UNIT XIV

Endocrinology and Reproduction

1. 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

2. Which statement about antidiuretic hormone (ADH) is true?
   A) It is synthesized in the posterior pituitary gland
   B) It increases salt and water reabsorption in the collecting tubules and ducts
   C) It stimulates thirst
   D) It has opposite effects on urine and plasma osmolality

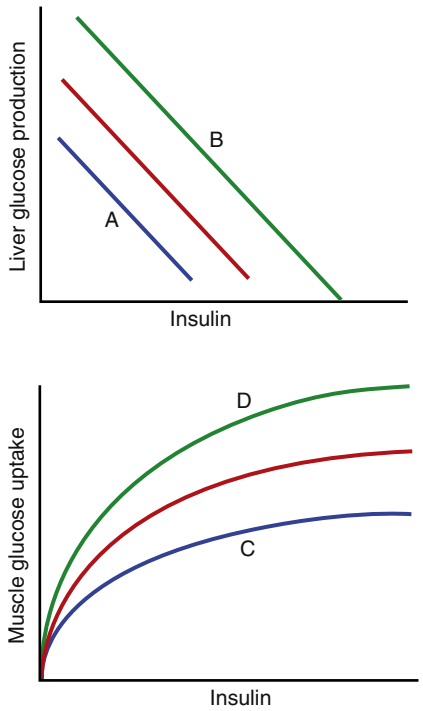
3. After menopause, hormone replacement therapy with estrogen-like compounds is effective in preventing the progression of osteoporosis. What is the mechanism of their protective effect?
   A) They stimulate the activity of osteoblasts
   B) They increase absorption of calcium from the gastrointestinal tract
   C) They stimulate calcium reabsorption by the renal tubules
   D) They stimulate parathyroid hormone (PTH) secretion by the parathyroid gland

4. A patient has nephrogenic diabetes insipidus. Of the following options, which outcome would be expected or which intervention would be suggested?
   A) Expected outcome: decreased plasma sodium concentration
   B) Expected outcome: increased secretion of ADH from the supraoptic and paraventricular nuclei
   C) Expected outcome: high urine osmolality
   D) Suggested intervention: water restriction
   E) Suggested intervention: ADH antagonists (vaptans)

5. Within minutes after a normal delivery, flow through the foramen ovale decreases dramatically. What is the cause of this change?
   A) Increased formation of prostaglandin E_2 (PGE_2) in the endocardium
   B) Increased rate of flow through the pulmonary artery
   C) Increased left atrial pressure
   D) Increased right atrial pressure
   E) Increased partial pressure of oxygen ($Po_{2)}$

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. A young woman is given daily injections of a substance beginning on the sixteenth day of her normal menstrual cycle and continuing for 3 weeks. As long as the injections continue, she does not menstruate. The injected substance could be which of the following?
    A) Testosterone
    B) FSH
    C) An inhibitor of progesterone's actions
    D) A PGE_2 inhibitor
    E) HCG

13. Which of the following increases secretion of GH?
    A) Senescence
    B) Insulin-like growth factor-1 (IGF-1)
    C) Somatostatin
    D) Hypoglycemia
    E) Exogenous GH administration

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_2 effects
    D) Mechanically dilating and stimulating the cervix
    E) Administration of oxytocin

15. Exposure to ultraviolet light directly facilitates which of the following?
    A) Conversion of cholesterol to 25-hydroxycholicalciferol
    B) Conversion of 25-hydroxycholicalciferol to 1,25-dihydroxycholicalciferol
    C) Transport of calcium into the extracellular fluid
    D) Formation of calcium-binding protein
    E) Storage of vitamin D_3 in the liver

16. Which of the following decreases the pressure in the pulmonary artery after birth?
    A) An increase in systemic arterial pressure
    B) Closure of ductus arteriosus
    C) An increase in left ventricular pressure
    D) A decrease in pulmonary vascular resistance

17. Which of the following is both synthesized and stored in the hypothalamus?
    A) ADH
    B) Thyroid-stimulating hormone (TSH)
    C) LH
    D) Somatostatin
    E) Somatomedin

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. By which mechanism do LH and FSH return to baseline levels?
    A) LH surge
    B) Negative feedback on gonadotropin-releasing hormone (GnRH) by progesterone
    C) Negative feedback on GnRH by estradiol
    D) Negative feedback on GnRH from testosterone

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. Which of the following is true during the 12-hour period preceding ovulation?
    A) A surge of LH is secreted from the pituitary
    B) The surge occurs immediately after the formation of the corpus luteum
    C) The surge is followed immediately by a fall in the plasma concentration of progesterone
    D) The number of developing follicles is increasing

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. What accompanies sloughing of the endometrium during the endometrial cycle in a normal woman?
    A) An increase in progesterone
    B) The LH "surge"
    C) A decrease in both progesterone and estrogen
    D) An increase in estradiol

24. Some cells secrete chemicals into the extracellular fluid that act on cells in the same tissue. Which of the following refers to this type of regulation?
    A) Neural
    B) Endocrine
    C) Neuroendocrine
    D) Paracrine
    E) Autocrine

25. Which of the following pairs is an example of the type of regulation referred to in Question 24?
    A) Somatostatin—GH secretion
    B) Somatostatin—insulin secretion
    C) Dopamine—prolactin secretion
    D) Norepinephrine—corticotropin-releasing hormone (CRH) secretion
    E) CRH—adrenocorticotropic hormone (ACTH) secretion

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. What is the nongenomic effect of testosterone on vascular smooth muscle?
    A) Vasodilation
    B) Vasoconstriction
    C) Increase in prostaglandins
    D) Increase in estrogen receptors

28. In the circulatory system of a fetus, which of the following is greater before birth than after birth?
    A) Arterial Po_2
    B) Right atrial pressure
    C) Aortic pressure
    D) Left ventricular pressure

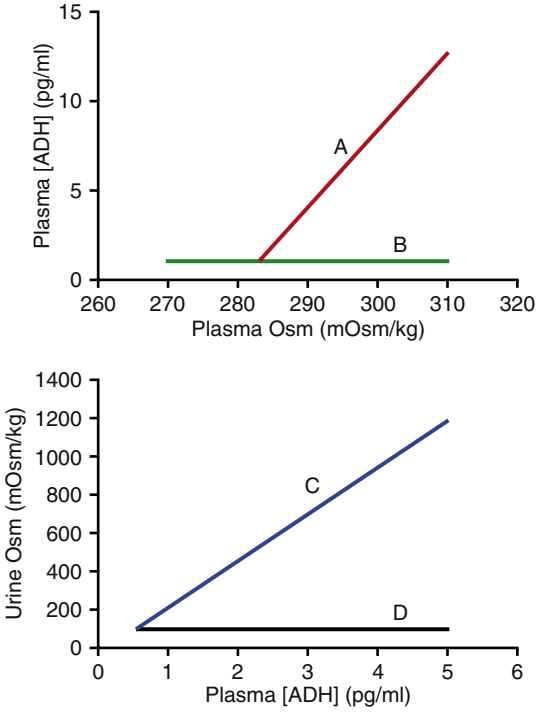
Questions 29 and 30

Match each of the patients described in Questions 29 and 30 with the correct set of plasma values listed in the table below. Normal values are as follows: plasma aldosterone concentration, 10 ng/dl; plasma cortisol concentration, 10 mg/dl; and plasma potassium concentration, 4.5 mEq/L.

	Aldosterone Concentration	Cortisol Concentration	Potassium Concentration
A)	10.0	2.0	4.5
B)	2.0	2.0	6.0
C)	40.0	30.0	2.0
D)	40.0	10.0	4.5
E)	40.0	10.0	2.0

29. A patient with Conn's syndrome.

30. A patient consuming a low-sodium diet.



31. In the above figure, which lines most likely reflect the responses in a patient with nephrogenic diabetes insipidus?
    A) A and C
    B) A and D
    C) B and C
    D) B and D

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. PTH does what directly?
    A) Controls the rate of 25-hydroxycholicalciferol formation
    B) Controls the rate of calcium transport in the mucosa of the small intestine
    C) Controls the rate of formation of calcium-binding protein
    D) Controls the rate of formation of 1,25-dihydroxycholicalciferol
    E) Stimulates renal tubular phosphate reabsorption

35. Which substances are most likely to produce the greatest increase in insulin secretion?
    A) Amino acids
    B) Amino acids and glucose
    C) Amino acids and somatostatin
    D) Glucose and somatostatin

36. Which of the following would be expected in a child with dwarfism due to pituitary dysfunction?

	Plasma [IGF-1]	Growth-Hormone-Releasing Hormone Secretion	Fasting Plasma [Glucose]
A)	↑	↑	↓
B)	↑	↑	↑
C)	↑	↓	↓
D)	↓	↓	↑
E)	↓	↓	↓
F)	↓	↑	↓

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. A patient has an elevated plasma thyroxine (T_4) concentration, a low plasma TSH concentration, and her thyroid gland is smaller than normal. What is the most likely explanation for these findings?
    A) A lesion in the anterior pituitary that prevents TSH secretion
    B) The patient is taking propylthiouracil
    C) The patient is taking thyroid extract
    D) The patient is consuming large amounts of iodine
    E) Graves' disease

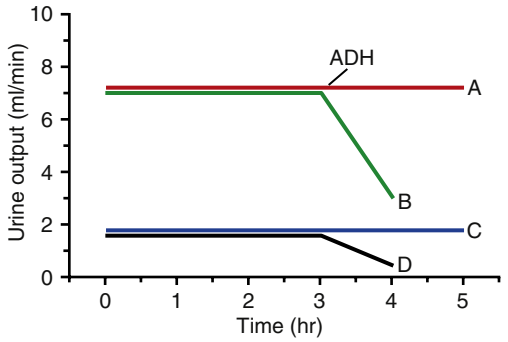
39. Extracellular ionic calcium activity will be decreased within 1 minute by which of the following?
    A) An increase in extracellular phosphate ion activity
    B) An increase in extracellular pH
    C) A decrease in extracellular partial pressure of carbon dioxide (P_{CO_2})
    D) All the above
    E) None of the above

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 anterior pituitary hormone plays a major role in the regulation of a nonendocrine target gland?
    A) ACTH
    B) TSH
    C) Prolactin
    D) FSH
    E) LH

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. A patient has a goiter associated with high plasma levels of both TRH and TSH. Her heart rate is elevated. This patient most likely has which condition?
    A) An endemic goiter
    B) A hypothalamic tumor secreting large amounts of TRH
    C) A pituitary tumor secreting large amounts of TSH
    D) Graves' disease

47. A man eats a low-carbohydrate meal that is rich in proteins containing the amino acids that stimulate insulin secretion. Which response accounts for the absence of hypoglycemia?
    A) Suppression of GH
    B) Suppression of somatomedin C secretion
    C) Stimulation of cortisol secretion
    D) Stimulation of glucagon secretion
    E) Stimulation of epinephrine secretion

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 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 the male?
    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_4
    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?

	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 percent 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 the male embryo. 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. Which change would be expected to occur with increased binding of a hormone to plasma proteins?
    A) Increase in plasma clearance of the hormone
    B) Decrease in half-life of the hormone
    C) Increase in hormone activity
    D) Increase in degree of negative feedback exerted by the hormone
    E) Increase in plasma reservoir for rapid replenishment of free hormone

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:

Sodium	137 mmol/L
Bicarbonate	14 mmol/L
Free calcium	2.8 mmol/L
Potassium	4.8 mmol/L
pH	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:

Sodium	138 mmol/L
Bicarbonate	22 mmol/L
Free calcium	2.3 mmol/L
Potassium	4.5 mmol/L
pH	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 HPO_4^-, which shifted the equilibrium between HPO_4^- and Ca^{++} toward $CaHPO_4$
    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. A patient presents with tachycardia and heat intolerance. You suspect Graves' disease. Which of the following is not consistent with your diagnosis?
    A) Increased total and free T_4
    B) Suppressed plasma [TSH]
    C) Exophthalmos
    D) Goiter
    E) Decreased thyroid radioactive iodine uptake

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?

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

69. Why is it important to feed newborn infants every few hours?
    A) The hepatic capacity to store and synthesize glycogen and glucose is not adequate to maintain the plasma glucose concentration in a normal range for more than a few hours after feeding
    B) If adequate fluid is not ingested frequently, the plasma protein concentration will rise to greater than normal levels within a few hours
    C) The function of the gastrointestinal system is poorly developed and can be improved by keeping food in the stomach at all times
    D) The hepatic capacity to form plasma proteins is minimal and requires the constant availability of amino acids from food to avoid hypoproteinemic edema

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. A chronic increase in the plasma concentration of thyroxine-binding globulin (TBG) would result in which of the following?
    A) An increased delivery of T_4 to target cells
    B) A decrease in plasma free [T_4]
    C) An increase in the conversion of T_4 to triiodothyronine (T_3) in peripheral tissues
    D) An increase in TSH secretion
    E) No change in metabolic rate

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

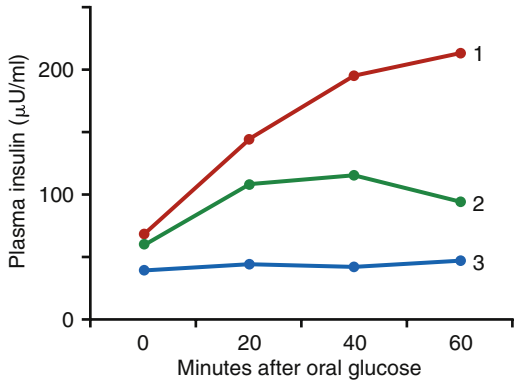
75. A 55-year-old man has developed the syndrome of inappropriate antidiuretic hormone secretion due to carcinoma of the lung. Which physiological response would be expected?
    A) Increased plasma osmolality
    B) Inappropriately low urine osmolality (relative to plasma osmolality)
    C) Increased 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_2 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 (DM)?

	Healthy	Type 1 DM	Type 2 DM
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 the neonate than in the 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 is diabetic, with poorly controlled hyperglycemia
    D) The mother is obese

86. In the fetus, why can normal growth occur despite low P_{O_2} levels?
    A) The concentration of hemoglobin A is increased in the fetus
    B) The hemoglobin of the fetus can carry more oxygen at lower P_{CO_2} levels
    C) The oxyhemoglobin curve in the fetus is shifted to the left
    D) The mother has increased blood volume during pregnancy

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_3 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. The placenta is incapable of synthesizing which hormones?
    A) Estrogen
    B) Progesterone
    C) Androgens
    D) Estriol

93. A neonate develops jaundice and has a bilirubin concentration of 10 mg/dl on day 2 (normal is 3 mg/dl at 2 days old). The neonatologist can be confident that the condition is not erythroblastosis fetalis if which of the following is true?
    A) The bilirubin concentration rises no further
    B) Hematocrit falls only slightly
    C) The mother, father, and neonate are all Rh-negative
    D) The mother has no history of hepatic dysfunction

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_4 and T_3. 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 PGE_2 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. Which symptom would least likely be associated with thyrotoxicosis?
    A) Tachycardia
    B) Increased appetite
    C) Somnolence
    D) Increased sweating
    E) Muscle tremor

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 DM?
    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)2D
   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. An experiment is conducted in which patients in group 1 are given compound X and patients in group 2 are given compound Y. After 3 weeks, studies show that patients in group 1 have a higher rate of ACTH secretion and a lower blood glucose concentration than those in group 2. Identify compounds X and Y.

	Compound X	Compound Y
A)	Cortisone	Placebo
B)	Cortisol	Placebo
C)	Placebo	Cortisol
D)	ACTH	Placebo
E)	Placebo	ACTH

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_4 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 component of the reproductive system has the most far-reaching effects on the physiology of the organism?
   A) /Y chromosomal effects
   B) X dose—one X chromosome versus two X chromosomes
   C) Gonadal steroid hormones
   D) Prenatal testosterone levels

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. Birth control pills containing combinations of synthetic estrogen and progesterone compounds that are given for the first 21 days of the menstrual cycle are effective in preventing pregnancy. What is the explanation for their efficacy?
   A) Prevention of the preovulatory surge of LH secretion from the pituitary gland
   B) Prevention of development of the ovarian follicles
   C) Suppression of the function of the corpus luteum soon after it forms
   D) Prevention of normal development of the endometrium

121. Which of the following would be expected in a patient with a genetic deficiency of 11-β-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_3 than for T_4?

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. Failure of the ductus arteriosus to close is a common developmental defect. Which condition would likely be present in a 12-month-old infant with patent ductus arteriosus?

A) Below normal arterial Po_2
B) Below normal arterial Pco_2
C) Greater than normal arterial blood pressure
D) Lower than normal pulmonary arterial pressure

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 severalfold. 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. During the latter stages of pregnancy, many women experience an increase in body hair growth in a masculine pattern. What is the explanation for this phenomenon?

A) The ovaries secrete some testosterone along with the large amounts of estrogen produced late in pregnancy
B) The fetal ovaries and testes secrete androgenic steroids
C) The maternal and fetal adrenal glands secrete large amounts of androgenic steroids that are used by the placenta to form estrogen
D) The placenta secretes large amounts of estrogen, some of which is metabolized to testosterone

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?

A) GH
B) Cortisol
C) Oxytocin
D) Prolactin
E) ACTH

139. During the week after ovulation, the endometrium increases in thickness to 5 to 6 millimeters. What stimulates this increase in thickness?

A) LH
B) Estrogen from the corpus luteum
C) Progesterone from the corpus luteum
D) FSH

140. Inhibition of the iodide pump would be expected to cause which change?

A) Increased synthesis of T_4
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 [β-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 would be expected to occur during the postprandial period?

	Adipocyte α-Glycerol Phosphate	Plasma [Insulin]	Glycogen Phosphorylase
A)	↑	↑	↓
B)	↑	↑	↑
C)	↑	↓	↑
D)	↓	↓	↑
E)	↓	↓	↓
F)	↓	↑	↓

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?

	Plasma [1,25-(OH)2D3]	Plasma [Phosphate]	Urinary Ca^{++} 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.

	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_4
D) ACTH
E) Cortisol

152. What is hormone 2?

A) TSH
B) T_4
C) CRH
D) ACTH
E) Cortisol

153. Which of the following would be expected in a patient with vitamin D deficiency?

	Plasma [1,25-(OH)2D3]	Bone Resorption	Intestinal Calbindin
A)	↑	↑	↑
B)	↑	↓	↑
C)	↑	↓	↓
D)	↓	↓	↑
E)	↓	↑	↓
F)	↓	↑	↑

ANSWERS

1. **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.
   TMP13 p. 1027

2. **D)** ADH increases the permeability of the collecting tubules and ducts to water, but not to sodium, which in turn increases water reabsorption and decreases water excretion. As a result, urine concentration increases and the retained water dilutes the plasma. ADH is synthesized in the supraoptic and paraventricular nuclei of the hypothalamus and has no direct effect on the thirst center.
   TMP13 pp. 949-364, 404, 949

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.
   TMP13 pp. 949, 1045

4. **B)** In nephrogenic diabetes insipidus, the kidneys cannot respond to ADH. Consequently, dilute urine and loss of water from the extracellular fluid occurs, resulting in hypernatremia. Hypernatremia stimulates thirst, which attenuates the severity of hypernatremia, whereas water restriction exacerbates hypernatremia. Hypernatremia also stimulates ADH secretion from the magnocellular neurons in the hypothalamus.
   TMP13 p. 949

5. **C)** After birth, systemic arterial resistance increases dramatically due to loss of the placental vasculature. Consequently, arterial pressure, left ventricular pressure, and left atrial pressure all increase. At the same time, pulmonary vascular resistance decreases due to expansion of the lungs, and pulmonary artery pressure, right ventricular pressure, and right atrial pressure all fall. Blood flow through the foramen is a function of the pressure gradient, which after birth favors flow from the left to the right atrium, but most of the flow is blocked by the septal flap on the septal wall of the left atrium.
   TMP13 pp. 1073-1075

6. **A)** Norepinephrine is released from the nerve terminals and endothelin is released from endothelial cells in the vasculature, causing vasoconstriction of the vasculature.
   TMP13 p. 1027

7. **C)** Type 2 DM 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.
   TMP13 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.
   TMP13 pp. 943-944, 996-997

9. **A)** During exercise, glucose utilization by muscle is increased, which is largely independent of insulin.
   TMP13 p. 985

10. **A)** Thecal cells do not have the capacity to produce estradiol because they lack aromatase.
    TMP13 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.
    TMP13 pp. 1043, 1044

12. **E)** HCG has the same stimulatory effect as LH on the corpus luteum. Administration of HCG would cause the corpus luteum to continue to secrete estrogen and progesterone, preventing degradation of the endometrium and the onset of menstruation.
    TMP13 p. 1059

13. **D)** Hypoglycemia is a potent stimulus for GH. GH decreases with aging and in response to the hypothalamic inhibitory hormone somatostatin. GH secretion would decrease in response to both exogenous GH administration and IGF-1 as a result of negative feedback inhibition.
    TMP13 p. 945

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_2 strongly stimulates uterine smooth muscle contraction and is formed at an increasing rate by the placenta late in gestation.
TMP13 p. 1064, 1066

15. A) Ultraviolet light absorbed by the skin directly facilitates conversion of cholesterol to 25-hydroxycholesterol.
TMP13 p. 1007

16. D) Pulmonary vascular resistance greatly decreases as a result of expansion of the lungs. In the unexpanded fetal lungs, the blood vessels are compressed because of the small volume of the lungs. Immediately upon expansion, these vessels are no longer compressed, and the resistance to blood flow decreases severalfold.
TMP13 pp. 1073, 1074

17. D) The inhibitory hormone somatostatin is both synthesized and stored in the hypothalamus. Both TSH and LH are synthesized and stored in the anterior pituitary gland. ADH is synthesized in the hypothalamus but is stored in the posterior pituitary gland. Somatomedin (IGF-1) is synthesized in the liver.
TMP13 p. 946

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.
TMP13 p. 936

19. C) Just before the LH surge, estradiol levels increase, which causes negative feedback on GnRH to stop producing LH and FSH, resulting in the decrease in their levels.
TMP13 p. 1039

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.
TMP13 p. 1033

21. B) Ovulation will not take place unless a surge of LH precedes it. Immediately prior to ovulation, the number of follicles is decreasing due to normal attrition of all but one follicle, and consequently estrogen synthesis by the ovary is decreasing. Progesterone synthesis is stimulated by the LH surge.
TMP13 pp. 1039, 1040

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.
TMP13 pp. 1046-1047

23. C) At the end of the luteal phase, the corpus luteum is resorbed and fails to produce progesterone and estradiol, making levels fall precipitously and causing the endometrium to slough.
TMP13 p. 1039

24. D) Paracrine communication refers to cell secretions that diffuse into the extracellular fluid to affect neighboring cells.
TMP13 p. 925

25. B) The delta cells of the pancreas secrete somatostatin, which inhibits the secretion of insulin and glucagon from the pancreatic beta and alpha cells, respectively. Choice D is an example of neural communication, and the remaining choices are examples of neuroendocrine communication.
TMP13 pp. 925, 993

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.
TMP13 pp. 1028, 1031

27. A) Testosterone causes vasodilation by inhibiting L-type calcium channels to inhibit calcium influx into the cells, thus causing vasodilation.
TMP13 p. 1026

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.
TMP13 pp. 1073-1075

29. E) Patients with Conn's syndrome have tumors of the zona glomerulosa that secrete large amounts of aldosterone. Consequently, plasma levels of aldosterone are elevated, causing hypokalemia. The secretion of cortisol from the zona fasciculata is normal.
TMP13 p. 981

30. D) Aldosterone secretion is elevated when dietary sodium intake is low, but cortisol secretion is normal. Although aldosterone increases the rate of potassium secretion by the principal cells of the collecting tubules, this effect is offset by a low distal tubular flow rate. Consequently, there is little change in either potassium excretion or plasma potassium concentration.
TMP13 pp. 971-972

31. B) In patients with nephrogenic diabetes insipidus, the kidneys do not respond appropriately to ADH, and the ability to form concentrated urine is impaired. In contrast, there is a normal ADH secretory response to changes in plasma osmolality.
TMP13 pp. 380-381, 949

32. C) Aromatase causes conversion of testosterone to estradiol.
TMP13 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.
TMP13 pp. 1073, 1074

34. D) Parathyroid hormone acts in the renal cortex to stimulate the reaction forming 1,25-dihydroxycholicalciferol from 25-hydroxycholicalciferol. It has no effects on other the other reactions.
TMP13 pp. 1007-1008

35. B) Both amino acids and glucose stimulate insulin secretion. Furthermore, amino acids strongly potentiate the glucose stimulus for insulin secretion. Somatostatin inhibits insulin secretion.
TMP13 pp. 990-991, 993

36. F) In this form of dwarfism, there is decreased synthesis and secretion of GH into the circulation. As a result, stimulation of hepatic IGF-1 secretion is decreased and secretion of hypothalamic GnRH is increased due to diminished negative feedback. GH has several actions to increase blood levels of glucose, and when blood levels of GH are inappropriately low, fasting blood glucose concentration tends to fall.
TMP13 pp. 943-947

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.
TMP13 pp. 1033, 1060-1061

38. C) If a subject took sufficient amounts of exogenous thyroid extract to increase plasma levels of T_4 above normal, feedback would cause the secretion of TSH to decrease. Low plasma levels of TSH would result in atrophy of the thyroid gland. In a person with Graves' disease, the same changes in plasma levels of T_4 and TSH would be present, but the thyroid gland would not be atrophied. In fact, goiter is often present in patients with Graves' disease. A lesion in the anterior pituitary that prevents TSH secretion or the taking of propylthiouracil or large amounts of iodine would be associated with low plasma levels of T_4.
TMP13 pp. 959-960

39. D) Choices A to C would all shift the mass action balance toward the side favoring association of ionic calcium with phosphate compounds or other anionic compounds, resulting in reduced levels of free ionic calcium.
TMP13 p. 1001

40. B) In the nonpregnant female, 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.
TMP13 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.
TMP13 pp. 954, 958-962

42. C) The major target tissue for prolactin is the breast, where it stimulates the secretion of milk. The other anterior pituitary hormones (ACTH, TSH, FSH, and LH) stimulate hormones from endocrine glands.
TMP13 p. 927

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.
TMP13 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.
TMP13 p. 949

45. B) NO is the vasodilator that is normally released, causing vasodilation in these arteries.
TMP13 pp. 1027, 1034

46. B) A hypothalamic tumor secreting large amounts of TRH would stimulate the pituitary gland to secrete increased amounts of TSH. As a result, the secretion of thyroid hormones would increase, which would result in an elevated heart rate. In comparison, a patient with either a pituitary tumor secreting large amounts of TSH or Graves' disease would have low plasma levels of TRH because of feedback. Both TRH and TSH levels would be elevated in an endemic goiter, but the heart rate would be depressed because of the low rate of T_4 secretion.
TMP13 pp. 957-962

47. D) Consumption of amino acids stimulates both GH and glucagon secretion. Increased glucagon secretion tends to increase blood glucose concentration and thus opposes the effects of insulin to cause hypoglycemia.
TMP13 pp. 992-993

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.
TMP13 pp. 958-962

49. D) Inhibin prevents FSH release from the anterior pituitary, preventing Sertoli cells from causing aromatization to produce estradiol.
TMP13 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.
TMP13 pp. 1050, 1051

51. D) Phosphodiesterase-5 receptors prevent hydrolysis of cyclic guanosine monophosphate, thus keeping the levels high and maintaining vasodilation.
TMP13 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.
TMP13 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.
TMP13 p. 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.
TMP13 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.
TMP13 p. 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. That process leads to the release of enzymes that "harden" the zona pellucida and prevent other sperm from penetrating.
TMP13 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.
TMP13 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.
TMP13 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.
TMP13 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.
TMP13 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 luteae 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).
TMP13 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.
TMP13 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.
TMP13 pp. 219-220, 364, 383, 405, 949-950

64. E) Protein-bound hormones are biologically inactive and cannot be metabolized. Thus, an increase in protein binding would tend to decrease hormone activity and plasma clearance and increase the half-life of the hormone. Free hormone is also responsible for negative feedback inhibition of hormone secretion. Therefore, a sudden increase in hormone binding to plasma proteins would decrease negative feedback. Protein binding of hormones does, however, provide a reservoir for the rapid replacement of free hormone.
TMP13 pp. 929-930

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.
TMP13 pp. 1011-1012

66. E) In Graves' disease, antibodies against the TSH receptor in the thyroid gland stimulate many of the steps in the synthesis of thyroid hormones, including increased iodine uptake. Due to excessive stimulation of the gland, the thyroid gland hypertrophies and secretes increased amounts of thyroid hormones. High circulating levels of thyroid hormones inhibit TSH secretion due to negative feedback inhibition. The antibodies present in Graves' disease also cause pathological changes in the tissue surrounding the eyes, leading to protrusion of the eyeballs.
TMP13 pp. 960-961

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.
TMP13 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.
TMP13 pp. 970, 981

69. A) Because the liver functions imperfectly during the first weeks of life, the glucose concentration in the blood is unstable and falls to very low levels within a few hours after feeding.
TMP13 pp. 1075, 1076

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.
TMP13 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.
TMP13 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.
TMP13 pp. 971-972, 979-980

73. E) In the steady state, high plasma levels of TBG would simply increase the reservoir for hormone and, therefore, the total amount of thyroid hormone in the circulation. However, protein-bound hormone is inactive. The metabolic effects of thyroid hormones and their feedback inhibition on TSH secretion are determined

by the free thyroid hormone and not the total amount of thyroid hormone in the circulation. Both the plasma levels of free thyroid hormone and TSH would be expected to be normal in the steady state. Consequently, the metabolic rate would be unchanged.

TMP13 pp. 929-930, 955-960

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.

TMP13 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.

TMP13 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.

TMP13 pp. 1027, 971-972

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

TMP13 p. 1048

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

TMP13 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 DM, insulin secretion is depressed. In contrast, in type 2 DM, 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.

TMP13 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.

TMP13 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.

TMP13 p. 932

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

TMP13 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.

TMP13 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.

TMP13 pp. 957, 962-963

85. C) An infant born of an untreated diabetic mother 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.

TMP13 pp. 1078-1079

86. C) Hemoglobin F levels are higher in the fetus than in the mother, and hemoglobin F in the fetus can carry more oxygen than can hemoglobin in the mother.

TMP13 p. 1058

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).

TMP13 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.

TMP13 p. 971

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

TMP13 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.

TMP13 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.
TMP13 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.
TMP13 p. 1060

93. C) For erythroblastosis fetalis to occur, the baby must inherit Rh-positive red blood cells from the father. If the mother is Rh-negative, she then becomes immunized against the Rh-positive antigen in the red blood cells of the fetus, and her antibodies destroy fetal red blood cells, releasing large quantities of bilirubin into the plasma of the fetus.
TMP13 p. 1076

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.
TMP13 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.
TMP13 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.
TMP13 p. 1024

97. B) A protein meal stimulates all three hormones indicated.
TMP13 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.
TMP13 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 adrenocorticotropic hormone secretion and, therefore, a decrease in plasma cortisol concentration.
TMP13 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.
TMP13 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.
TMP13 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.
TMP13 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.
TMP13 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.
TMP13 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.
TMP13 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.

TMP13 pp. 972-973, 976-977, 979-980

107. C) Thyrotoxicosis indicates the effects of thyroid hormone excess. Thyroid hormone excites synapses. In contrast, somnolence is characteristic of hypothyroidism. Tachycardia, increased appetite, increased sweating, and muscle tremor are all signs of hyperthyroidism.

TMP13 pp. 956-958, 961

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.

TMP13 p. 1029

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

TMP13 p. 1055

110. D) Because insulin secretion is deficient in persons with type 1 DM, 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 DM.

TMP13 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.

TMP13 pp. 945-946

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

TMP13 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.

TMP13 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.

TMP13 pp. 961, 981

115. C) Increased plasma levels of cortisol tend to increase plasma glucose concentration and inhibit ACTH secretion. Therefore, if cortisol were administered to patients in group 2, the patients in group 1 would have lower plasma glucose concentrations and higher plasma levels of ACTH.

TMP13 pp. 972-973, 976-977

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.

TMP13 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.

TMP13 pp. 1026, 1027

118. C) The gonadal steroids, in addition to controlling reproductive function, also control nonreproductive organ function via their estrogen and androgen receptors. For example, estrogens control vascular function due to their ability to increase intracellular calcium in vascular smooth cells causing vasodilation. In addition, estradiol upregulates synthesis of endothelial NO synthase, leading to vasodilation.

TMP13 p. 1034

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.

TMP13 pp. 1006-1007

120. A) Administration of either estrogen or progesterone in appropriate quantities during the first half of the menstrual cycle can inhibit ovulation by preventing the preovulatory surge of LH secretion by the anterior pituitary gland, which is essential for ovulation.
TMP13 pp. 1040, 1041

121. B) In the absence of 11-β-hydroxysteroid dehydrogenase, renal epithelial cells cannot convert cortisol to cortisone and, 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.
TMP13 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.
TMP13 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.
TMP13 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.
TMP13 pp. 1068-1069

125. A) If the ductus arteriosus remains patent, poorly oxygenated blood from the pulmonary artery flows into the aorta, giving the arterial blood an oxygen level that is below normal.
TMP13 p. 1075

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.
TMP13 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.
TMP13 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.
TMP13 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.
TMP13 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.
TMP13 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.
TMP13 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.
TMP13 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.
TMP13 p. 942

134. B) Increased heart rate, increased respiratory rate, and decreased cholesterol concentration are all responses to excess thyroid hormone.
TMP13 pp. 956-958

135. C) Estrogen secreted by the placenta is not synthesized from basic substrates in the placenta. Instead, it is formed almost entirely from androgenic steroid compounds that are formed in the adrenal glands of both the mother and the fetus. These androgenic compounds are transported by the blood to the placenta and converted by the trophoblast cells to estrogen compounds. Their concentration in the maternal blood may also stimulate hair growth on the body.
TMP13 pp. 1060-1061

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.
TMP13 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.
TMP13 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.
TMP13 pp. 925, 948-950

139. C) Progesterone secreted in large quantities from the corpus luteum causes marked swelling and secretory development of the endometrium.
TMP13 pp. 1046-1047

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.
TMP13 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).
TMP13 p. 1056

142. A) Both ADH and oxytocin are peptides containing nine amino acids. Their chemical structures differ in only two amino acids.
TMP13 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.
TMP13 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.
TMP13 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.
TMP13 p. 1074

146. A) After eating a meal, insulin secretion increases. Increased plasma levels of insulin inhibit glycogen phosphorylase, the enzyme that causes glycogen to split into glucose. In addition, insulin promotes glucose uptake in adipose tissue, providing α-glycerol

phosphate, which is needed to combine fatty acids with triglycerides, the storage form of fat.

TMP13 pp. 985-990

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.

TMP13 p. 942

148. D) Osteoblasts secrete all of the above 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.

TMP13 pp. 1004-1006

149. B) In primary hyperparathyroidism, high plasma levels of PTH increase the formation of 1,25-(OH)2D3, 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.

TMP13 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.

TMP13 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.

TMP13 pp. 955-957, 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.

TMP13 pp. 972-974, 976-977

153. E) Vitamin D deficiency leads to rickets in children and osteomalacia in adults. A deficiency in vitamin D leads to reduced synthesis of the active form of the vitamin 1,25-(OH)2D3. In turn, in the presence of low plasma levels of 1,25-(OH)2D3, the synthesis of calbindin in the intestine is reduced, resulting in impaired intestinal absorption of calcium. Impaired intestinal absorption of calcium tends to cause hypocalcemia, which stimulates PTH secretion. Increased PTH secretion contributes to the maintenance of plasma calcium concentration, in part, by increasing bone resorption.

TMP13 pp. 1010-1011, 1015