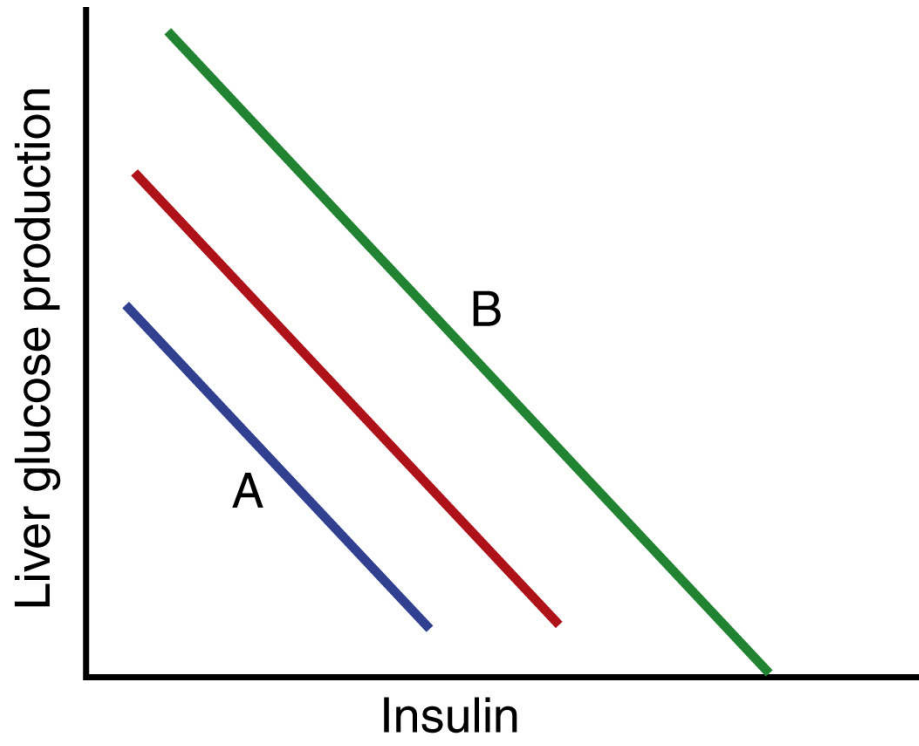
## Unit XIV: Endocrinology and Reproduction

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1. Which of the following is expected to exhibit the greatest biological activity?
  - A) Insulin like growth factor-1 free in the plasma
  - B) Cholecalciferol (vitamin D3)
  - C) Cortisol bound to corticosteroid binding globulin
  - D) T4 bound to thyroxine binding globulin
  - E) Aldosterone bound to plasma albumin
2. Which receptor controls nitric oxide (NO) release to cause vasodilation during penile erection?
  - A) Leptin receptor
  - B) Angiotensin AT1 receptor
  - C) Endothelin ETA receptor
  - D) Muscarinic receptor
3. After menopause, hormone replacement therapy with estrogen-like compounds is effective in preventing the progression of osteoporosis. What is the mechanism of their protective effect? 
  - A) They stimulate the activity of osteoblasts
  - B) They increase absorption of calcium from the gastrointestinal tract
  - C) They stimulate calcium reabsorption by the renal tubules
  - D) They stimulate parathyroid hormone (PTH) secretion by the parathyroid gland
4. Neurons that secrete antidiuretic hormone or oxytocin terminate in which of the following structures?
  - A) Posterior pituitary
  - B) Median eminence
  - C) Mammillary body
  - D) Paraventricular nucleus
  - E) Supraoptic nucleus
5. Which of the following represents a physiological action of growth hormone?
  - A) Increases the breakdown of muscle protein


- B) Increases utilization of glucose in muscle
  - C) Decreases storage of lipids in adipose cells
  - D) Decreases gene transcription
  - E) Decreases gluconeogenesis in the liver
6. Which hormones antagonize the effect of NO and cause the penis to become flaccid after orgasm?
- A) Endothelin and norepinephrine
  - B) Estrogen and progesterone
  - C) Luteinizing hormone (LH) and follicle-stimulating hormone (FSH)
  - D) Progesterone and LH

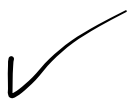
**Questions 7–9**



The red lines in the above figure illustrate the normal relationships between plasma insulin concentration and glucose production in the liver and between plasma insulin concentration and glucose uptake in muscle. Use this figure to answer Questions 7–9.

7. Which lines most likely illustrate these relationships in a patient with type 2 diabetes?
  - A) A and C
  - B) A and D
  - C) B and C
  - D) B and D
8. Which lines most likely illustrate these relationships in a patient with acromegaly?
  - A) A and C
  - B) A and D
  - C) B and C
  - D) B and D
9. Line D most likely illustrates the influence of which of the following?
  - A) Exercise
  - B) Obesity
  - C) Growth hormone (GH)
  - D) Cortisol
  - E) Glucagon
10. Thecal cells in the follicle are not able to produce what sex steroid?
  - A) Estradiol
  - B) Testosterone
  - C) Progesterone
  - D) Dihydrotestosterone
11. A baby is born with a penis, a scrotum with no testes, no vagina, and XX chromosomes. This condition is referred to as hermaphroditism. What could cause this abnormality?
  - A) Abnormally high levels of human chorionic gonadotropin (hCG) production by the trophoblast cells
  - B) The presence of a testosterone-secreting tumor in the mother's right adrenal gland
  - C) Abnormally high levels of LH in the maternal blood
  - D) Abnormally low levels of testosterone in the maternal blood
  - E) Abnormally low rates of estrogen production by the placenta

12. Antidiuretic hormone (ADH) is increased by which of the following?
- A) A hyperosmotic extracellular fluid in the hypothalamus
  - B) A hyperosmotic extracellular fluid in the adenohypophysis
  - C) A hypoosmotic extracellular fluid in the hypothalamus
  - D) A hypoosmotic extracellular fluid in the adenohypophysis
  - E) A hypoosmotic fluid in the atria of the heart
13. In an individual with panhypopituitarism, which selection below best describes the plasma hormone changes that would occur?
- A) ↓GHRH, ↓somatostatin, ↓growth hormone, ↓somatomedin C
  - B) ↓GHRH, ↓somatostatin, ↓growth hormone, ↑somatomedin C
  - C) ↑GHRH, ↑somatostatin, ↑growth hormone, ↓somatomedin C
  - D) ↑GHRH, ↑somatostatin, ↓ growth hormone, ↓somatomedin C
  - E) ↑GHRH, ↓somatostatin, ↓growth hormone, ↓somatomedin C
14. Which of the following could inhibit the initiation of labor?
- A) Administration of an antagonist of the actions of progesterone
  - B) Administration of LH
  - C) Administration of an antagonist of PGE<sub>2</sub> effects 
  - D) Mechanically dilating and stimulating the cervix
  - E) Administration of oxytocin
15. A patient has nephrogenic diabetes insipidus. Which of the following would either be expected or a suggested intervention?
- A) Decreased plasma sodium concentration
  - B) Increased secretion of ADH from the supraoptic nuclei
  - C) High urine osmolality
  - D) Increased AVPR<sub>2</sub> function
  - E) Decrease secretion of ADH from the supraoptic and paraventricular nuclei
16. Which of the following would most likely cause a decrease in the release of thyroid-stimulating hormone?
- A) Decreased iodinase enzyme
  - B) Decreased iodine pump activity in thyroid gland
  - C) Decreased body temperature
  - D) Increased thyrotropin releasing hormone
  - E) Increased plasma thyroxine by venous infusion
17. The increased cardiac output caused by elevated circulating levels of thyroid hormones is most likely caused by
- A) Direct actions of thyroid-stimulating hormone on the heart

- B) Direct actions of thyroid-stimulating hormone on the brain
  - C) An increase in the metabolic demand of the tissues
  - D) An increase in plasma cholesterol and triglycerides
  - E) An increase in total body weight
18. If a radioimmunoassay is properly conducted and the amount of radioactive hormone bound to antibody is low, what would this result indicate?
- A) Plasma levels of endogenous hormone are high
  - B) Plasma levels of endogenous hormone are low
  - C) More antibody is needed
  - D) Less radioactive hormone is needed
19. Which of the following depicts the most likely sequence of events in an individual exposed to cold?
- A) ↑Thyrotropin-releasing hormone, ↑thyroid-stimulating hormone, ↑thyroxine
  - B) ↑Thyrotropin-releasing hormone, ↓thyroid-stimulating hormone, ↑thyroxine
  - C) ↑Thyroid-stimulating hormone, ↑thyrotropin-releasing hormone, ↑thyroxine
  - D) ↑Thyroid-stimulating hormone, ↓thyrotropin-releasing hormone, ↑thyroxine
  - E) ↑Thyroxine, ↑thyrotropin-releasing hormone, ↑thyroid-stimulating hormone
20. Spermatogenesis is regulated by a negative feedback control system in which FSH stimulates the steps in sperm cell formation. Which negative feedback signal associated with sperm cell production inhibits pituitary formation of FSH?
- A) Testosterone
  - B) Inhibin
  - C) Estrogen
  - D) LH
21. In an individual with a thyroid hormone producing adenoma, one might expect which of the following?
- A) ↑ T4, ↓ T3, ↓ TRH, ↓ TSH
  - B) ↑ T4, ↑ T3, ↓ TRH, ↓ TSH
  - C) ↑ T4, ↑ T3, ↑ TRH, ↓ TSH
  - D) ↑ T4, ↑ T3, ↓ TRH, ↑ TSH
  - E) ↓ T4, ↑ T3, ↓ TRH, ↓ TSH
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22. When do progesterone levels rise to their highest point during the female hormonal cycle?
- A) Between ovulation and the beginning of menstruation
  - B) Immediately before ovulation
  - C) When the blood concentration of LH is at its highest point
  - D) When 12 primary follicles are developing to the antral stage
23. You suspect thyroid disease in a female patient. Based on the plasma values below, which of the following would be expected?


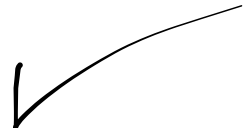
|              | [TSH]        | Total [T4]     | [TBG]         |
|--------------|--------------|----------------|---------------|
| Normal range | 0.4-5.5 mU/l | 5.6-14.7 µg/dl | 1.7-3.6 µg/dl |
| Patient data | 9.3          | 2.3            | 3.0           |

- A) Graves' disease
  - B) Secondary hyperthyroidism
  - C) Hashimoto's disease
  - D) Secondary hypothyroidism
  - E) Euthyroid pregnant
24. Which of the following enzymes catalyzes the conversion of cholesterol to pregnenolone?
- A) Aldosterone synthase
  - B) Lipoprotein lipase
  - C) Hormone sensitive lipase
  - D) 11β-Hydroxylase
  - E) Cholesterol desmolase
25. Which of the following would most likely occur if plasma aldosterone levels were low?
- A) Hyperkalemia
  - B) Hypokalemia
  - C) Hybernatriemia
  - D) Hypertension
26. A professional athlete in her mid-20s has not had a menstrual cycle for 5 years, although a bone density scan revealed normal skeletal mineralization. Which fact may explain these observations?
- A) She consumes a high-carbohydrate diet
  - B) Her grandmother sustained a hip fracture at age 79 years



- C) Her blood pressure is higher than normal
  - D) Her plasma estrogen concentration is very low
  - E) She has been taking anabolic steroid supplements for 5 years
27. During a chronic infusion of aldosterone in an experimental animal model, one would expect which of the following?
- A) ↑Blood pressure, ↔extracellular fluid volume, ↓urinary sodium excretion
  - B) ↑Blood pressure, ↓extracellular fluid volume, ↔urinary sodium excretion
  - C) ↑Blood pressure, ↔extracellular fluid volume, ↑urinary sodium excretion
  - D) ↑Blood pressure, ↑extracellular fluid volume, ↔urinary sodium excretion
  - E) ↑Blood pressure, ↔extracellular fluid volume, ↔urinary sodium excretion
28. In the circulatory system of a fetus, which of the following is greater before birth than after birth?
- A) Arterial Po<sub>2</sub>
  - B) Right atrial pressure
  - C) Aortic pressure
  - D) Left ventricular pressure
29. In response to a physiological stimulus such as the stress of taking an important quiz, which of the following reflects the most likely sequence of events?
- A) ↑Cortisol, ↑corticotropin, ↑corticotropin-releasing hormone
  - B) ↑Corticotropin-releasing hormone, ↑corticotropin, ↑cortisol
  - C) ↑Cortisol, ↓corticotropin, ↑corticotropin-releasing hormone
  - D) ↑Corticotropin-Releasing hormone, ↑corticotropin, ↓cortisol
  - E) ↑Cortisol, ↑corticotropin, ↓corticotropin-releasing hormone
30. Which of the following best characterizes the metabolic actions of cortisol?
- A) ↑Muscle glucose uptake, ↑muscle amino acid uptake, ↑adipose tissue fat uptake
  - B) ↑Muscle glucose uptake, ↓muscle amino acid uptake, ↑adipose tissue fat uptake
  - C) ↓Muscle glucose uptake, ↓muscle amino acid uptake, ↑adipose tissue fat uptake
  - D) ↓Muscle glucose uptake, ↑muscle amino acid uptake, ↓adipose tissue fat uptake

- E) ↓Muscle glucose uptake, ↓muscle amino acid uptake, ↓adipose tissue fat uptake
31. Which of the following is most likely to occur as a result of chronic hyperglycemia associated with untreated type 1 diabetes mellitus?
- A) Increased intracellular fluid volume
  - B) Decreased urinary glucose
  - C) Metabolic alkalosis
  - D) Osmotic diuresis and polyuria
  - E) Improved eyesight
32. Which enzyme in the cytochrome P450 steroid synthesis cascade is directly responsible for estradiol synthesis?
- A) 17-Beta-hydroxysteroid dehydrogenase
  - B) 5-Alpha reductase
  - C) Aromatase
  - D) Side chain cleavage enzyme
33. Which of the following is greater after birth than before birth?
- A) Flow through the foramen ovale
  - B) Pressure in the right atrium
  - C) Flow through the ductus arteriosus
  - D) Aortic pressure
34. Immediately after consuming a meal consisting of a large burger, French fries, onion rings, and a diet cola, one might expect a DECREASE in which of following?
- A) Amino acid transport into cells
  - B) Fatty acid synthesis
  - C) Hormone sensitive lipase
  - D) Liver glycogen
  - E) Cell permeability to glucose
35. In an individual with untreated insulin dependent diabetes mellitus (type 1), one would expect which of the following?
- A) ↑Plasma free fatty acids, ↓liver glycogen, ↑skeletal muscle mass
  - B) ↑Plasma free fatty acids, ↓liver glycogen, ↓skeletal muscle mass
  - C) ↑Plasma free fatty acids, ↑liver glycogen, ↓skeletal muscle mass
  - D) ↓Plasma free fatty acids, ↓liver glycogen, ↑skeletal muscle mass

- E) ↓Plasma free fatty acids, ↑liver glycogen, ↓skeletal muscle mass
36. Which of the following changes would be expected to help maintain plasma glucose in the postabsorptive?
- A) ↓Insulin, ↑glucagon, ↓growth hormone, ↓cortisol
  - B) ↓Insulin, ↑glucagon, ↑growth hormone, ↓cortisol
  - C) ↓Insulin, ↑glucagon, ↑growth hormone, ↑cortisol
  - D) ↑Insulin, ↓glucagon, ↓growth hormone, ↑cortisol
  - E) ↑Insulin, ↓glucagon, ↑growth hormone, ↑cortisol
37. For male differentiation to occur during embryonic development, testosterone must be secreted from the testes. What stimulates the secretion of testosterone during embryonic development?
- A) LH from the maternal pituitary gland
  - B) hCG
  - C) Inhibin from the corpus luteum 
  - D) GnRH from the embryo's hypothalamus
38. Which of the following best describes insulin?
- A) Lipid-soluble hormone tightly bound to plasma proteins
  - B) Peptide hormone that activates an intracellular receptor
  - C) Peptide hormone that activates a G-coupled protein receptor
  - D) Peptide hormone that activates an enzyme-linked receptor
  - E) Steroid hormone that activates an enzyme-linked receptor
39. If one were to experience a sudden decrease in extracellular fluid calcium, which of the following would most likely be the first physiological response to buffer the change in calcium?
- A) Increased calcium absorption in the gut
  - B) Decreased phosphate absorption in the gut
  - C) Increased parathyroid hormone from the anterior pituitary
  - D) Decreased renal excretion of phosphate
  - E) Increased exchange of calcium with the bone fluid
40. As menstruation ends, estrogen levels in the blood rise rapidly. What is the source of the estrogen?
- A) Corpus luteum
  - B) Developing follicles 
  - C) Endometrium
  - D) Stromal cells of the ovaries
  - E) Anterior pituitary gland
41. A 30-year-old woman reports to the clinic for a routine physical examination. The examination reveals she is pregnant. Her plasma

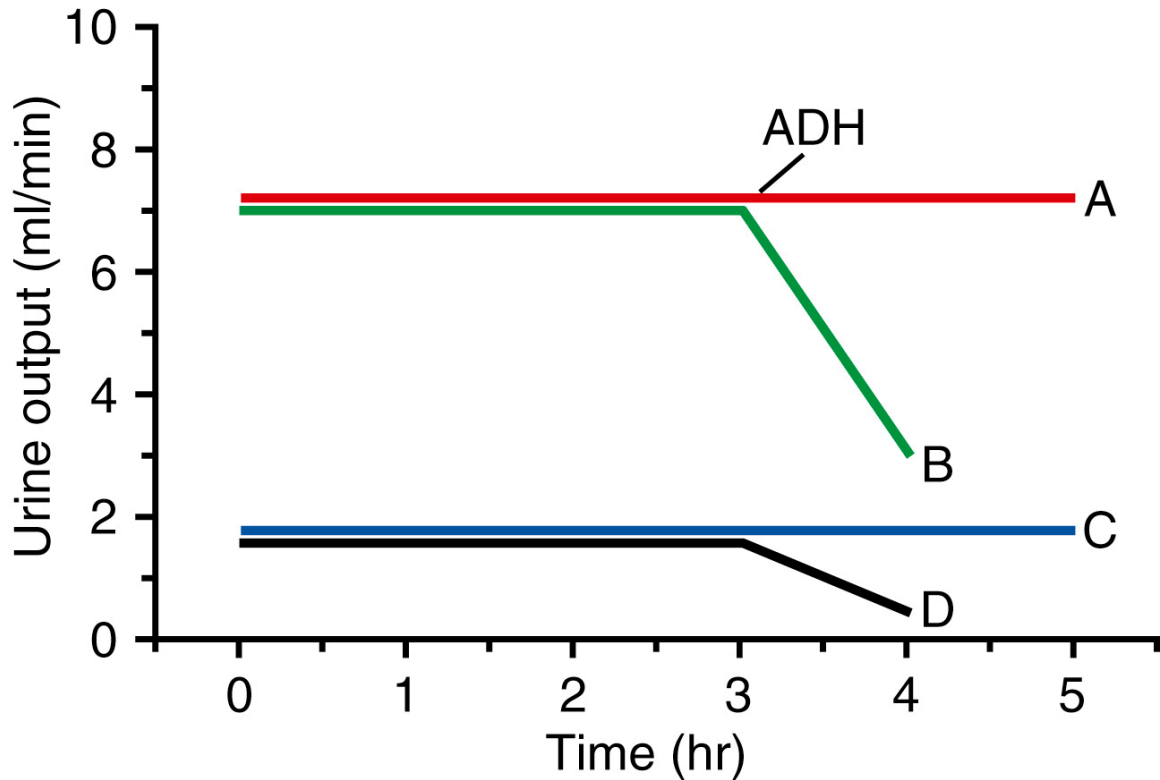
levels of TSH are high, but her total thyroid hormone concentration is normal. Which of the following best reflects the patient's clinical state?

- A) Graves' disease
  - B) Hashimoto's disease
  - C) A pituitary tumor secreting TSH
  - D) A hypothalamic tumor secreting thyrotropin-releasing hormone (TRH)
  - E) The patient is taking thyroid extract
42. Which of the following would be expected in a patient with chronic renal failure?

|    | Plasma [1,25-(OH) <sub>2</sub> D] | Plasma [PTH] | Bone Resorption |
|----|-----------------------------------|--------------|-----------------|
| A) | ↑                                 | ↑            | ↑               |
| B) | ↑                                 | ↑            | ↓               |
| C) | ↑                                 | ↓            | ↓               |
| D) | ↓                                 | ↓            | ↑               |
| E) | ↓                                 | ↑            | ↓               |
| F) | ↓                                 | ↑            | ↑               |

43. A female athlete who took testosterone-like steroids for several months stopped having normal menstrual cycles. What is the best explanation for this observation?

- A) Testosterone stimulates inhibin production from the corpus luteum
- B) Testosterone binds to receptors in the endometrium, resulting in the failure of the endometrium to develop during the normal cycle
- C) Testosterone binds to receptors in the anterior pituitary that stimulate the secretion of FSH and LH
- D) Testosterone inhibits the hypothalamic secretion of GnRH and the pituitary secretion of LH and FSH


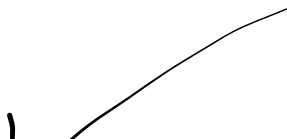


44. An experiment is conducted in which ADH is administered at hour 3 to four subjects (A to D). In the above figure, which lines most likely reflect the response to ADH administration in a normal patient and in a patient with central diabetes insipidus?

|    | Normal | Central Diabetes Insipidus |
|----|--------|----------------------------|
| A) | B      | A                          |
| B) | B      | D                          |
| C) | D      | A                          |
| D) | D      | B                          |

45. Which of the following decreases the resistance in the arteries leading to the sinuses of the penis?

- A) Stimulation of the sympathetic nerves innervating the arteries
- B) NO
- C) Inhibition of activity of the parasympathetic nerves leading to the arteries
- D) All the above

46. Using the three following statements, select the best answer.
1. Hydroxyapatite is the major crystalline salt in calcified bone
  2. An osteon is made up of concentric layers of bone called lamellae
  3. Osteocytes are the major cells responsible for the formation of new bone tissue
- A) Only statement 1 is correct  
B) Statement 1 and 2 are correct  
C) Statements 1 and 3 are correct  
D) All statements are correct  
E) No statements are correct
47. All of the following statements about parathyroid hormone are true EXCEPT one. Which one is the EXCEPTION?
- A) PTH directly activates osteoblasts and osteocytes  
B) PTH inhibits the production of vitamin D hormones  
C) PTH promotes bone resorption in response to decreased plasma calcium  
D) PTH promotes the movement of calcium from bone fluid to the extracellular fluid  
E) PTH promotes calcium reabsorption in the renal distal tubule and collecting duct
48. A 46-year-old man has "puffy" skin and is lethargic. His plasma TSH concentration is low and increases markedly when he is given TRH. What is the most likely diagnosis?
- A) Hyperthyroidism due to a thyroid tumor  
B) Hyperthyroidism due to an abnormality in the hypothalamus  
C) Hypothyroidism due to an abnormality in the thyroid  
D) Hypothyroidism due to an abnormality in the hypothalamus  
E) Hypothyroidism due to an abnormality in the pituitary
49. Negative feedback on FSH release from the anterior pituitary in men that results in a reduction in estradiol production is due to which hormone?
- A) Progesterone  
B) Estradiol  
C) Testosterone  
D) Inhibin
50. During the first few years after menopause, FSH levels are normally extremely high. A 56-year-old woman completed
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menopause 3 years ago. However, she is found to have low levels of FSH in her blood. What is the best explanation for this finding?

- A) She has been receiving hormone replacement therapy with estrogen and progesterone since she completed menopause
- B) Her adrenal glands continue to produce estrogen
- C) Her ovaries continue to secrete estrogen
- D) She took birth control pills for 20 years before menopause

51. Blockade of what receptors will prolong erection in a man?

- A) Estrogen receptors
- B) Cholesterol receptors
- C) Muscarinic receptors
- D) Phosphodiesterase-5 receptors

52. Which of the following pairs of hormones and the corresponding action is incorrect?

- A) Glucagon – increased glycogenolysis in liver
- B) Glucagon – increased glycogenolysis in skeletal muscle
- C) Glucagon – increased gluconeogenesis
- D) Cortisol – increased gluconeogenesis
- E) Cortisol – decreased glucose uptake in muscle

53. A large dose of insulin is administered intravenously to a patient. Which set of hormonal changes is most likely to occur in the plasma in response to the insulin injection?

|    | Growth Hormone | Glucagon | Epinephrine |
|----|----------------|----------|-------------|
| A) | ↑              | ↓        | ↔           |
| B) | ↔              | ↑        | ↑           |
| C) | ↑              | ↑        | ↑           |
| D) | ↓              | ↑        | ↑           |
| E) | ↓              | ↓        | ↔           |

54. What is a frequent cause of delayed breathing at birth?

- A) Fetal hypoxia during the birth process
- B) Maternal hypoxia during the birth process
- C) Fetal hypercapnia
- D) Maternal hypercapnia

55. Which hormone is largely unbound to plasma proteins?

- A) Cortisol

- B) T<sub>4</sub>
- C) ADH
- D) Estradiol
- E) Progesterone

✓ 56. What is the mechanism by which the zona pellucida becomes “hardened” after penetration of a sperm cell to prevent a second sperm from penetrating?

- A) A reduction in estradiol
- B) The proteins released from the acrosome of the sperm
- C) An increase in intracellular calcium in the oocyte
- D) An increase in testosterone that affects the sperm

✓ 57. Why is milk produced by a woman only after delivery, not before?

- A) Levels of LH and FSH are too low during pregnancy to support milk production
- B) High levels of progesterone and estrogen during pregnancy suppress milk production
- C) The alveolar cells of the breast do not reach maturity until after delivery
- D) High levels of oxytocin are required for milk production to begin, and oxytocin is not secreted until the baby stimulates the nipple

58. Which of the following increases the rate of excretion of calcium ions by the kidney?

- A) A decrease in calcitonin concentration in the plasma
- B) An increase in phosphate ion concentration in the plasma
- C) A decrease in the plasma level of PTH
- D) Metabolic alkalosis

59. A patient has hyperthyroidism due to a pituitary tumor. Which set of physiological changes would be expected?

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|    | Thyroglobulin Synthesis | Heart Rate | Exophthalmos |
|----|-------------------------|------------|--------------|
| A) | ↑                       | ↑          | +            |
| B) | ↑                       | ↑          | -            |
| C) | ↑                       | ↓          | +            |
| D) | ↓                       | ↓          | +            |
| E) | ↓                       | ↓          | -            |
| F) | ↓                       | ↑          | -            |



60. A 25-year-old man is severely injured when hit by a speeding vehicle and loses 20% of his blood volume. Which set of physiological changes would be expected to occur in response to the hemorrhage?

|    | Atrial Stretch Receptor Activity | Arterial Baroreceptor Activity | ADH Secretion |
|----|----------------------------------|--------------------------------|---------------|
| A) | ↓                                | ↓                              | ↑             |
| B) | ↓                                | ↓                              | ↓             |
| C) | ↔                                | ↑                              | ↑             |
| D) | ↑                                | ↑                              | ↑             |
| E) | ↑                                | ↑                              | ↓             |

61. If a woman has a tumor that is secreting large amounts of estrogen from the adrenal gland, which of the following will occur?

- A) Progesterone levels in the blood will be very low
- B) Her LH secretion rate will be totally suppressed
- C) She will not have normal menstrual cycles
- D) Her bones will be normally calcified
- E) All the above

62. When compared with the postabsorptive state, which set of metabolic changes would most likely occur during the postprandial state?

|    | Hepatic Glucose Uptake | Muscle Glucose Uptake | Hormone-Sensitive Lipase Activity |
|----|------------------------|-----------------------|-----------------------------------|
| A) | ↑                      | ↑                     | ↑                                 |
| B) | ↑                      | ↓                     | ↑                                 |
| C) | ↓                      | ↑                     | ↓                                 |
| D) | ↑                      | ↑                     | ↓                                 |
| E) | ↓                      | ↑                     | ↑                                 |

63. Very early in embryonic development, testosterone is formed within male embryos. What is the function of this hormone at this stage of development?

- A) Stimulation of bone growth
- B) Stimulation of development of male sex organs
- C) Stimulation of development of skeletal muscle

- D) Inhibition of LH secretion
64. During spermatogenesis, estrogen is produced by
- A) Leydig cells in response to FSH
  - B) Sertoli cells in response to FSH
  - C) Leydig cells in response to LH
  - D) Sertoli cells in response to LH

65. A patient arrives in the emergency department apparently in cardiogenic shock due to a massive heart attack. His initial arterial blood sample reveals the following concentrations of ions and pH level:

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|                     |            |
|---------------------|------------|
| <b>Sodium</b>       | 137 mmol/l |
| <b>Bicarbonate</b>  | 14 mmol/l  |
| <b>Free calcium</b> | 2.8 mmol/l |
| <b>Potassium</b>    | 4.8 mmol/l |
| <b>pH</b>           | 7.16       |

To correct the acidosis, the attending physician begins an infusion of sodium bicarbonate and after 1 hour obtains another blood sample, which reveals the following values:

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|                     |            |
|---------------------|------------|
| <b>Sodium</b>       | 138 mmol/l |
| <b>Bicarbonate</b>  | 22 mmol/l  |
| <b>Free calcium</b> | 2.3 mmol/l |
| <b>Potassium</b>    | 4.5 mmol/l |
| <b>pH</b>           | 7.34       |

What is the cause of the decrease in calcium ion concentration?

- A) The increase in arterial pH resulting from the sodium bicarbonate infusion inhibited PTH secretion
- B) The increase in pH resulted in the stimulation of osteoblasts, which removed calcium from the circulation
- C) The increase in pH resulted in an elevation in the concentration of  $\text{HPO}_4^-$ , which shifted the equilibrium between  $\text{HPO}_4^-$  and  $\text{Ca}^{2+}$  toward  $\text{CaHPO}_4$
- D) The increase in arterial pH stimulated the formation of 1,25-dihydroxycholecalciferol, which resulted in an increased rate of

absorption of calcium from the gastrointestinal tract

66. The prostate fluid contributes the bulk of the volume of semen, which includes

- A) Calcium, citrate, phosphate, and profibrinolysin
- B) Fructose, citric acid, prostaglandins, and fibrinogen
- C) Sex hormones
- D) Mucus

67. A 30-year-old woman is breastfeeding her infant. During suckling, which hormonal response is expected in the woman?

- A) Increased secretion of ADH from the supraoptic nuclei
- B) Increased secretion of ADH from the paraventricular nuclei
- C) Increased secretion of oxytocin from the paraventricular nuclei
- D) Decreased secretion of neurophysin
- E) Increased plasma levels of both oxytocin and ADH

68. A 30-year-old man has Conn's syndrome. Which set of physiological changes is most likely to occur in this patient compared with a healthy person?

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|    | Arterial Pressure | Extracellular Fluid Volume | Sodium Excretion |
|----|-------------------|----------------------------|------------------|
| A) | ↔                 | ↔                          | ↔                |
| B) | ↑                 | ↔                          | ↔                |
| C) | ↑                 | ↑                          | ↔                |
| D) | ↔                 | ↑                          | ↓                |
| E) | ↑                 | ↑                          | ↓                |

69. Which of the following is important in the process of capacitation of sperm after ejaculation?

- A) Microtubule reorganization
- B) Increased testosterone secretion by spermatozoa
- C) Washout of inhibitory factors
- D) Influx of glucose

70. Dehydroepiandrosterone sulfate (DHEAS), the precursor for the high levels of estradiol that occur in pregnancy, is made in what tissue?

- A) Fetal adrenal gland
- B) Ovary of the mother

- C) Placenta
  - D) Adrenal gland of the mother
71. What is the consequence of sporadic nursing of the neonate by the mother?
- A) An increase in prolactin-releasing hormone
  - B) An increase in oxytocin
  - C) Lack of birth control
  - D) Lack of prolactin surge
72. Which of the following would be associated with parallel changes in aldosterone and cortisol secretion?
- A) Addison's disease
  - B) Cushing's disease
  - C) Cushing's syndrome (adrenal tumor)
  - D) A low-sodium diet
  - E) Administration of a converting enzyme inhibitor
73. The process of spermatogenesis begins with spermatogonia and results in which of the following?
- A) 1 diploid spermatid
  - B) 4 diploid spermatids
  - C) 1 haploid spermatid
  - D) 2 haploid spermatids
  - E) 4 haploid spermatids
74. RU486 causes abortion if it is administered before or soon after implantation. What is the specific effect of RU486?
- A) It binds to LH receptors, stimulating the secretion of progesterone from the corpus luteum
  - B) It blocks progesterone receptors so that progesterone has no effect within the body
  - C) It blocks the secretion of FSH by the pituitary
  - D) It blocks the effects of oxytocin receptors in the uterine muscle
75. A 55-year-old man has developed the syndrome of inappropriate antidiuretic hormone secretion due to carcinoma of the lung. Which physiological response would be expected?
- A) Increased plasma osmolality
  - B) Inappropriately low urine osmolality (relative to plasma osmolality)
  - C) Increased thirst
  - D) Decreased secretion of ADH from the pituitary gland

✓ 76. During pregnancy, the uterine smooth muscle is quiescent. During the ninth month of gestation, the uterine muscle becomes progressively more excitable. What factor contributes to the increase in excitability?

- A) Placental estrogen synthesis rises to high rates
- B) Progesterone synthesis by the placenta decreases
- C) Uterine blood flow reaches its highest rate
- D) PGE<sub>2</sub> synthesis by the placenta decreases
- E) Activity of the fetus falls to low levels

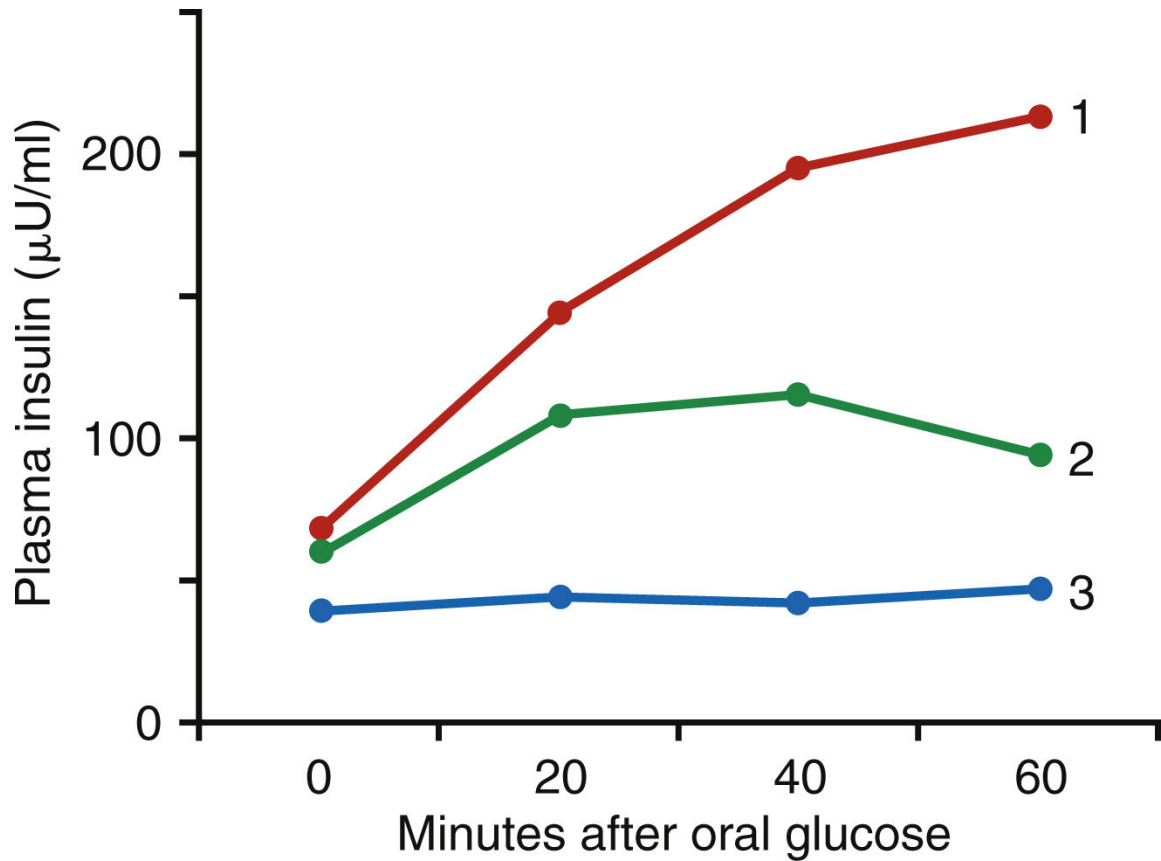
✓ 77. A 20-year-old woman is not having menstrual cycles. Her plasma progesterone concentration is found to be minimal. What is the explanation for the low level of progesterone?

- A) LH secretion rate is elevated
- B) LH secretion rate is suppressed
- C) FSH secretion rate is suppressed
- D) No corpus luteum is present
- E) High inhibin concentration in the plasma has suppressed progesterone synthesis

✓ 78. Before the preovulatory surge in LH, granulosa cells of the follicle secrete which hormone?

- A) Testosterone
- B) Progesterone
- C) Estrogen
- D) Inhibin

**Questions 79 and 80**



79. Based on the above figure, which set of curves most likely reflects the responses in a healthy individual and in patients with type 1 or type 2 diabetes mellitus (Diabetes mellitus)?

|    | Healthy | Type 1 Diabetes mellitus | Type 2 Diabetes mellitus |
|----|---------|--------------------------|--------------------------|
| A) | 3       | 2                        | 1                        |
| B) | 1       | 2                        | 3                        |
| C) | 1       | 3                        | 2                        |
| D) | 2       | 1                        | 3                        |
| E) | 2       | 3                        | 1                        |

80. Based on the above figure, which set of curves most likely reflects the responses in a healthy person and in a patient in the early stages of Cushing's syndrome?

---

|    | Healthy | Cushing's Syndrome |
|----|---------|--------------------|
| A) | 3       | 2                  |
| B) | 1       | 2                  |
| C) | 1       | 3                  |
| D) | 2       | 1                  |
| E) | 2       | 3                  |

81. Which hormone activates enzyme-linked receptors?

- A) ADH
- B) Insulin
- C) ACTH
- D) PTH
- E) Aldosterone

82. Which of the following is produced by the trophoblast cells during the first 3 weeks of pregnancy?

- A) Estrogen
- B) LH
- C) Oxytocin
- D) hCG
- E) None of the above

83. Which of the following is higher in a neonate than in a fetus?

- A) Flow through the foramen ovale
- B) Right atrial pressure
- C) Flow through the ductus arteriosus
- D) Aortic pressure

84. Which finding is most likely in a patient who has myxedema?

- A) Somnolence
- B) Palpitations
- C) Increased respiratory rate
- D) Increased cardiac output
- E) Weight loss

85. At birth, a large, well-nourished baby is found to have a plasma glucose concentration of 17 mg/dl (normal is 80 to 100 mg/dl) and a plasma insulin concentration twice the normal value. What is the explanation for these findings?

- A) The neonate experienced in utero malnutrition
- B) The mother was malnourished during pregnancy

- C) The mother has diabetes, with poorly controlled hyperglycemia  
D) The mother is obese
86. Degradation of the corpus luteum is prevented by which of the following?  
A) Increased estrogen secretion by the developing placenta  
B) Release of hCG from the trophoblasts  
C) Forward positive regulation by LH  
D) Placental derived prolactin
87. Which of the following stimulates the secretion of PTH?  
A) An increase in extracellular calcium ion activity above the normal value  
B) An increase in calcitonin concentration  
C) Respiratory acidosis  
D) Increased secretion of PTH-releasing hormone from the hypothalamus  
E) None of the above
88. A 40-year-old woman consumes a high-potassium diet for several weeks. Which hormonal change is most likely to occur?  
A) Increased secretion of DHEA  
B) Increased secretion of cortisol  
C) Increased secretion of aldosterone  
D) Increased secretion of ACTH  
E) Decreased secretion of CRH
89. After implantation into the uterus, nutrition of the blastocyst comes from which structure?  
A) Placenta  
B) Decidua  
C) Glomerulosa cells  
D) Corpus luteum
90. Which hormone is not stored in its endocrine-producing gland?  
A)  $T_4$   
B) PTH  
C) Aldosterone  
D) ACTH  
E) Insulin
91. A young woman comes to the emergency department with a vertebral compression fracture. Radiographs of the spine indicate



generalized demineralization. She is vegetarian, does not smoke or drink alcohol, and has a normal plasma potassium concentration of 5.4 mEq/l, a sodium concentration of 136 mEq/l, and a plasma calcium concentration of 7.0 mg/dl. Her vitamin D<sub>3</sub> value is several times greater than normal, although her 1,25-dihydroxycholecalciferol concentration is at the lower limit of detectability. She has been in renal failure for the past 5 years and undergoes hemodialysis three times each week. What is the cause of her low 1,25-dihydroxycholecalciferol level?

- A) Metabolic acidosis
- B) Metabolic alkalosis
- C) She is unable to form 1,25-dihydroxycholecalciferol because of her extensive kidney disease
- D) She is undergoing dialysis with a dialysis fluid that does not contain calcium
- E) She is taking receiving calcium supplements

92. A placenta is incapable of synthesizing which hormones?

- A) Estrogen
- B) Progesterone
- C) Androgens
- D) Estriol

93. Which of the following hormones is most closely associated with the secretory phase of the endometrial cycle?

- A) Progesterone
- B) Estrogen
- C) FSH
- D) LH
- E) Inhibin

94. Which finding would likely be reported in a patient with a deficiency in iodine intake?

- A) Weight loss
- B) Nervousness
- C) Increased sweating
- D) Increased synthesis of thyroglobulin
- E) Tachycardia

95. A 37-year-old woman presents to her physician with an enlarged thyroid gland and high plasma levels of T<sub>4</sub> and T<sub>3</sub>. Which of the following is likely to be decreased?

- A) Heart rate
- B) Cardiac output
- C) Peripheral vascular resistance
- D) Ventilation rate
- E) Metabolic rate

96. Before intercourse, a woman irrigates her vagina with a solution that lowers the pH of the vaginal fluid to 4.5. What will be the effect on sperm cells in the vagina?

- A) The metabolic rate will increase
- B) The rate of movement will decrease
- C) The formation of PGE2 will increase
- D) The rate of oxygen consumption will increase

97. Which hormonal responses would be expected after a meal high in protein?

|    | Insulin | Glucagon | Growth Hormone |
|----|---------|----------|----------------|
| A) | ↑       | ↑        | ↓              |
| B) | ↑       | ↑        | ↑              |
| C) | ↑       | ↓        | ↓              |
| D) | ↓       | ↓        | ↑              |
| E) | ↓       | ↑        | ↑              |

98. Men who take large doses of testosterone-like androgenic steroids for long periods are sterile in the reproductive sense of the word. What is the explanation for this finding?

- A) High levels of androgens bind to testosterone receptors in the Sertoli cells, resulting in overstimulation of inhibin formation
- B) Overstimulation of sperm cell production results in the formation of defective sperm cells
- C) High levels of androgen compounds inhibit the secretion of GnRH by the hypothalamus, resulting in the inhibition of LH and FSH release by the anterior pituitary
- D) High levels of androgen compounds produce hypertrophic dysfunction of the prostate gland

99. Cortisone is administered to a 30-year-old woman for the treatment of an autoimmune disease. Which of the following is most likely to occur?


- A) Increased ACTH secretion
  - B) Increased cortisol secretion
  - C) Increased insulin secretion
  - D) Increased muscle mass
  - E) Hypoglycemia between meals
100. In the hypothalamic-pituitary-gonadal axis of the female, what is the follicular cell type that produces inhibin?
- A) Cytotrophoblasts
  - B) Synthiotrophoblasts
  - C) Granulosa
  - D) Thecal
101. The function of which of the following is increased by an elevated parathyroid hormone concentration?
- A) Osteoclasts
  - B) Hepatic formation of 25-hydroxycholecalciferol
  - C) Phosphate reabsorptive pathways in the renal tubules
  - D) All the above
102. Which statement about peptide or protein hormones is usually true?
- A) They have longer half-lives than steroid hormones
  - B) They have receptors on the cell membrane
  - C) They have a slower onset of action than both steroid and thyroid hormones
  - D) They are not stored in endocrine-producing glands
103. Which set of physiological changes would be most likely to occur in a patient with acromegaly?

---

|    | Pituitary Mass | Kidney Mass | Femur Length |
|----|----------------|-------------|--------------|
| A) | ↓              | ↓           | ↑            |
| B) | ↓              | ↑           | ↑            |
| C) | ↑              | ↔           | ↔            |
| D) | ↑              | ↑           | ↔            |
| E) | ↑              | ↑           | ↑            |

104. Cortisol and GH are most dissimilar in their metabolic effects on which of the following?
- A) Protein synthesis in muscle

- B) Glucose uptake in peripheral tissues
  - C) Plasma glucose concentration
  - D) Mobilization of triglycerides
105. Why do infants of mothers who had adequate nutrition during pregnancy not require iron supplements or a diet rich in iron until about 3 months of age?
- A) Growth of the infant does not require iron until after the third month
  - B) The fetal liver stores enough iron to meet the infant's needs until the third month
  - C) Synthesis of new red blood cells begins after 3 months
  - D) Muscle cells that develop before the third month do not contain myoglobin
106. Cortisone is administered to a patient for the treatment of an autoimmune disease. Which of the following would least likely occur in response to the cortisone treatment?
- A) Hypertrophy of the adrenal glands
  - B) Increased plasma levels of C-peptide
  - C) Decreased CRH secretion
  - D) Increased blood pressure
  - E) Hyperglycemia
107. All of the following accurately describe the regulation of the female sexual cycle EXCEPT one. Which one is the EXCEPTION?
- A) Estradiol inhibits GnRH release during the post ovulatory phase
  - B) Progesterone increases GnRH release during the post ovulatory phase
  - C) Estradiol increases LH in the days immediately preceding ovulation
  - D) Falling progesterone and estrogen late in the luteal phase allows LH and FSH to rise
  - E) LH and FSH increase estradiol release during the follicular phase
108. If a male is born without a penis and testes, a defect is likely in which gene on the Y chromosome?
- A) ERE—estrogen response element
  - B) ARE—androgen response element
  - C) SRY—affecting Sertoli cells
  - D) ERG—early response genes

109. Where does fertilization normally take place?
- A) Uterus
  - B) Cervix
  - C) Ovary
  - D) Ampulla of the fallopian tubes
110. Which finding is most likely to occur in a patient who has uncontrolled type 1 diabetes mellitus?
- A) Decreased plasma osmolality
  - B) Increased plasma volume
  - C) Increased plasma pH
  - D) Increased release of glucose from the liver
  - E) Decreased rate of lipolysis
111. GH secretion would most likely be suppressed under which condition?
- A) Acromegaly
  - B) Gigantism
  - C) Deep sleep
  - D) Exercise
  - E) Acute hyperglycemia
112. Pregnenolone is not in the biosynthetic pathway of which substance?
- A) Cortisol
  - B) Estrogen
  - C) Aldosterone
  - D) 1,25(OH)<sub>2</sub>D
  - E) DHEA
113. Two days before the onset of menstruation, secretions of FSH and LH reach their lowest levels. What is the cause of this low level of secretion?
- A) The anterior pituitary gland becomes unresponsive to the stimulatory effect of GnRH
  - B) Estrogen from the developing follicles exerts a feedback inhibition on the hypothalamus
  - C) The rise in body temperature inhibits hypothalamic release of GnRH
  - D) Secretion of estrogen, progesterone, and inhibin by the corpus luteum suppresses hypothalamic secretion of GnRH and pituitary secretion of FSH
- 

114. Which condition contributes to “sodium escape” in persons with Conn’s syndrome?
- A) Decreased plasma levels of atrial natriuretic peptide
  - B) Increased plasma levels of angiotensin II
  - C) Decreased sodium reabsorption in the collecting tubules
  - D) Increased arterial pressure
115. Which of the following most accurately describes events in the female sexual cycle?
- A) FSH causes the development of the corpus luteum
  - B) Estrogen and LH have a positive feedback relationship during the late follicular phase
  - C) Estrogens are primarily produced by theca cells in the developing ovary
  - D) During the luteal phase, estrogen increases to a greater degree than progesterone
  - E) LH is most responsible for the development of primary follicles
116. A 30-year-old woman reports to the clinic for a routine physical examination, which reveals she is pregnant. Her plasma levels of TSH are high, but her total T<sub>4</sub> concentration (protein bound and free) is normal. Which of the following best reflects this patient’s clinical state?
- A) Graves’ disease
  - B) Hashimoto’s disease
  - C) A pituitary tumor that is secreting TSH
  - D) A hypothalamic tumor that is secreting TRH
  - E) The patient is taking thyroid extract
117. A man has a disease that destroyed only the motor neurons of the spinal cord below the thoracic region. Which aspect of sexual function would not be possible?
- A) Arousal
  - B) Erection
  - C) Lubrication
  - D) Ejaculation
118. Which of the following is responsible for invasion of the uterus and formation of the placenta?
- A) Trophoblasts
  - B) Oocyte

- C) Decidua
  - D) Endometrium
119. A sustained program of lifting heavy weights will increase bone mass. What is the mechanism of this effect of weightlifting?
- A) Elevated metabolic activity stimulates parathyroid hormone secretion
  - B) Mechanical stress on the bones increases the activity of osteoblasts
  - C) Elevated metabolic activity results in an increase in dietary calcium intake
  - D) Elevated metabolic activity results in stimulation of calcitonin secretion
120. The hormone most responsible for maintaining milk production after parturition is
- A) Estrogen
  - B) Progesterone
  - C) Oxytocin
  - D) Prolactin
  - E) Inhibin
121. Which of the following would be expected in a patient with a genetic deficiency of 11- $\beta$ -hydroxysteroid dehydrogenase type II?
- A) Hyperkalemia
  - B) Hypertension
  - C) Increased plasma renin activity
  - D) Increased plasma [aldosterone]
  - E) Hyperglycemia
122. Which physiological response is greater for T<sub>3</sub> than for T<sub>4</sub>?
- A) Secretion rate from the thyroid
  - B) Plasma concentration
  - C) Plasma half-life
  - D) Affinity for nuclear receptors in target tissues
  - E) Latent period for the onset of action in target tissues
123. A "birth control" compound for men has been sought for several decades. Which substance would provide effective sterility?
- A) A substance that mimics the actions of LH
  - B) A substance that blocks the actions of inhibin
  - C) A substance that blocks the actions of FSH
  - D) A substance that mimics the actions of GnRH

124. For milk to flow from the nipple of the mother into the mouth of the nursing infant, what must occur?
- A) Myoepithelial cells must relax
  - B) Prolactin levels must fall
  - C) Oxytocin secretion from the posterior pituitary must take place
  - D) The baby's mouth must develop a strong negative pressure over the nipple
  - E) All the above
125. A number of normal physiological changes occur during pregnancy. Which of the following best describes one of these changes in the mother?
- A) Increase total peripheral resistance
  - B) Increased cardiac output
  - C) Decreased metabolic rate
  - D) Decreased body weight
  - E) Decreased uterine size
126. Which set of physiological changes would be expected in a nondiabetic patient with Cushing's disease?

---

|    | Plasma Aldosterone | Plasma Cortisol | Plasma Insulin |
|----|--------------------|-----------------|----------------|
| A) | ↑                  | ↑               | ↑              |
| B) | ↑                  | ↑               | ↔              |
| C) | ↑                  | ↔               | ↔              |
| D) | ↔                  | ↔               | ↑              |
| E) | ↔                  | ↑               | ↔              |
| F) | ↔                  | ↑               | ↑              |

127. When compared with the late-evening values typically observed in normal subjects, plasma levels of both ACTH and cortisol would be expected to be higher in which persons?
- A) Normal subjects after waking in the morning
  - B) Normal subjects who have taken dexamethasone
  - C) Patients with Cushing's syndrome (adrenal adenoma)
  - D) Patients with Addison's disease
  - E) Patients with Conn's syndrome



128. Which of the following conditions or hormones would most likely increase GH secretion?
- A) Hyperglycemia
  - B) Exercise
  - C) Somatomedin
  - D) Somatostatin
  - E) Aging
129. Which set of findings would be expected in a person maintained on a long-term low-sodium diet?

|    | Plasma [Aldosterone] | Plasma [Atrial Natriuretic Peptide] | Plasma [Cortisol] |
|----|----------------------|-------------------------------------|-------------------|
| A) | ↑                    | ↑                                   | ↔                 |
| B) | ↑                    | ↓                                   | ↓                 |
| C) | ↑                    | ↓                                   | ↔                 |
| D) | ↔                    | ↔                                   | ↔                 |
| E) | ↓                    | ↓                                   | ↓                 |
| F) | ↓                    | ↑                                   | ↓                 |

130. What would be associated with parallel changes in aldosterone and cortisol secretion?
- A) Addison's disease
  - B) Cushing's disease
  - C) Cushing's syndrome (ectopic ACTH-producing tumor)
  - D) A high-sodium diet
  - E) Administration of a converting enzyme inhibitor
131. Which blood vessel in the fetus has the highest  $PO_2$ ?
- A) Ductus arteriosus
  - B) Ductus venosus
  - C) Ascending aorta
  - D) Left atrium
132. A 59-year-old woman has osteoporosis, hypertension, hirsutism, and hyperpigmentation. Magnetic resonance imaging indicates that the pituitary gland is not enlarged. Which condition is most consistent with these findings?
- A) Pituitary ACTH-secreting tumor
  - B) Ectopic ACTH-secreting tumor
  - C) Inappropriately high secretion rate of CRH

- D) Adrenal adenoma
- E) Addison's disease

133. Which set of findings is an inappropriate hypophysial hormone response to the hypothalamic hormone listed?

|    | Hypothalamic Hormone Secretion | Hypophysial Hormone |
|----|--------------------------------|---------------------|
| A) | Somatostatin                   | ↓ GH                |
| B) | Dopamine                       | ↑ Prolactin         |
| C) | GnRH                           | ↑ LH                |
| D) | TRH                            | ↑ TSH               |
| E) | CRH                            | ↑ ACTH              |

134. A patient is administered sufficient  $T_4$  to increase plasma levels of the hormone several fold. Which set of changes is most likely in this patient after several weeks of  $T_4$  administration?

|    | Respiratory Rate | Heart Rate | Plasma Cholesterol Concentration |
|----|------------------|------------|----------------------------------|
| A) | ↑                | ↑          | ↑                                |
| B) | ↑                | ↑          | ↓                                |
| C) | ↑                | ↓          | ↑                                |
| D) | ↓                | ↓          | ↑                                |
| E) | ↓                | ↑          | ↓                                |

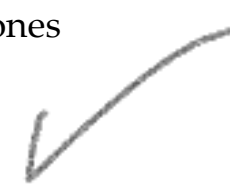
135. Which of the following hormones is most critical for sustaining a successful pregnancy, even up through week 12 of gestation?

- A) Estrogen
- B) Progesterone
- C) hCG
- D) GnRH
- E) Inhibin

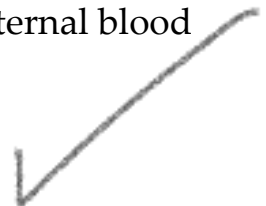


136. What causes menopause?

- A) Reduced levels of gonadotropic hormones secreted from the anterior pituitary gland
- B) Reduced responsiveness of the follicles to the stimulatory effects of gonadotropic hormones



- C) Reduced rate of secretion of progesterone from the corpus luteum
  - D) Reduced numbers of follicles available in the ovary for stimulation by gonadotropic hormones
137. What does not increase when insulin binds to its receptor?
- A) Fat synthesis in adipose tissue
  - B) Protein synthesis in muscle
  - C) Glycogen synthesis
  - D) Gluconeogenesis in the liver
  - E) Intracellular tyrosine kinase activity
138. Release of which hormone is an example of neuroendocrine secretion?
- F) GH
  - G) Cortisol
  - H) Oxytocin
  - I) Prolactin
  - J) ACTH
139. The ability of a fetus to effectively use the relatively low maternal  $P_{O_2}$  is facilitated by which of the following?
- A) Decreased glucose transport in the placental villi
  - B) Increased production of amniotic fluid
  - C) Increased total fetal hemoglobin concentration
  - D) Decreased placental membrane permeability
  - E) Decreased fetal hemoglobin binding capacity
140. Inhibition of the iodide pump would be expected to cause which change?
- A) Increased synthesis of T<sub>4</sub>
  - B) Increased synthesis of thyroglobulin
  - C) Increased metabolic rate
  - D) Decreased TSH secretion
  - E) Extreme nervousness
141. Before implantation, the blastocyst obtains its nutrition from uterine endometrial secretions. How does the blastocyst obtain nutrition during the first week after implantation?
- A) It continues to derive nutrition from endometrial secretions
  - B) The cells of the blastocyst contain stored nutrients that are metabolized for nutritional support
  - C) The placenta provides nutrition derived from maternal blood



- D) The trophoblast cells digest the nutrient-rich endometrial cells and then absorb their contents for use by the blastocyst
142. Which pituitary hormone has a chemical structure most similar to that of ADH?
- A) Oxytocin
  - B) ACTH
  - C) TSH
  - D) FSH
  - E) Prolactin
143. Which option would not be efficacious in the treatment of patients with type 2 diabetes?
- A) Glucocorticoids
  - B) Insulin injections
  - C) Thiazolidinediones
  - D) Sulfonylureas
  - E) Weight loss
144. Which of the following is most likely to occur in the early stages of type 2 diabetes?
- A) Increased insulin sensitivity
  - B) Decreased hepatic glucose output
  - C) Increased plasma levels of C-peptide
  - D) Increased plasma [ $\beta$ -hydroxybutyric acid]
  - E) Hypovolemia
145. What is the most common cause of respiratory distress syndrome in neonates born at 7 months' gestation?
- A) Pulmonary edema due to pulmonary arterial hypertension
  - B) Formation of a hyaline membrane over the alveolar surface
  - C) Failure of the alveolar lining to form adequate amounts of surfactant
  - D) Excessive permeability of the alveolar membrane to water
146. Which of the following is an expected circulatory change that occurs after birth?
- A) Opening of the ductus venosus
  - B) Opening of the foramen ovale
  - C) Opening of the ductus arteriosus
  - D) Closing of the ductus arteriosus
  - E) Closing of the inferior vena cava
147. A 45-year-old woman has a mass in the sella turcica that compresses the portal vessels, disrupting pituitary access to

hypothalamic secretions. The secretion rate of which hormone would most likely increase in this patient?

- A) ACTH
- B) GH
- C) Prolactin
- D) LH
- E) TSH

148. Which of the following is not produced by osteoblasts?

- A) Alkaline phosphatase
- B) RANK ligand
- C) Collagen
- D) Pyrophosphate
- E) Osteoprotegerin

149. Which set of findings would be expected in a patient with primary hyperparathyroidism?

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|    | Plasma [1,25-(OH)2D3] | Plasma [Phosphate] | Urinary Ca <sup>2+</sup> Excretion |
|----|-----------------------|--------------------|------------------------------------|
| A) | ↑                     | ↑                  | ↑                                  |
| B) | ↑                     | ↓                  | ↑                                  |
| C) | ↑                     | ↓                  | ↓                                  |
| D) | ↓                     | ↓                  | ↑                                  |
| E) | ↓                     | ↑                  | ↓                                  |
| F) | ↓                     | ↑                  | ↑                                  |

150. A man who has been exposed to high levels of gamma radiation is sterile due to destruction of the germinal epithelium of the seminiferous tubules, although he has normal levels of testosterone. Which of the following would be found in this patient?

- A) A normal secretory pattern of GnRH
- B) Normal levels of inhibin
- C) Suppressed levels of FSH
- D) Absence of Leydig cells

Questions 151 and 152

An experiment was conducted in which rats were injected with one of two hormones or saline solution (control) for 2 weeks. Autopsies were then

performed, and organ weights were measured (in milligrams). Use this information to answer Questions 151 and 152.

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|                | Control | Hormone 1 | Hormone 2 |
|----------------|---------|-----------|-----------|
| Pituitary      | 12.9    | 8.0       | 14.5      |
| Thyroid        | 250     | 500       | 245       |
| Adrenal glands | 40      | 37        | 85        |
| Body weight    | 300     | 152       | 175       |

151. What is hormone 1?

- A) TRH
- B) TSH
- C) T<sub>4</sub>
- D) ACTH
- E) Cortisol

152. What is hormone 2?

- A) TSH
- B) T<sub>4</sub>
- C) CRH
- D) ACTH
- E) Cortisol

153. An infant is born with yellow pigmentation in the skin and eyes.

What is the most likely cause of this?

- A) Elevated circulating ACTH
- B) Poor renal clearance of bilirubin
- C) The lack of a fully functional liver at birth
- D) Failure of the foramen ovale to close
- E) Delayed onset of breathing

## Answers

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1. **A)** The freely circulating (unbound) hormone is the biologically active hormone. Cholecalciferol is a prohormone and thus is not the biologically active vitamin D hormone. In this question, cortisol, T<sub>4</sub>, and aldosterone are all bound to carrier proteins.

**TMP14 p. 929**

2. **D)** Parasympathetic postganglionic fibers release acetylcholine that activates muscarinic receptors on endothelium to produce NO and increases cyclic guanosine monophosphate, which activates protein kinase G, causing a reduction in intracellular calcium (also increasing NO by positive feedback) and causing vasodilation.

**TMP14 p. 1027**

3. **A)** Estrogen compounds are believed to have an osteoblast-stimulating effect. When the amount of estrogen in the blood falls to very low levels after menopause, the balance between the bone-building activity of the osteoblasts and the bone-degrading activity of the osteoclasts is tipped toward bone degradation. When estrogen compounds are added as part of hormone replacement therapy, the bone-building activity of the osteoblasts is increased to balance the osteoclastic activity.

**TMP14 pp. 949, 1045**

4. **A)** ADH is made in the supraoptic nuclei of the hypothalamus. It is transported in nerve fibers along with neurophysin carrier proteins that pass through the pituitary stalk and terminate in the posterior pituitary.

**TMP14 pp. 948–949**

5. **C)** GH promotes several metabolic changes. These include a net increase in amino acid uptake in the muscle and liver, a decrease in glucose utilization and storage, and an increase in lipolysis. The net effect of GH is to decrease glucose and lipid storage in adipose cells.

**TMP14 pp. 943–944**

6. **A)** Norepinephrine is released from the nerve terminals, and endothelin is released from endothelial cells in the vasculature, causing vasoconstriction of the vasculature.

**TMP14 p. 1027**

7. **C)** Type 2 diabetes mellitus is characterized by diminished sensitivity of target tissues to the metabolic effects of insulin—that is, there is insulin resistance. As a result, hepatic uptake of glucose is impaired, and glucose release is enhanced. In muscle, the uptake of glucose is impaired.

**TMP14 pp. 985–986, 995**

8. **C)** In acromegaly, high plasma levels of GH cause insulin resistance. Consequently, glucose production by the liver is increased, and glucose uptake by peripheral tissues is impaired.

**TMP14 pp. 943–944, 996–997**

9. **A)** During exercise, glucose utilization by muscle is increased, which is largely independent of insulin.

**TMP14 p. 985**

10. **A) Thecal** cells do not have the capacity to produce estradiol because they lack aromatase.

**TMP14 pp. 1040, 1043, 1044**

11. **B)** A very high concentration of testosterone in a female embryo will induce formation of male genitalia. An adrenal tumor in the mother that synthesizes testosterone at a high, uncontrolled rate could produce the masculinizing effect.

**TMP14 pp. 1043, 1044**

12. **A)** Osmoreceptors in, or near, the hypothalamus are important regulators of ADH. Hyperosmotic extracellular fluid causes the cells of the hypothalamus to shrink and stimulates the release of ADH, which promotes renal H<sub>2</sub>O reabsorption to restore the extracellular fluid to isosmotic.

**TMP14 p. 949**

13. **E)** An individual with panhypopituitarism has generalized dysfunction of the pituitary gland. GHRH from the hypothalamus is increased in an attempt to restore the pituitary function. For similar reasons, somatostatin is decreased. Because pituitary function is impaired, growth hormone production is reduced, and because growth hormone stimulates the production of somatomedin, its production is also reduced.

**TMP14 pp. 946–947**

14. **C)** Antagonism of progesterone's effects, dilation of the cervix, and oxytocin all increase uterine smooth muscle excitability and facilitate contractions and the onset of labor. LH would have no effect.



Prostaglandin E<sub>2</sub> strongly stimulates uterine smooth muscle contraction and is formed at an increasing rate by the placenta late in gestation.

**TMP14 pp. 1064, 1066**

15. **B) AVPR2** function is impaired in patients with nephrogenic diabetes insipidus, rendering ADH ineffective at increasing H<sub>2</sub>O reabsorption in the distal nephron. This causes a compensatory increase in the release of ADH from the supraoptic nuclei of the hypothalamus. Patients with diabetes insipidus run the risk of developing hypernatremia, and they produce a large volume of dilute urine.

**TMP14 pp. 381, 439**

16. **E)** Thyroxine (T<sub>4</sub>) is the major thyroid hormone, along with triiodothyronine (T<sub>3</sub>). An increase in the thyroid hormones attenuates the production of thyroid-stimulating hormone (TSH) through negative feedback inhibition.

**TMP14 pp. 958–959**

17. **C)** Thyroid hormones cause a general increase in basal metabolic rate. With an increased metabolic rate, there is an increased metabolic demand of the tissues which is the primary determinant of cardiac output.

**TMP14 p. 957**

18. **A)** In a radioimmunoassay, there is too little antibody to completely bind the radioactively tagged hormone and the hormone in the fluid (plasma) to be assayed. Thus, there is competition between the labeled and endogenous hormone for binding sites on the antibody. Consequently, if the amount of radioactive hormone bound to antibody is low, this finding would indicate that plasma levels of endogenous hormone are high.

**TMP14 p. 936**

19. **A)** Cold exposure is an important physiological stimulus for the production and release of the thyroid hormones. Cold causes the hypothalamic production of thyrotropin-releasing hormone, which stimulates thyrotropes of the anterior pituitary to release thyroid-stimulating hormone (TSH). The increased TSH stimulates the

production of the thyroid hormones, including thyroxine, which helps to relieve the physiological stress caused by the cold.

**TMP14 pp. 958–959**

20. **B)** The Sertoli cells of the seminiferous tubules secrete inhibin at a rate proportional to the rate of production of sperm cells. Inhibin has a direct inhibitory effect on anterior pituitary secretion of FSH. FSH binds to specific receptors on the Sertoli cells, causing the cells to grow and secrete substances that stimulate sperm cell production. The secretion of inhibin thereby provides the negative feedback control signal from the seminiferous tubules to the pituitary gland.

**TMP14 p. 1033**

21. **B)** A thyroid hormone–producing adenoma causes an increase in thyroid hormones. Thus, one would expect an increase in both circulating T4 and T3 caused by the adenoma. The increased T4 and T3 feeds back to inhibit the production and release of TRH from the hypothalamus and TSH from the anterior pituitary to halt further production of the thyroid hormones. However, the adenoma does not respond to normal feedback regulation, and thus T3 and T4 remain high.

**TMP14 pp. 958–961**

22. **A)** The corpus luteum is the only source of progesterone production, except for minute quantities **secreted** from the follicle before ovulation. The corpus luteum is functional between ovulation and the beginning of menstruation, during which time the concentration of LH is suppressed below the level achieved during the preovulatory LH surge.

**TMP14 pp. 1046–1047**

23. **C)** The high levels of TSH (outside the normal range) are indicative of hypofunction of the thyroid, and this is further observed with the low total T4. Thyroxine-binding globulin remains in the normal range, making the best answer Hashimoto’s disease, which is the most common form of hypothyroidism. Secondary hypothyroidism occurs in response to failure of the pituitary gland to stimulate the thyroid. Therefore, the high TSH rules out this possibility.

**TMP14 pp. 961–962**

24. **E)** Cholesterol desmolase is the key enzyme responsible for the conversion of cholesterol to pregnenolone for the process of steroid synthesis.

**TMP14 p. 966**

25. **A)** Aldosterone increases the Na<sup>+</sup>K<sup>+</sup> ATPase in the basolateral membrane of the principal cells and increases ENaC channels in the luminal side. This creates a driving force for Na<sup>+</sup> reabsorption and K<sup>+</sup> excretion **leading** to hypokalemia. When aldosterone is low, K<sup>+</sup> excretion is attenuated, leading to hyperkalemia.

**TMP14 pp. 969–970**

26. **E)** Anabolic steroids bind to testosterone receptors in the hypothalamus, providing feedback inhibition of normal ovarian cycling and preventing menstrual cycling as well as stimulation of osteoblastic activity in the bones.

**TMP14 pp. 1028, 1031**

27. **D)** Chronically elevated aldosterone increases sodium and water retention leading to an expansion of extracellular fluid volume. Increased extracellular fluid leads to increased blood pressure, which promotes pressure natriuresis, causing urinary sodium excretion to come into balance. Thus, during a chronic infusion urinary sodium excretion is not changed.

**TMP14 p. 970**

28. **B)** Right atrial pressure falls dramatically after the onset of breathing because of a reduction in pulmonary vascular resistance, pulmonary arterial pressure, and right ventricular pressure.

**TMP14 pp. 1073–1075**

29. **B)** Physiological stimuli for glucocorticoids, such as stress, cause the hypothalamic production of corticotropin-releasing hormone (CRH). CRH stimulates corticotropes from the anterior pituitary to release corticotropin (or ACTH). Corticotropin promotes the production of cortisol from the adrenal cortex to help alleviate the physiological stressor.

**TMP14 pp. 974–977**

30. **E)** The metabolic actions of cortisol increase the availability of circulating fuel sources in response to physiological stressors. Cortisol impairs skeletal muscle glucose and amino acid uptake (although it promotes hepatic amino acid uptake) and promotes lipolysis from adipocytes. This has the net effect to increase plasma glucose, free fatty acids, and amino acids.

**TMP14 pp. 972–973**

31. **D)** Glucose is normally filtered in the glomerulus and reabsorbed in the proximal tubule. However, during untreated type I diabetes, the amount of filtered glucose exceeds (180 mg/dl) the reabsorptive capacity of the proximal tubule, increasing urinary osmolarity. This causes an increase in water filtration, leading to frequent urination (polyuria).

**TMP14 pp. 995**

32. **C)** Aromatase causes conversion of testosterone to estradiol.

**TMP14 p. 1043**

33. **D)** Because of the loss of blood flow through the placenta, systemic vascular resistance doubles at birth, which increases the aortic pressure as well as the pressure in the left ventricle and left atrium.

**TMP14 pp. 1073, 1074**

34. **C)** Consuming a meal consisting of carbohydrate, protein, and fat will stimulate the production and release of insulin, which promotes energy storage. Insulin increases cell permeability to glucose to promote its storage in the form of glycogen (liver) and fat through fatty acid synthesis and storage in the adipose. Hormone-sensitive lipase promotes the breakdown of fat to free fatty acids and is decreased in response to insulin.

**TMP14 pp. 985–989**

35. **B)** Type I diabetes is associated with low insulin and thus an impaired ability to store energy. Thus, in the absence of insulin, plasma free fatty acids are increased to be made available for energy, liver glycogen is depleted in an attempt to maintain plasma glucose, and skeletal muscle mass decreases as protein is metabolized to make amino acids available for energy.

**TMP14 pp. 994–995**

36. **C)** The postabsorptive state begins approximately 2 hours after a meal when plasma glucose has typically returned to normal. During the postabsorptive state, counter regulatory mechanisms are activated which help to maintain constant plasma glucose concentration. Thus, insulin is reduced to decrease the cellular uptake of glucose and glucagon is increased to promote hepatic production and release of glucose. After several hours, both growth hormone and cortisol are also increased to reduce skeletal muscle and adipose uptake of glucose. The net effect of these mechanisms is to prevent hypoglycemia.

**TMP14 pp. 986, 991–992, 994**

37. **B)** hCG also binds to LH receptors on the interstitial cells of the testes of the male fetus, resulting in the production of testosterone in male fetuses up to the time of birth. This small secretion of testosterone is what causes the fetus to develop male sex organs instead of female sex organs.

**TMP14 pp. 1033, 1060–1061**

38. **D)** **Insulin** is a peptide hormone that is derived from proinsulin. It binds to an enzyme linked receptor composed of 2 alpha and 2 beta subunits, leading to an increase in tyrosine kinase activity.

**TMP14 pp. 984–985**

39. **E)** The exchange of calcium between the bone fluid compartment and the ECF serves as a rapid and fast-acting mechanism to buffer changes in extracellular fluid calcium concentration.

**TMP14 p. 1005**

40. **B)** In nonpregnant woman, the only significant source of estrogen is ovarian follicles or corpus luteae. Menstruation begins when the corpus luteum degenerates. Menstruation ends when developing follicles secrete estrogen sufficiently to raise circulating concentration to a level that stimulates regrowth of the endometrium.

**TMP14 pp. 1039, 1042, 1046–1047**

41. **B)** As a result of negative feedback, plasma levels of TSH are a sensitive index of circulating levels of unbound (free) thyroid hormones. High plasma levels of TSH indicate inappropriately low levels of free thyroid hormones in the circulation, such as are present with autoimmune

destruction of the thyroid gland in persons with Hashimoto's disease. However, because elevated plasma levels of estrogen in pregnancy increase hepatic production of TBG, the total amount (bound + free) of thyroid hormones in the circulation is elevated. Plasma levels of thyroid hormones are elevated in persons with Graves' disease and in patients with a pituitary TSH-secreting tumor, as well in patients given thyroid extract for therapy.

**TMP14 pp. 954, 958–962**

42. **F)** The kidneys are essential for the conversion of inactive vitamin D prohormones to the biologically active vitamin D hormone (1,25-dihydroxycholecalciferol). This conversion is mediated by parathyroid hormone acting in the proximal tubule epithelial cells. Therefore, with impaired renal function, one would expect a decrease in plasma [1,25-(OH)<sub>2</sub>D], along with a compensatory increase in PTH. The increased plasma PTH causes bone resorption of calcium.

**TMP14 p. 1015**

43. **D)** The cells of the anterior pituitary that secrete LH and FSH, along with the cells of the hypothalamus that secrete GnRH, are inhibited by both estrogen and testosterone. The steroids taken by the woman caused sufficient inhibition to result in cessation of the monthly menstrual cycle.

**TMP14 pp. 1033, 1047–1048**

44. **D)** Patients with central diabetes insipidus have an inappropriately low secretion rate of ADH in response to changes in plasma osmolality, but their renal response to ADH is not impaired. Because plasma levels of ADH are depressed, the ability to concentrate urine is impaired, and a large volume of dilute urine is excreted. Loss of water tends to increase plasma osmolality, which stimulates the thirst center and leads to a very high rate of water turnover.

**TMP14 p. 949**

45. **B)** NO is the vasodilator that is normally released, causing vasodilation in these arteries.

**TMP14 pp. 1027, 1034**

46. **B)** Hydroxyapatite is the major salt found in calcified bone, and the osteon is composed of concentric layers of calcified bone. However, an osteocyte is a quiescent cell that resides in lacunae (spaces). Osteoblasts are the cells that actively form new bone.

**TMP14 pp. 1003, 1005–1006**

47. **B)** **One** of the major physiological roles for PTH is to promote the conversion of 25-hydroxycholecalciferol, to the active 1,25-dihydroxycholecalciferol in the proximal tubular epithelium. The other choices represent normal physiological actions of PTH.

**TMP14 pp. 1009–1012**

48. **D)** Lethargy and myxedema are signs of hypothyroidism. Low plasma levels of TSH indicate that the abnormality is in either the hypothalamus or the pituitary gland. The responsiveness of the pituitary to the administration of TRH suggests that pituitary function is normal and that the hypothalamus is producing insufficient amounts of TRH.

**TMP14 pp. 958–962**

49. **D)** **Inhibin** prevents FSH release from the anterior pituitary, preventing Sertoli cells from causing aromatization to produce estradiol.

**TMP14 p. 1032**

50. **A)** After menopause, the absence of feedback inhibition by estrogen and progesterone results in extremely high rates of FSH secretion. Women taking estrogen as part of hormone replacement therapy for symptoms associated with postmenopausal conditions have suppressed levels of FSH as a result of the inhibitory effect of estrogen.

**TMP14 pp. 1050, 1051**

51. **D)** Phosphodiesterase-5 receptors prevent hydrolysis of cyclic guanosine monophosphate, thus keeping the levels high and maintaining vasodilation.

**TMP14 p. 1034**

52. **B)** Glucagon stimulates glycogenolysis in the liver, but it has no physiological effects in muscle. Both glucagon and cortisol increase gluconeogenesis, and cortisol impairs glucose uptake by muscle.

**TMP14 pp. 972–973, 992**

53. **C)** Injection of insulin leads to a decrease in blood glucose concentration. Hypoglycemia stimulates the secretion of GH, glucagon, and epinephrine, all of which have counter regulatory effects to increase glucose levels in the blood.

**TMP14 pp. 945, 993–994**

54. **A)** Prolonged fetal hypoxia during delivery can cause serious depression of the respiratory center. Hypoxia may occur during delivery because of compression of the umbilical cord, premature separation of the placenta, excessive contraction of the uterus, or excessive anesthesia of the mother.

**TMP14 p. 1073**

55. **C)** In general, peptide hormones are water soluble and are not highly bound by plasma proteins. ADH, a neurohypophysial peptide hormone, is virtually unbound by plasma proteins. In contrast, steroid and thyroid hormones are highly bound to plasma proteins.

**TMP14 pp. 929–930**

56. **C)** The rise in intracellular calcium in the oocyte triggers the cortical reaction in which granules that previously lay at the base of the plasma membrane undergo exocytosis. This process leads to the release of enzymes that “harden” the zona pellucida and prevent other sperm from penetrating.

**TMP14 p. 1025**

57. **B)** Although estrogen and progesterone are essential for the physical development of the breast during pregnancy, a specific effect of both these hormones is to inhibit the actual secretion of milk. Even though prolactin levels are increased 10- to 20-fold at the end of pregnancy, the suppressive effects of estrogen and progesterone prevent milk production until after the baby is born. Immediately after birth, the sudden loss of both estrogen and progesterone secretion from the placenta allows the lactogenic effect of prolactin to promote milk production.

**TMP14 pp. 1066–1067**

58. **C)** The concentration of PTH strongly regulates the absorption of calcium ion from the renal tubular fluid. A reduction in hormone



concentration reduces calcium reabsorption and increases the rate of calcium excretion in the urine. The other choices either have little effect on or decrease calcium excretion.

**TMP14 pp. 1011–1012**

59. **B)** A pituitary tumor secreting increased amounts of TSH would be expected to stimulate the thyroid gland to secrete increased amounts of thyroid hormones. TSH stimulates several steps in the synthesis of thyroid hormones, including the synthesis of thyroglobulin. Increased heart rate is among the many physiological responses to high plasma levels of thyroid hormones. However, high plasma levels of thyroid hormones do not cause exophthalmos. Immunoglobulins cause exophthalmos in Graves' disease, the most common form of hyperthyroidism.

**TMP14 pp. 952, 957, 961**

60. **A)** Hemorrhage decreases the activation of stretch receptors in the atria and arterial baroreceptors. Decreased activation of these receptors increases ADH secretion.

**TMP14 p. 949**

61. **E)** Choices A to D are true: LH secretion will be suppressed (B) by the negative feedback effect of the estrogen from the tumor; consequently, she will not have menstrual cycles (C), and because she will not have normal cycles, no corpus lutea will develop, so no progesterone will be formed (A). The high levels of estrogen produced by the tumor will provide stimulation of osteoblastic activity to maintain normal bone activity (D).

**TMP14 pp. 1044, 1045**

62. **D)** After eating a meal, insulin secretion is increased. As a result, there is an increased rate of glucose uptake by both the liver and muscle. Insulin also inhibits hormone-sensitive lipase, which decreases hydrolysis of triglycerides in fat cells.

**TMP14 pp. 985–987, 992**

63. **B)** The primary function of testosterone in the embryonic development of males is to stimulate formation of the male sex organs.

**TMP14 pp. 219–220, 364, 383, 405, 949–950**

64. **B)** FSH stimulates the production of estrogens from Sertoli cells in the testis. The Sertoli cells receive testosterone from Leydig cells (stimulated by LH) and use the testosterone to make estrogen.

**TMP14 p. 1023**

65. **C)** The reduction in hydrogen ion indicated by the elevation in pH increases the concentration of negatively charged phosphate ion species available for ionic combination with calcium ions. Consequently, the free calcium ion concentration is reduced.

**TMP14 pp. 1011–1012**

66. **A)** Prostate fluid contains calcium, citrate, phosphate and fibrinolysin. The function of prostate fluid is to help neutralize the acidic environment associated with other seminal fluids and thus improve sperm motility.

**TMP14 p. 1024**

67. **C)** During suckling, stimulation of receptors on the nipples increases neural input to both the supraoptic and paraventricular nuclei. Activation of these nuclei leads to the release of oxytocin and neurophysin from secretion granules in the posterior pituitary gland. Suckling does not stimulate the secretion of appreciable amounts of ADH.

**TMP14 pp. 1066, 1067**

68. **C)** In Conn's syndrome, large amounts of aldosterone are secreted. Because aldosterone causes sodium retention, hypertension is a common finding in patients with this condition. However, the degree of sodium retention is modest, as is the resultant increase in extracellular fluid volume. This occurs because the rise in arterial pressure offsets the sodium-retaining effects of aldosterone, limiting sodium retention and permitting daily sodium balance to be achieved.

**TMP14 pp. 970, 981**

69. **C)** The activity of stored sperm is attenuated as a result of the acidic environment. After ejaculation, uterine and fallopian fluids wash away inhibitory factors, allowing for full activation of the spermatozoa.

**TMP14 pp. 1024–1025**

70. **D)** DHEA sulfate produced by the fetal adrenal gland diffuses to the placenta and is converted to DHEA and then to estradiol and provides estradiol to the mother.

**TMP14 pp. 1060, 1061**

71. **D)** Sporadic nursing of the mother results in a lack of prolactin surge because mechanosensors in the nipple cause prolactin release. Without prolactin release, there is a lack of milk production, and the mother eventually will not be able to provide milk for the baby.

**TMP14 pp. 1066, 1067**

72. **A)** Persons with Addison's disease have diminished secretion of both glucocorticoids (cortisol) and mineralocorticoids (aldosterone). In persons with Cushing's disease or Cushing's syndrome, cortisol secretion is elevated, but aldosterone secretion is normal. A low-sodium diet is associated with a high rate of aldosterone secretion but a secretion rate of cortisol that is normal. By inhibiting the generation of angiotensin II and thus the stimulatory effects of angiotensin II on the zona glomerulosa, administration of a converting enzyme inhibitor would decrease aldosterone secretion without altering the rate of cortisol secretion.

**TMP14 pp. 971–972, 979–980**

73. **E)** Spermatogonia undergo two rounds of meiotic division, leading to the production of four haploid spermatids. The spermatids ultimately differentiate into mature sperm.

**TMP14 pp. 1021–1022**

74. **B)** Progesterone is required to maintain the decidual cells of the endometrium. If progesterone levels fall, as they do during the last days of a nonpregnant menstrual cycle, menstruation will follow within a few days, with loss of pregnancy. Administration of a compound that blocks the progesterone receptor during the first few days after conception will terminate the pregnancy.

**TMP14 pp. 1060–1061**

75. **D)** An inappropriately high rate of ADH secretion from the lung promotes excess water reabsorption, which tends to produce concentrated urine and a decrease in plasma osmolality. Low plasma

osmolality suppresses both thirst and ADH secretion from the pituitary gland.

**TMP14 pp. 404, 949**

76. **B)** A very high plasma concentration of progesterone maintains the uterine muscle in a quiescent state during pregnancy. In the final month of gestation, the concentration of progesterone begins to decline, increasing the excitability of the muscle.

**TMP14 pp. 971–972, 1027**

77. **D)** The corpus luteum is the only source of progesterone. If she is not having menstrual cycles, no corpus luteum is present.

**TMP14 p. 1048**

78. **C)** FSH stimulates the granulosa cells of the follicle to secrete estrogen.

**TMP14 pp. 1040, 1048**

79. **E)** In response to increased blood levels of glucose, plasma insulin concentration normally increases during the 60-minute period following oral intake of glucose. In type 1 diabetes mellitus, insulin secretion is depressed. In contrast, in type 2 diabetes mellitus, insulin resistance is a common finding, and at least in the early stages of the disease, there is an abnormally high rate of insulin secretion.

**TMP14 pp. 995–998**

80. **D)** In Cushing's syndrome, high plasma levels of cortisol impair glucose uptake in peripheral tissues, which tends to increase plasma levels of glucose. As a result, the insulin response to oral intake of glucose is enhanced.

**TMP14 pp. 996–998**

81. **B)** In general, protein hormones cause physiological effects by binding to receptors on the cell membrane. However, of the four protein hormones indicated, only insulin activates an enzyme-linked receptor. Aldosterone is a steroid hormone and enters the cytoplasm of the cell before binding to its receptor.

**TMP14 p. 932**

82. **D)** hCG is secreted from the trophoblast cells beginning shortly after the blastocyst implants in the endometrium.

**TMP14 pp. 1060–1061**

83. **B)** Aortic pressure increases due to the increase in left ventricular pressure. The increase in left atrial pressure causes the foramen ovale to close. The ductus arteriosus also closes within a short time after birth.

**TMP14 pp. 1073–1075**

84. **A)** Somnolence is a common feature of hypothyroidism. Palpitations, increased respiratory rate, increased cardiac output, and weight loss are all associated with hyperthyroidism.

**TMP14 pp. 957, 962–963**

85. **C)** An infant born of a mother with untreated diabetes will have considerable hypertrophy and hyperfunction of the islets of Langerhans in the pancreas. As a consequence, the infant's blood glucose concentration may fall to lower than 20 mg/dl shortly after birth.

**TMP14 pp. 1078–1079**

86. **B)** If a successful fertilization event occurs, followed by implantation in the uterine wall, trophoblasts produce and secrete human chorionic gonadotropin, which maintains the corpus luteum and its production of estrogen and progesterone. Eventually, hCG levels decline in association with increased placental production of progesterone and estrogen.

**TMP14 p. 1042**

87. **E)** Choices A to D would not stimulate PTH secretion. An increase in calcium concentration (A) suppresses PTH secretion; calcitonin has little to no effect on PTH secretion (B); acidosis would increase free calcium in the extracellular fluid, thereby inhibiting PTH secretion (C); and PTH-releasing hormone does not exist (D).

**TMP14 pp. 1001, 1011**

88. **C)** Potassium is a potent stimulus for aldosterone secretion, as is angiotensin II. Therefore, a patient consuming a high-potassium diet would exhibit high circulating levels of aldosterone.

**TMP14 p. 971**

89. **B)** The decidua and trophoblasts provide the nutrition needed to provide nourishment of the blastocyst.

**TMP14 pp. 1057, 1060–1062**

90. C) Steroid hormones are not stored to any appreciable extent in their endocrine-producing glands. This is true for aldosterone, which is produced in the adrenal cortex. In contrast, there are appreciable stores of thyroid hormones and peptide hormones in their endocrine-producing glands.

**TMP14 p. 928**

91. C) 1,25-Dihydroxycholecalciferol is formed only in the renal cortex. Extensive renal disease reduces the amount of cortical tissue, eliminating the source of this active calcium regulating hormone.

**TMP14 p. 1015**

92. C) The placenta cannot produce androgens but can only produce DHEA by removal of the sulfate from DHEAS produced in the fetal adrenal glands.

**TMP14 p. 1060**

93. A) The secretory phase of the endometrial cycle aligns with the luteal phase of the ovarian cycle. Progesterone levels peak during this phase and promote the vascularization and thickening of the endometrial lining. If a fertilization event and subsequent implantation does not occur, the corpus luteum involutes causing progesterone levels to fall and the endometrial lining to slough off during menstruation.

**TMP14 pp. 1046–1047**

94. D) Because iodine is needed to synthesize thyroid hormones, the production of thyroid hormones is impaired if iodine is deficient. As a result of feedback, plasma levels of TSH increase and stimulate the follicular cells to increase the synthesis of thyroglobulin, which results in a goiter. Increased metabolic rate, sweating, nervousness, and tachycardia are all common features of hyperthyroidism, not hypothyroidism, due to iodine deficiency.

**TMP14 pp. 960–963**

95. C) Because of the effects of thyroid hormones to increase metabolism in tissues, tissues vasodilate, thus increasing blood flow and cardiac output. All the other choices increase in response to high plasma levels of thyroid hormones.

**TMP14 pp. 956–957**

96. **B)** Sperm cell motility decreases as pH is reduced below 6.8. At a pH of 4.5, sperm cell motility is significantly reduced. However, the buffering effect of sodium bicarbonate in the prostatic fluid raises the pH somewhat, allowing the sperm cells to regain some mobility.

**TMP14 p. 1024**

97. **B)** A protein meal stimulates all three hormones indicated.

**TMP14 pp. 945, 991, 993**

98. **C)** Testosterone secreted by the testes in response to LH inhibits hypothalamic secretion of GnRH, thereby inhibiting anterior pituitary secretion of LH and FSH. Taking large doses of testosterone-like steroids also suppresses the secretion of GnRH and the pituitary gonadotropic hormones, resulting in sterility.

**TMP14 p. 1033**

99. **C)** Steroids with potent glucocorticoid activity tend to increase plasma glucose concentration. As a result, insulin secretion is stimulated. Increased glucocorticoid activity also diminishes muscle protein. Because of feedback, cortisone administration leads to a decrease in adrenocorticotrophic hormone secretion and therefore a decrease in plasma cortisol concentration.

**TMP14 pp. 972–973**

100. **C)** Inhibin is the hormone that has a negative feedback on the anterior pituitary to prevent FSH from being released. Inhibin is produced by the granulosa cells in the ovary.

**TMP14 pp. 1040–1041**

101. **A)** An increase in the concentration of PTH results in the stimulation of existing osteoclasts and, over longer periods, increases the number of osteoclasts present in the bone.

**TMP14 pp. 1010–1011**

102. **B)** In general, peptide hormones produce biological effects by binding to receptors on the cell membrane. Peptide hormones are stored in secretion granules in their endocrine-producing cells and have relatively short half-lives because they are not highly bound to plasma proteins. Protein hormones often have a rapid onset of action because, unlike

steroid and thyroid hormones, protein synthesis is usually not a prerequisite to produce biological effects.

**TMP14 pp. 926, 929–932**

103. **D)** A pituitary tumor secreting GH is likely to present as an increase in pituitary gland size. The anabolic effects of excess GH secretion lead to enlargement of the internal organs, including the kidneys. Because acromegaly is the state of excess GH secretion after epiphyseal closure, increased femur length does not occur.

**TMP14 p. 947**

104. **A)** GH and cortisol have opposite effects on protein synthesis in muscle. GH is anabolic and promotes protein synthesis in most cells of the body, whereas cortisol decreases protein synthesis in extrahepatic cells, including muscle. Both hormones impair glucose uptake in peripheral tissues and therefore tend to increase plasma glucose concentration. Both hormones also mobilize triglycerides from fat stores.

**TMP14 pp. 943–944, 972–973**

105. **B)** If the mother has had adequate amounts of iron in her diet, the infant's liver usually has enough stored iron to form blood cells for 4 to 6 months after birth. However, if the mother had insufficient iron levels, severe anemia may develop in the infant after about 3 months of life.

**TMP14 pp. 1072, 1077**

106. **A)** High plasma levels of steroids with glucocorticoid activity suppress CRH and, consequently, ACTH secretion. Therefore, the adrenal glands would actually atrophy with chronic cortisone treatment. Increased plasma levels of glucocorticoids tend to cause sodium retention and increase blood pressure. They also tend to increase plasma levels of glucose and, consequently, stimulate insulin secretion and C-peptide, which is part of the insulin prohormone.

**TMP14 pp. 972–973, 976–977, 979–980**

107. **B)** During the postovulatory phase of the cycle, there is a negative feedback relationship between progesterone and estrogen and the hypothalamic pituitary axis. Therefore, progesterone suppresses GnRH release.

**TMP14 pp. 1040–1042**



108. C) SRY is the region on the Y chromosome that encodes a transcription factor that causes differentiation of Sertoli cells from precursors in testis. If SRY is not present, granulosa cells in the ovary are produced.

**TMP14 p. 1029**

109. D) Fertilization of the ovum normally takes place in the ampulla of one of the fallopian tubes.

**TMP14 p. 1055**

110. D) Because insulin secretion is deficient in persons with type 1 diabetes mellitus, there is increased (not decreased) release of glucose from the liver. Low plasma levels of insulin also lead to a high rate of lipolysis; increased plasma osmolality, hypovolemia, and acidosis are all symptoms of uncontrolled type 1 diabetes mellitus.

**TMP14 pp. 995–996**

111. E) Under acute conditions, an increase in blood glucose concentration will decrease GH secretion. GH secretion is characteristically elevated in the chronic pathophysiological states of acromegaly and gigantism. Deep sleep and exercise are stimuli that increase GH secretion.

**TMP14 pp. 945–946**

112. D) All the steroids listed include pregnenolone early in their biosynthetic pathway. 1,25(OH)<sub>2</sub>D is derived from vitamin D and does not include pregnenolone in its biosynthetic pathway.

**TMP14 pp. 965–967, 1007–1008**

113. D) Estrogen and, to a lesser extent, progesterone secreted by the corpus luteum during the luteal phase have strong feedback effects on the anterior pituitary gland to maintain low secretory rates of both FSH and LH. In addition, the corpus luteum secretes inhibin, which inhibits the secretion of FSH.

**TMP14 p. 1042**

114. D) Under chronic conditions, the effects of high plasma levels of aldosterone to promote sodium reabsorption in the collecting tubules are sustained. However, persistent sodium retention does not occur because of concomitant changes that promote sodium excretion. These changes include increased arterial pressure, increased plasma levels of

atrial natriuretic peptide, and decreased plasma angiotensin II concentration.

**TMP14 pp. 961, 981**

115. **B)** For reasons that are not entirely clear, the negative feedback regulation between estrogen and LH that occurs throughout the ovarian cycle briefly changes to a positive feedback mechanism. This occurs late in the follicular phase, just prior to ovulation, when LH promotes estrogen production and estrogen feeds back to stimulate the further release of LH. This underlies the surge in LH just before ovulation.

**TMP14 pp. 1040–1042**

116. **B)** Circulating levels of free  $T_4$  exert biological effects and are regulated by feedback inhibition of TSH secretion from the anterior pituitary gland. Protein-bound  $T_4$  is biologically inactive. Circulating  $T_4$  is highly bound to plasma proteins, especially to TBG, which increases during pregnancy. An increase in TBG tends to decrease free  $T_4$ , which then leads to an increase in TSH secretion, causing the thyroid to increase thyroid hormone secretion. Increased secretion of thyroid hormones persists until free  $T_4$  returns to normal levels, at which time there is no longer a stimulus for increased TSH secretion. Therefore, in a chronic steady-state condition associated with elevated TBG, high plasma total  $T_4$  (bound and free) and normal plasma TSH levels would be expected. In this pregnant patient, the normal levels of total  $T_4$ , along with high plasma levels of TSH, would indicate an inappropriately low plasma level of free  $T_4$ . Deficient thyroid hormone secretion in this patient would be consistent with Hashimoto's disease, the most common form of hypothyroidism.

**TMP14 pp. 954, 958–962**

117. **D)** The motor neurons of the spinal cord of the thoracic and lumbar regions are the sources of innervation for the skeletal muscles of the perineum involved in ejaculation.

**TMP14 pp. 1026, 1027**

118. **A)** Trophoblasts invade the endometrial lining of the uterus and provide nutrients to the growing blastocyst until the placenta is formed.

**TMP14 pp. 1056–1057**

119. **B)** Bone is deposited in proportion to the compressional load that the bone must carry. Continual mechanical stress stimulates osteoblastic deposition and calcification of bone.

**TMP14 pp. 1006–1007**

120. **D)** Prolactin is produced in the anterior pituitary from lactotrope cells and is responsible for promoting milk production and secretion.

**TMP14 pp. 1067–1068**

121. **B)** In the absence of 11- $\beta$ -hydroxysteroid dehydrogenase, renal epithelial cells cannot convert cortisol to cortisone; therefore, cortisol will bind to the mineralocorticoid receptor and mimic the actions of excess aldosterone. Consequently, this would result in hypertension associated with suppression of the renin-angiotensin-aldosterone system, along with hypokalemia.

**TMP14 pp. 968–970, 980–981**

122. **D)** In target tissues, nuclear receptors for thyroid hormones have a greater affinity for  $T_3$  than for  $T_4$ . The secretion rate, plasma concentration, half-life, and onset of action are all greater for  $T_4$  than for  $T_3$ .

**TMP14 pp. 953–955**

123. **C)** Blocking the action of FSH on the Sertoli cells of the seminiferous tubules interrupts the production of sperm. Choice C is the only option that is certain to provide sterility.

**TMP14 p. 1033**

124. **C)** Oxytocin is secreted from the posterior pituitary gland and carried in the blood to the breast, where it causes the cells that surround the outer walls of the alveoli and ductile system to contract. Contraction of these cells raises the hydrostatic pressure of the milk in the ducts to 10 to 20 mm Hg. Consequently, milk flows from the nipple into the baby's mouth.

**TMP14 pp. 1068–1069**

125. **B)** Resulting from the growing fetal-placental unit, there is a large increase in metabolic demand during a normal pregnancy. Given that metabolic demand is the major determinant for cardiac output, the

increase in metabolic demand during pregnancy causes an increase in cardiac output.

**TMP14 p. 1062**

126. **F)** Persons with Cushing's disease have a high rate of cortisol secretion, but aldosterone secretion is normal. High plasma levels of cortisol tend to increase plasma glucose concentration by impairing glucose uptake in peripheral tissues and by promoting gluconeogenesis. However, at least in the early stages of Cushing's disease, the tendency for glucose concentration to increase appreciably is counteracted by increased insulin secretion.

**TMP14 pp. 972–973, 979–980**

127. **A)** In healthy patients, the secretory rates of ACTH and cortisol are low in the late evening but high in the early morning. In patients with Cushing's syndrome (adrenal adenoma) or in patients taking dexamethasone, plasma levels of ACTH are very low and are certainly not higher than normal early morning values. In patients with Addison's disease, plasma levels of ACTH are elevated as a result of deficient adrenal secretion of cortisol. The secretion of ACTH and cortisol would be expected to be normal in Conn's syndrome.

**TMP14 pp. 977–980**

128. **B)** Exercise stimulates GH secretion. Hyperglycemia, somatomedin, and the hypothalamic inhibitory hormone somatostatin all inhibit GH secretion. GH secretion also decreases as persons age.

**TMP14 p. 945**

129. **C)** A low-sodium diet would stimulate aldosterone but not cortisol secretion. Increased atrial stretch associated with volume expansion would stimulate atrial natriuretic peptide secretion but would not be expected during a low-sodium diet.

**TMP14 pp. 364, 405, 971–972**

130. **A)** Adrenal gland hypofunction with Addison's disease is associated with decreased secretion of both aldosterone and cortisol. In Cushing's disease and Cushing's syndrome associated with an ectopic tumor, the mineralocorticoid-hypertension induced by high plasma levels of cortisol would suppress aldosterone secretion. Neither a high-sodium

diet nor administration of a converting enzyme inhibitor would affect cortisol secretion.

**TMP14 pp. 971-972, 979-980**

131. **B)** Blood returning from the placenta through the umbilical vein passes through the ductus venosus. The blood coming from the placenta has the highest concentration of oxygen found in the fetus.

**TMP14 p. 1074**

132. **B)** Osteoporosis, hypertension, hirsutism, and hyperpigmentation are all symptoms of Cushing's syndrome associated with high plasma levels of ACTH. If the high plasma ACTH levels were the result of either a pituitary adenoma or an abnormally high rate of corticotropin-releasing hormone secretion from the hypothalamus, the patient would likely have an enlarged pituitary gland. In contrast, the pituitary gland would not be enlarged if an ectopic tumor were secreting high levels of ACTH.

**TMP14 pp. 979-980**

133. **B)** Prolactin secretion is inhibited, not stimulated, by the hypothalamic release of dopamine into the median eminence. GH is inhibited by the hypothalamic-inhibiting hormone somatostatin. The secretion of LH, TSH, and ACTH are all under the control of the releasing hormones indicated.

**TMP14 p. 942**

134. **B)** Increased heart rate, increased respiratory rate, and decreased cholesterol concentration are all responses to excess thyroid hormone.

**TMP14 pp. 956-958**

135. **C)** hCG is produced by syncytial trophoblasts from the growing blastocyst. hCG is responsible for maintaining the corpus luteum which produces estrogens and progesterone up through approximately 12 weeks' gestation. After that time, the placenta makes enough estrogen and progesterone to sustain the pregnancy.

**TMP14 pp. 1059-1060**

136. **D)** By age 45 years, only a few primordial follicles remain in the ovaries to be stimulated by gonadotropic hormones, and the production of estrogen decreases as the number of follicles approaches zero. When estrogen production falls below a critical value, it can no longer inhibit

the production of gonadotropic hormones from the anterior pituitary. FSH and LH are produced in large quantities, but as the remaining follicles become atretic, production by the ovaries falls to zero.

**TMP14 pp. 1050, 1051**

137. **D)** The binding of insulin to its receptor activates tyrosine kinase, resulting in metabolic events leading to increased synthesis of fats, proteins, and glycogen. In contrast, gluconeogenesis is inhibited.

**TMP14 pp. 984–989**

138. **C)** The secretion of chemical messengers (neurohormones) from neurons into the blood is referred to as neuroendocrine secretion. Thus, in contrast to the local actions of neurotransmitters at nerve endings, neurohormones circulate in the blood before producing biological effects at target tissues. Oxytocin is synthesized from magnocellular neurons whose cell bodies are located in the paraventricular and supraoptic nuclei and whose nerve terminals terminate in the posterior pituitary gland. Target tissues for circulating oxytocin are the breast and uterus, where the hormone plays a role in lactation and parturition, respectively.

**TMP14 pp. 925, 948–950**

139. **C)** The placenta is hypoxic under normal physiological conditions. The diffusion of oxygen from the maternal circulation to the fetal circulation is enhanced by the fact that fetal hemoglobin carries a greater quantity of oxygen at a given blood  $P_{O_2}$  than maternal hemoglobin. In addition, the hemoglobin concentration is greater in the fetal circulation than in the maternal circulation.

**TMP14 p. 1058**

140. **B)** Inhibition of the iodide pump decreases the synthesis of thyroid hormones but does not impair the production of thyroglobulin by follicular cells. Decreased plasma levels of thyroid hormones result in a low metabolic rate and lead to an increase in TSH secretion. Increased plasma levels of TSH stimulate the follicular cells to synthesize more thyroglobulin. Nervousness is a symptom of hyperthyroidism and is not caused by thyroid hormone deficiency.

**TMP14 pp. 951–952, 956–960**

141. **D)** As the blastocyst implants, the trophoblast cells invade the decidua, digesting and imbibing it. The stored nutrients in the decidual cells are used by the embryo for growth and development. During the first week after implantation, this is the only means by which the embryo can obtain nutrients. The embryo continues to obtain at least some of its nutrition in this way for up to 8 weeks, although the placenta begins to provide nutrition after about the 16th day beyond fertilization (a little more than 1 week after implantation).

**TMP14 p. 1056**

142. **A)** Both ADH and oxytocin are peptides containing nine amino acids. Their chemical structures differ in only two amino acids.

**TMP14 p. 949**

143. **A)** Because glucocorticoids decrease the sensitivity of tissues to the metabolic effects insulin, they would exacerbate diabetes. Thiazolidinediones and weight loss increase insulin sensitivity. Sulfonylureas increase insulin secretion. If weight loss and the aforementioned drugs are ineffective, exogenous insulin may be used to regulate blood glucose concentration.

**TMP14 pp. 991, 996–997**

144. **C)** In the early stages of type 2 diabetes, the tissues have a decreased sensitivity to insulin. As a result, there is a tendency for plasma glucose to increase, in part because decreased hepatic insulin sensitivity leads to increased hepatic glucose output. Because of the tendency for plasma glucose to increase, there is a compensatory increase in insulin secretion, including C-peptide, which is part of the insulin prohormone. Hypovolemia and increased production of ketone bodies, although commonly associated with uncontrolled type 1 diabetes, are not typically present in the early stages of type 2 diabetes.

**TMP14 pp. 984, 994–998**

145. **C)** One of the most characteristic findings in respiratory distress syndrome is failure of the respiratory epithelium to secrete adequate quantities of surfactant into the alveoli. Surfactant decreases the surface tension of the alveolar fluid, allowing the alveoli to open easily during inspiration. Without sufficient surfactant, the alveoli tend to collapse, and there is a tendency to develop pulmonary edema.

**TMP14 p. 1074**

146. **D)** Several circulatory changes occur in the fetal circulation after birth. These include the closing of physiological shunts. The ductus arteriosus is a shunt that carries blood from the fetal pulmonary artery into the descending aorta, thus bypassing the pulmonary circulation. At birth, this shunt closes as systemic resistance increases, causing blood to flow back into the pulmonary circulation through the shunt. Within hours of birth, the walls of the ductus arteriosus close, and eventually the closing becomes fibrous for permanent closure.

**TMP14 pp. 1074–1075**

147. **C)** The primary controllers of ACTH, GH, LH, and TSH secretion from the pituitary gland are hypothalamic-releasing hormones. They are secreted into the median eminence and subsequently flow into the hypothalamic-hypophysial portal vessels before bathing the cells of the anterior pituitary gland. Conversely, prolactin secretion from the pituitary gland is influenced primarily by the hypothalamic-inhibiting hormone dopamine. Consequently, obstruction of blood flow through the portal vessels would lead to reduced secretion of ACTH, GH, LH, and TSH but increased secretion of prolactin.

**TMP14 p. 942**

148. **D)** Osteoblasts secrete all of these except pyrophosphate. Secretions (alkaline phosphatase) from osteoblasts neutralize pyrophosphate, an inhibitor of hydroxyapatite crystallization. Neutralization of pyrophosphate permits the precipitation of calcium salts into collagen fibers.

**TMP14 pp. 1004–1006**

149. **B)** In primary hyperparathyroidism, high plasma levels of PTH increase the formation of 1,25-(OH)<sub>2</sub>D<sub>3</sub>, which increases intestinal absorption of calcium. This action of PTH, along with its effects to increase bone resorption and renal calcium reabsorption, leads to hypercalcemia. However, because of the high filtered load of calcium, calcium is excreted in the urine. High plasma levels of PTH also decrease phosphate reabsorption and increase urinary excretion, leading to a fall in plasma phosphate concentration.

**TMP14 pp. 1009–1012, 1014–1015**



150. **A)** Gamma radiation destroys the cells undergoing the most rapid rates of mitosis and meiosis, the germinal epithelium of the testes. The man described is said to have normal testosterone levels, suggesting that the secretory patterns of GnRH and LH are normal and that his interstitial cells are functional. Because he is not producing sperm, the levels of inhibin secreted by the Sertoli cells would be maximally suppressed, and his levels of FSH would be strongly elevated.

**TMP14 p. 1033**

151. **B)** In this experiment, the size of the thyroid gland increased because TSH causes hypertrophy and hyperplasia of its target gland and increased secretion of thyroid hormones. Increased plasma levels of thyroid hormones inhibit the secretion of TRH, which decreases stimulation of the pituitary thyrotropes, resulting in a decrease in the size of the pituitary gland. Higher plasma levels of thyroid hormones also increase metabolic rate and decrease body weight.

**TMP14 pp. 955–955, 960**

152. **C)** In this experiment, the size of the pituitary and adrenal glands increased because CRH stimulates the pituitary corticotropes to secrete ACTH, which in turn stimulates the adrenals to secrete corticosterone and cortisol. Higher plasma levels of cortisol increase protein degradation and lipolysis and therefore decrease body weight.

**TMP14 pp. 972–974, 976–977**

153. **C)** At birth, the neonatal liver is not fully functional. Therefore, it does not excrete bilirubin properly over the first several days of life. The increased concentration of circulating bilirubin gives infants a yellow pigmentation in the skin and eyes (jaundice).

**TMP14 pp. 1076–1077**