

YR 2 – NERVOUS, SENSE ORGANS, ENDOCRINE SYSTEMS

Station A: Neurons and Reflex Arc

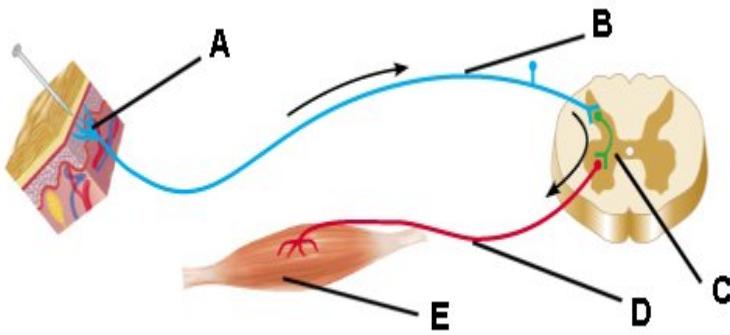


Diagram 1

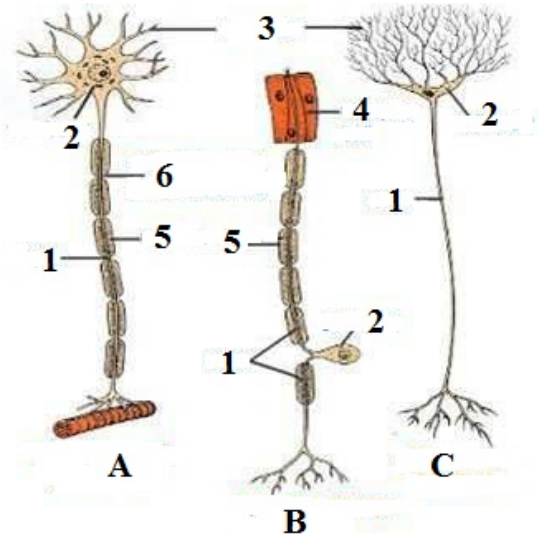


Diagram 2

Use the Diagram 1 in answering Questions 1-5.

1. Give the name and functions of the structure *labeled A* on the diagram.
2. Give the name and functions of the structure *labeled B* on the diagram.
3. Give the name and functions of the structure *labeled C* on the diagram.
4. Give the name and functions of the structure *labeled D* on the diagram.
5. Give the name and functions of the structure *labeled E* on the diagram.

Use Diagram 2 in answering Questions 6-10

6. Which neuron (*A, B, C*) is the interneuron?
7. Which neuron (*A, B, C*) is the sensory neuron?
8. Which neuron (*A, B, C*) is the motor neuron?
9. Give the name and function of the structure *labeled 5* on the diagram?
10. Using the numbers representing axon, cell body, and dendrite, give the numbers in the order of the travel of the impulse along the neuron.

Station A: Neurons and Reflex Arc

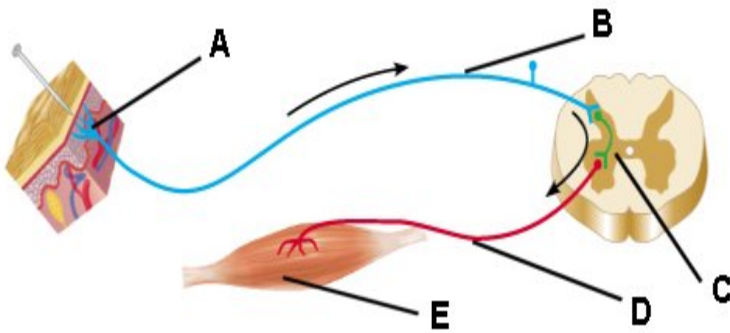


Diagram 1

Use the *Diagram 1* in answering Questions 1-5.

1. Give the name and functions of the structure labeled A on the diagram.
Receptor - reacts to a stimulus
2. Give the name and functions of the structure labeled B on the diagram.
Sensory Neuron (Afferent Neuron) - conducts impulses to the CNS
3. Give the name and functions of the structure labeled C on the diagram.
Interneuron (Association Neuron) - consists of one or more synapses in the CNS (most are in the spine)
4. Give the name and functions of the structure labeled D on the diagram.
Motor Neuron (Efferent Neuron) - conducts impulses from CNS to effector.
5. Give the name and functions of the structure labeled E on the diagram.
Effector - muscle fibers or glands, responds by contracting or secreting a product.

Use *Diagram 2* in answering Questions 6-10

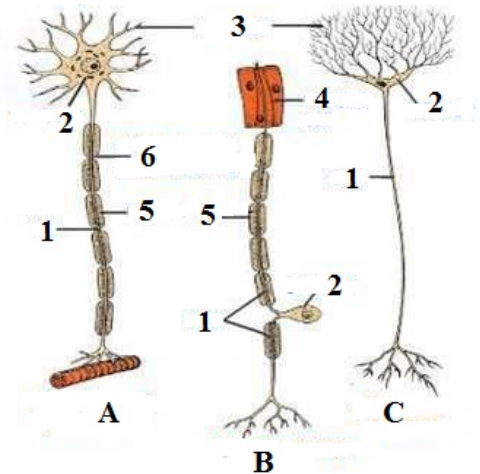


Diagram 2

6. Which neuron (A, B, C) is the interneuron?
C
7. Which neuron (A, B, C) is the sensory neuron?
B
8. Which neuron (A, B, C) is the motor neuron?
A
9. Give the name and function of the structure labeled 5 on the diagram?
Myelin Sheath – fatty layer that provides insulation for the axon
10. Using the numbers representing axon, cell body, and dendrite, give the numbers in the order of the travel of the impulse through the body
3-> 2-> 1

Station B: Brain

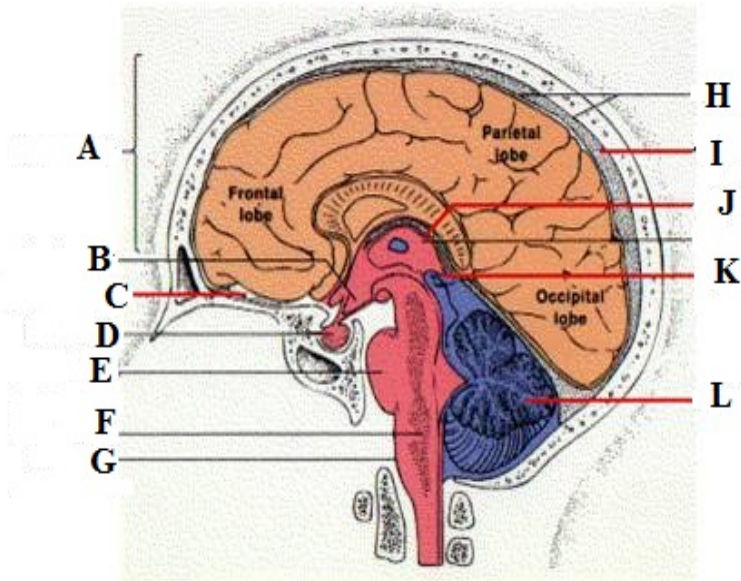


DIAGRAM 1

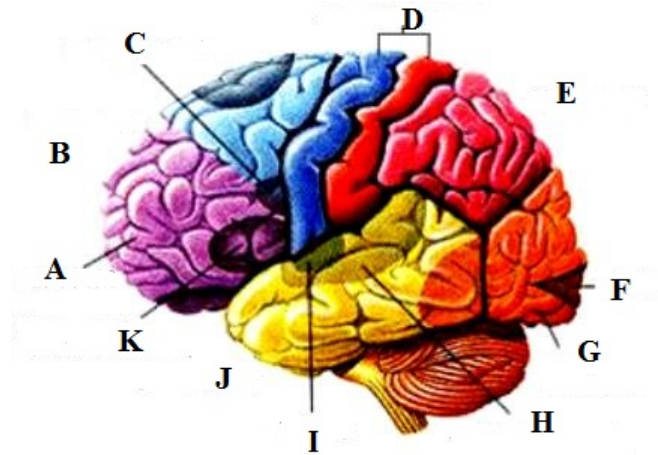


DIAGRAM 2

For Questions 11-15, use Diagram 1 to give the letter from the diagram for the location and then give the function for the following of the structures:

11. Medulla oblongata
12. Reticular formation
13. Cerebellum
14. Cerebrum
15. Hypothalamus

For Questions 11-15, use Diagram 2 to give the letter from the diagram for the location and then give the function for the following of the structures:

16. Sensory-Motor Area
17. Auditory Area
18. Broca's area in the Left Hemisphere
19. Visual Area
20. Frontal eye field

Station B: Brain

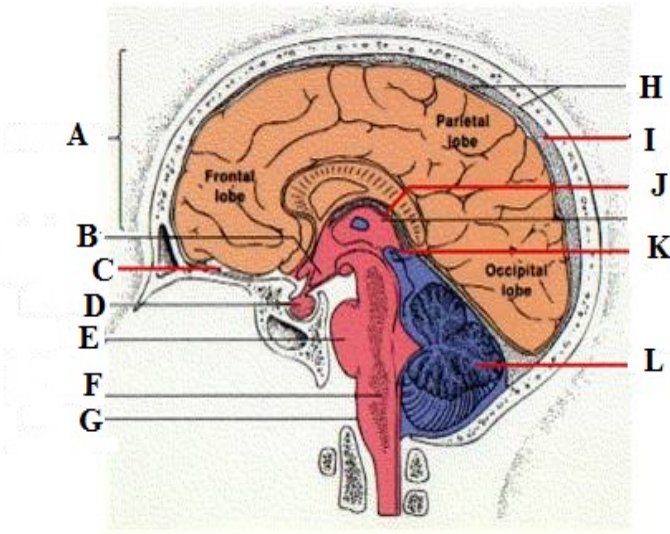


DIAGRAM 1

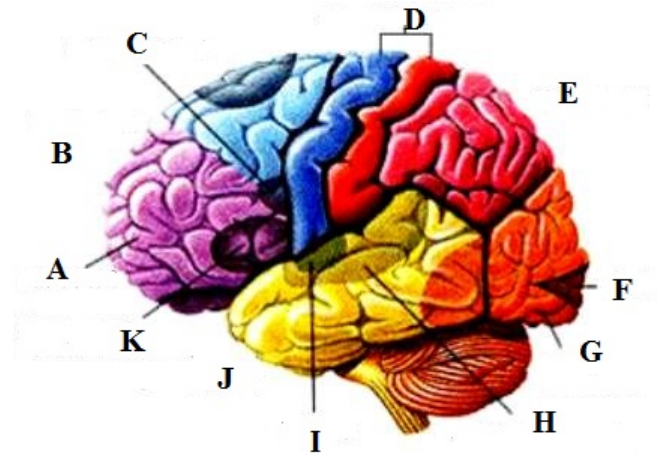


DIAGRAM 2

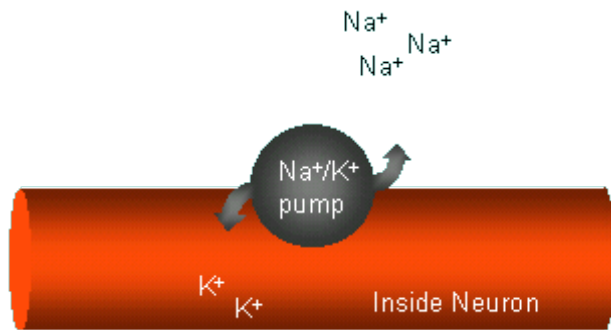
For Questions 11-15, use Diagram 1 to give the letter from the diagram for the location and then give the function for the following of the structures:

11. Medulla oblongata
G– vital reflexes as heart beat, respiration
12. Reticular formation
F– sets priorities
13. Cerebellum
L–muscle coordination, muscle tone, balance
14. Cerebrum
A– conscious activities
15. Hypothalamus
B– control of hormones

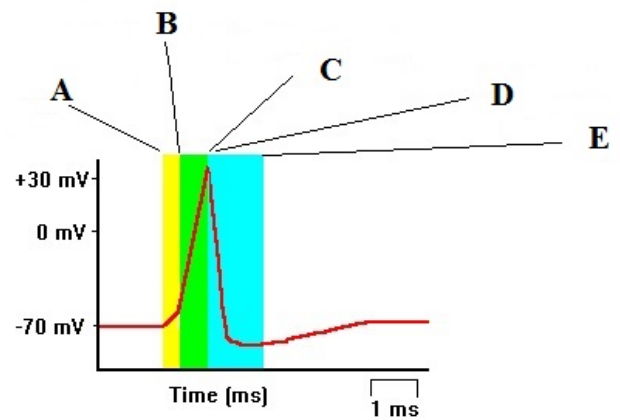
For Questions 16-20, use Diagram 2 to give the letter from the diagram for the location and then give the function for the following of the structures:

16. Sensory-Motor Area
D- impulses come in and voluntary responses go out
17. Auditory Area
I-hearing
18. Broca's area in the Left Hemisphere
K- production of language or speech
19. Visual Area
F- receives visual information from thalamus and associated with G – the visual association area that interprets the visual information that has been received
20. Frontal eye field
C- visual attention and eye movements

Station C: Nerve Impulse Mechanism



Sodium-potassium pump



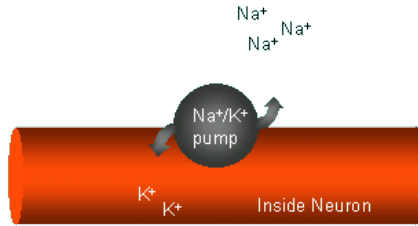
Action Potential Graph

21. – 25. Explain the mechanism by which a nerve impulse travels along a nerve cell. Use the diagrams if it will help you with your explanation.

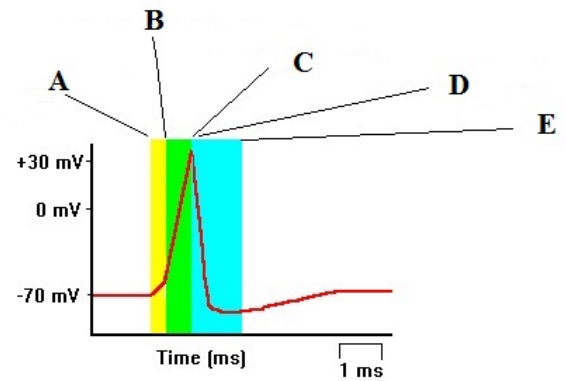
For Questions 26 – 30, use the letters from the Action Potential Graph to answer the questions?

26. Which letter represent when the potassium channels open?
27. Which letter represent when the sodium channels open?
28. Which letter represent when the more sodium channels open?
29. Which letter represent when the sodium channels close?
30. Which letter represent when the potassium channels close ?

Station C: Nerve Impulse Mechanism



Sodium-potassium pump



Action Potential Graph

21. – 25. Explain the mechanism by which a nerve impulse travels along a nerve cell. Use the diagrams if it will help you with your explanation.

Sodium pump explained

- *Neurons have a charge difference from the extracellular fluid surrounding them and this difference is termed a potential. The nerve impulse uses sodium and potassium ions to change potential forming an impulse or action potential by depolarization and repolarization and is termed its ACTION POTENTIAL*
- *Na⁺K⁺ pump - Mechanism for nerve impulse movement*
 - *The cell membrane of the neuron has thousands of tiny molecules called gates which allow sodium or potassium ions to pass through*
 - *Generally the gates are closed when the neuron is at rest*
 - *A nerve impulse begins when an impulse disturbs the cell membrane enough to OPEN the Sodium Gates.*
 - *The opening of the sodium gates allows sodium ions to MOVE INTO the neuron causing the inside to become more Positive than the outside with is called depolarized*
 - *As the impulse passes, the Potassium Gates OPEN allowing potassium ions to FLOW OUT so the inside resumes a negative charge and is termed repolarized.*

After a nerve impulse there is a short period when the neuron cannot transmit an impulse while it returns to normal – the Refractory Period when the sodium-potassium pumps

- *returns sodium ions to the outside and potassium ions back to the inside returning the neuron to its RESTING POTENTIAL*

For Questions 26 – 30, use the letters from the Action Potential Graph to answer the questions?

26. Which letter represent when the potassium channels open?

D

27. Which letter represent when the sodium channels open?

A

28. Which letter represent when the more sodium channels open?

B

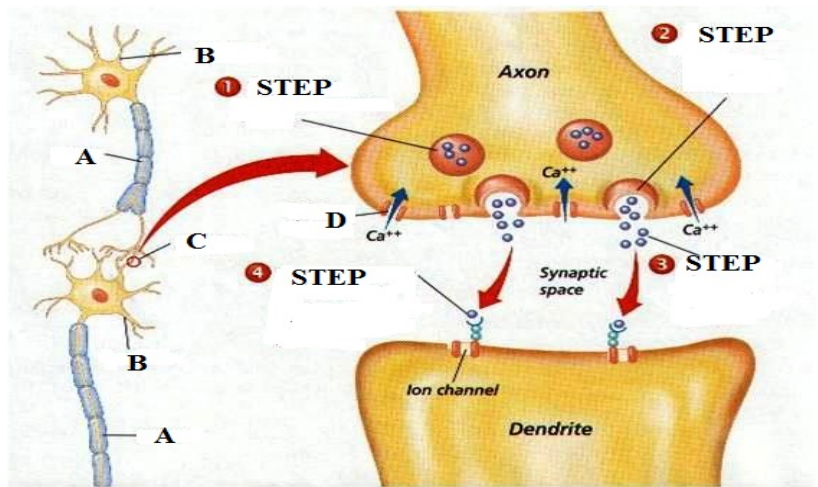
29. Which letter represent when the sodium channels close?

C

30. Which letter represent when the potassium channels close ?

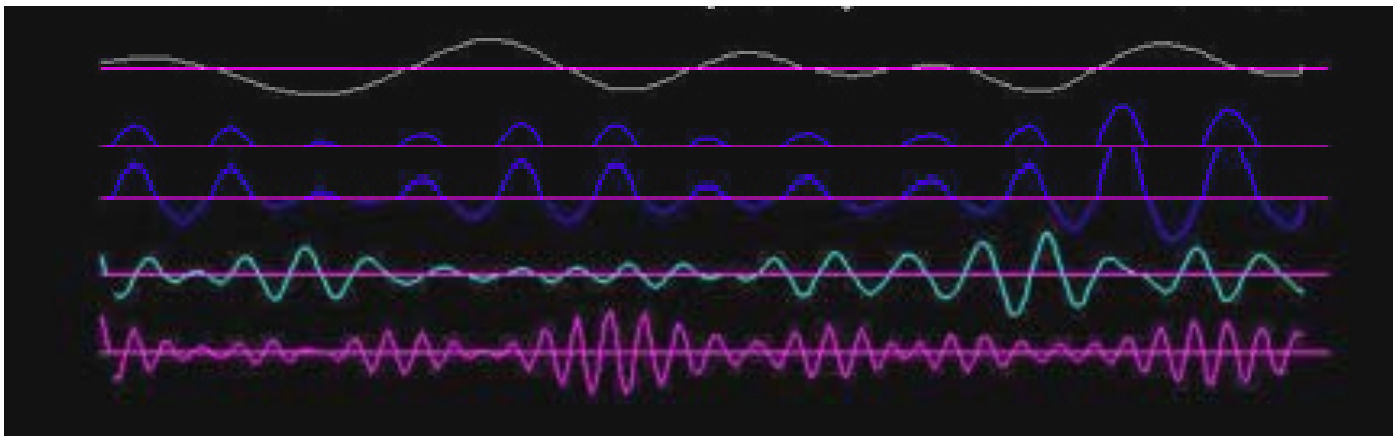
E

Station D: Synapse & Brain Waves



31. -35. Explain the process occurring as an impulse reaches the Axon Terminal

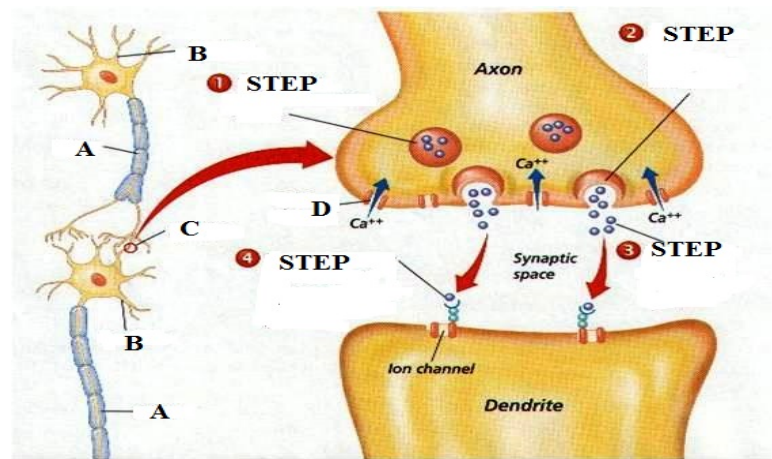
Alpha, Beta, Delta, and Theta Brain Waves



For questions 36 – 39, identify the above resting wave forms from top to bottom.

- 36.
- 37.
- 38.
- 39.
40. Which of these wave forms tend to be present posteriorly more than anteriorly and are especially prominent with closed eyes and with relaxation?

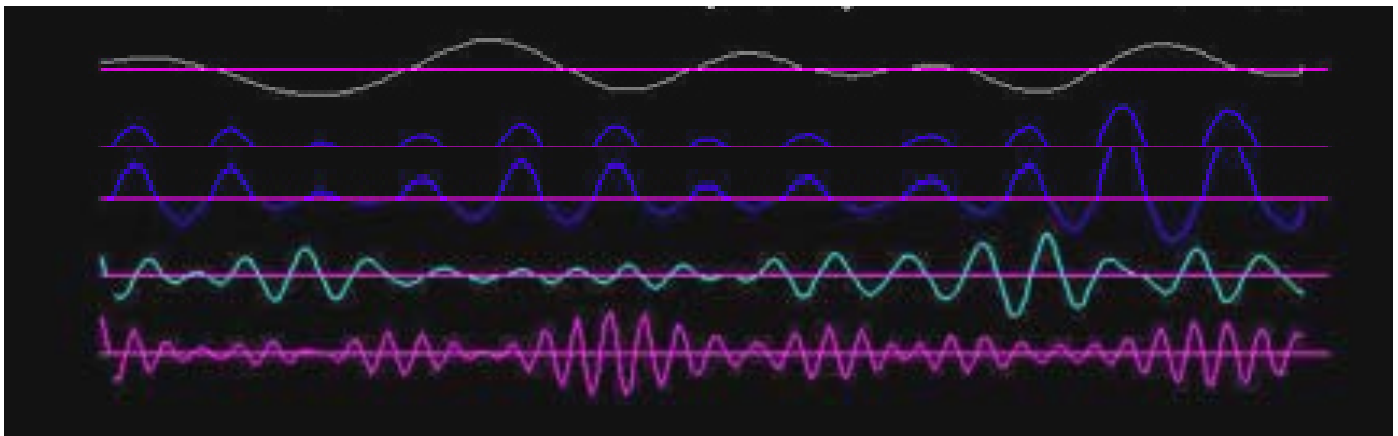
Station D: Synapse & Brain Waves



31. -35. Explain the process occurring as an impulse reaches the Axon Terminal

- *When the impulse reaches the Axon Terminal, dozens of vesicles fuse with the cell membrane and discharge the neurotransmitter into the Synaptic Cleft or Space*
- *When the neurotransmitter diffuses across the synapse and binds with the receptor on the dendrite of the next nerve cells, the new impulse is started in the dendrite*
- *After the neurotransmitter relays its message, it is rapidly removed or destroyed.*

Alpha, Beta, Delta, and Theta Brain Waves



For questions 36 – 39, identify the above resting wave forms from top to bottom.

36. *Delta waves*

37. *Theta waves*

38. *Alpha waves*

39. *Beta waves*

40. Which of these wave forms tend to be present posteriorly more than anteriorly and are especially prominent with closed eyes and with relaxation?

Alpha waves

Station E: Senses

- 41. What are the 5 types of Sensory Receptors based upon the stimulus they detect?
- 42. Where are the Sense Organs located?
- 43. What are the Special Senses?
- 44. Where are General Sense Receptors located?
- 45. What do the general senses detect?

For Questions 46-50, use the following key to name the type of General Sense Receptors

- A. Proprioceptors**
- B. Nociceptors**
- C. Pacinian corpuscles**
- D. Meissner's corpuscles**
- E. Ruffini endings**

- 46. Skin receptors for light touch at the surface of the skin
- 47. Pain receptors that respond selectively to painful stimuli – potentially damaging stimuli as extremes in temperature pressure, and injury-related chemicals
- 48. Detect pressure deep in your skin
- 49. Stretch receptors located in joints, ligaments, and tendons
- 50. Respond to **continuous** pressure in the dermis of your skin

Station E: Senses

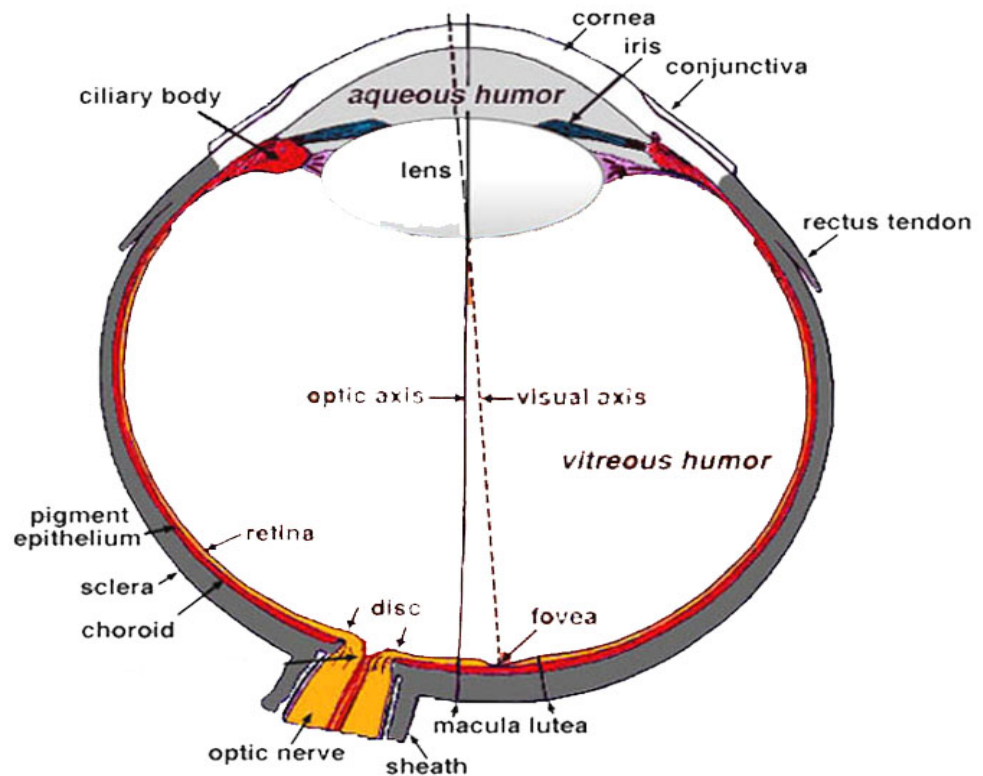
41. What are the 5 types of Sensory Receptors based upon the stimulus they detect?
mechanoreceptors, thermoreceptors, pain receptors, chemoreceptors, and photoreceptors
42. Where are the Sense Organs located?
in the head
43. What are the Special Senses?
vision, hearing, equilibrium, taste and smell
44. Where are General Sense Receptors located?
the receptors are widely distributed in the skin, muscles, tendons, joints and viscera
45. What do the general senses detect?
Skin – Hot, cold, pressure, pain
Muscles, joints, and tendons – proprioceptors- stretch receptors respond to stretch or compression
Pain Receptors – somatic or visceral

For Questions 46-50, use the following key to name the type of General Sense Receptors

- A. Proprioceptors
- B. Nociceptors
- C. Pacinian corpuscles
- D. Meissner's corpuscles
- E. Ruffini endings

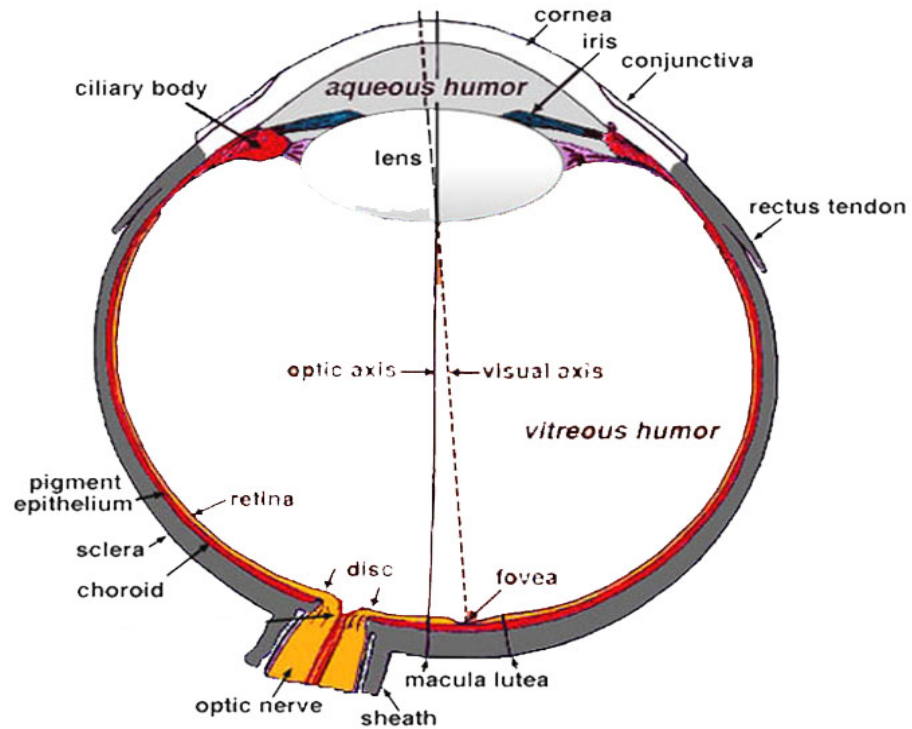
46. Skin receptors for light touch at the surface of the skin **D**
47. Pain receptors that respond selectively to painful stimuli – potentially damaging stimuli as extremes in temperature pressure, and injury-related chemicals **B**
48. Detect pressure deep in your skin **C**
49. Stretch receptors located in joints, ligaments, and tendons **A**
50. Respond to *continuous* pressure in the dermis of your skin **E**

Station F: Eye



51. Where are the rods and cones located?
52. Which layer has dark pigment to absorb extra light and keep the inside of the eye dark?
53. What part has the pigment for eye color?
54. What substance fills the posterior chamber and keep the eye from collapsing?
55. What structure regulates the amount of light passing to the visual receptors of the eye?
56. Vision is most acute when light rays are brought to focus on what region of the retina?
57. The perception of color comes from which 3 types of cones?
58. An increase in aqueous fluid pressure is a symptom of what disorder?
59. Night blindness can be treated with vitamin?
60. What type of eye disorder is caused by the eyeball being too long? (nearsightedness or farsightedness)

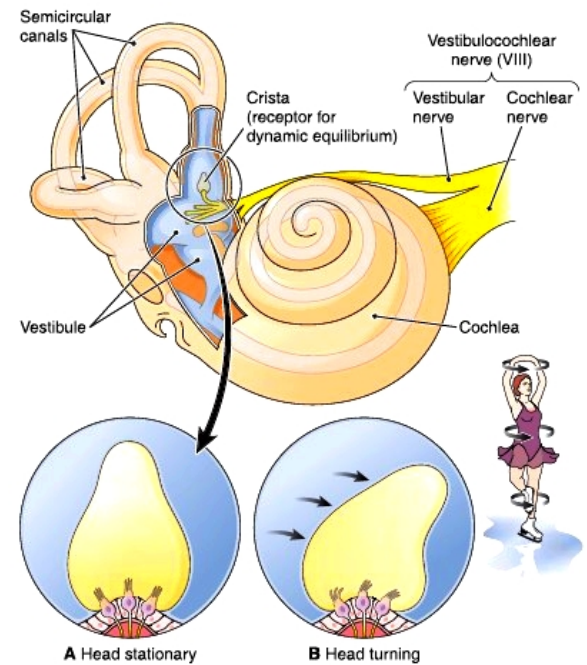
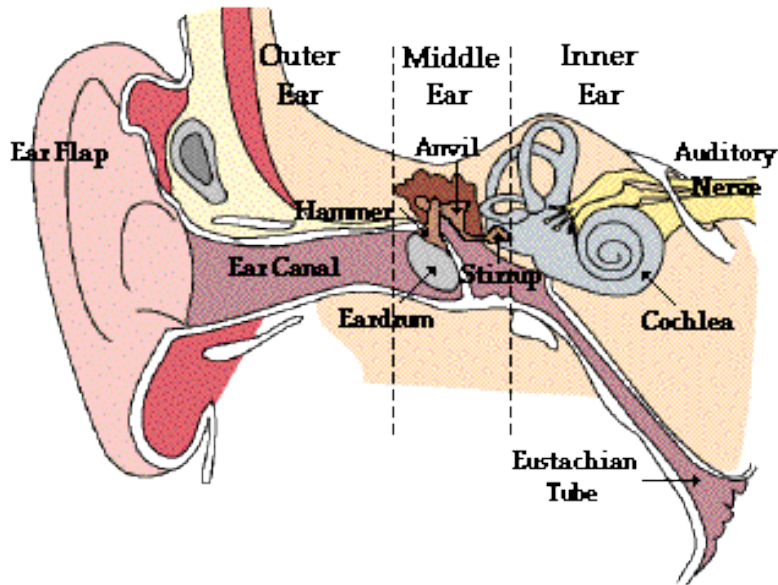
Station F: Eye



51. Where are the rods and cones located?
Retina
52. Which layer has dark pigment to absorb extra light and keep the inside of the eye dark?
Choroid
53. What part has the pigment for eye color?
Iris
54. What substance fills the posterior chamber and keep the eye from collapsing?
Vitreous humor
55. What structure regulates the amount of light passing to the visual receptors of the eye?
Iris
56. Vision is most acute when light rays are brought to focus on what region of the retina?
Fovea
57. The perception of color comes from which 3 types of cones? *red, green, and blue*
58. An increase in aqueous fluid pressure is a symptom of what disorder? *glaucoma*
59. Night blindness can be treated with vitamin? *Vitamin A*
60. What type of eye disorder is caused by the eyeball being too long? (nearsightedness or farsightedness)
nearsightedness – Myopia

Station G: Ear

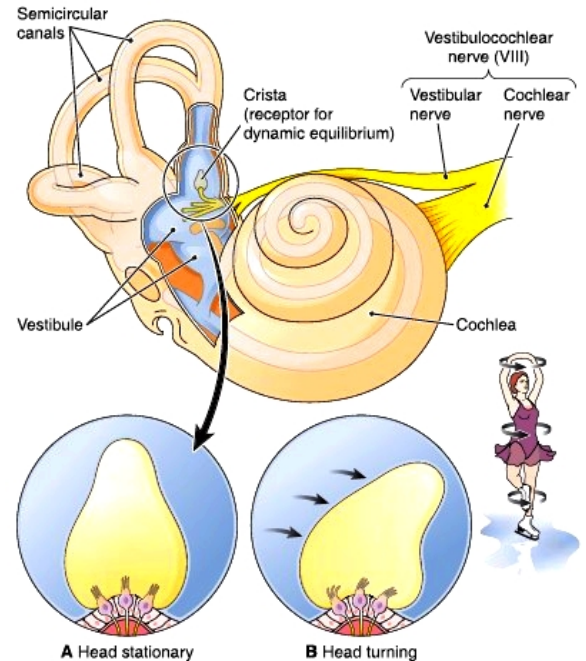
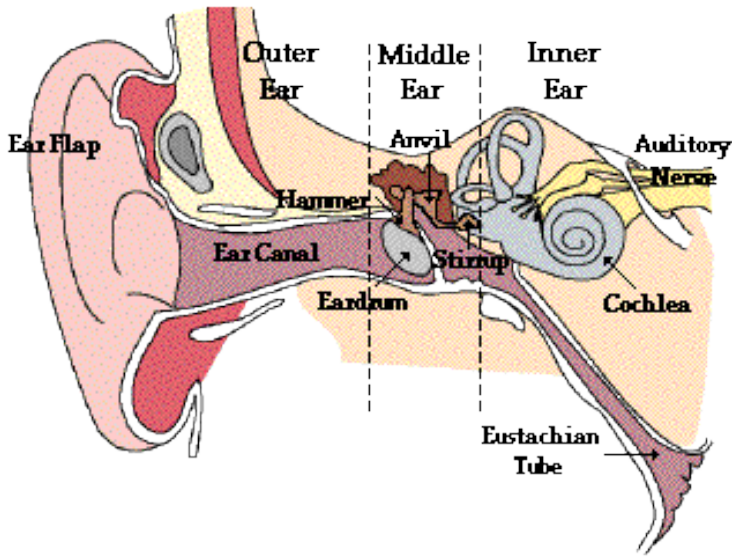
Examine the diagram and answer the following questions.



61. What is the role of the outer ear?
62. How do the ear drum and the three bones of the middle ear help with the transmission of sound?
63. What fills the cochlea of the middle ear to transmit sound?
64. What type of cells are the receptors for sound in the cochlea?
65. What is the role of the Eustachian tube?
66. What is the difference between static equilibrium and dynamic equilibrium?
67. What major part of the ear has the receptors for equilibrium?
68. Why is it important the three canals to be in different planes?
69. Where in the brain does the vestibular nerve transmit impulses?
70. What role if any does sight play in equilibrium.

Station G: Ear

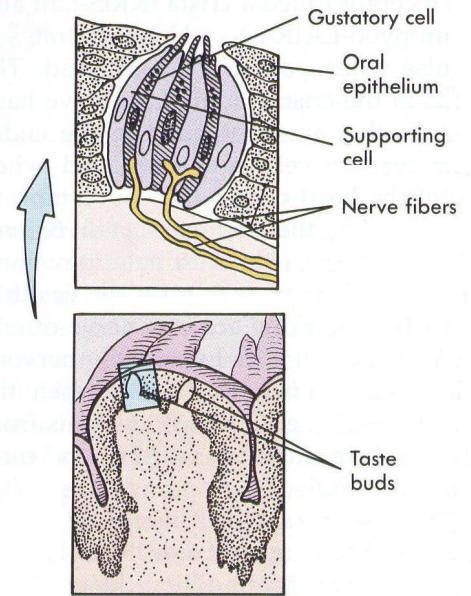
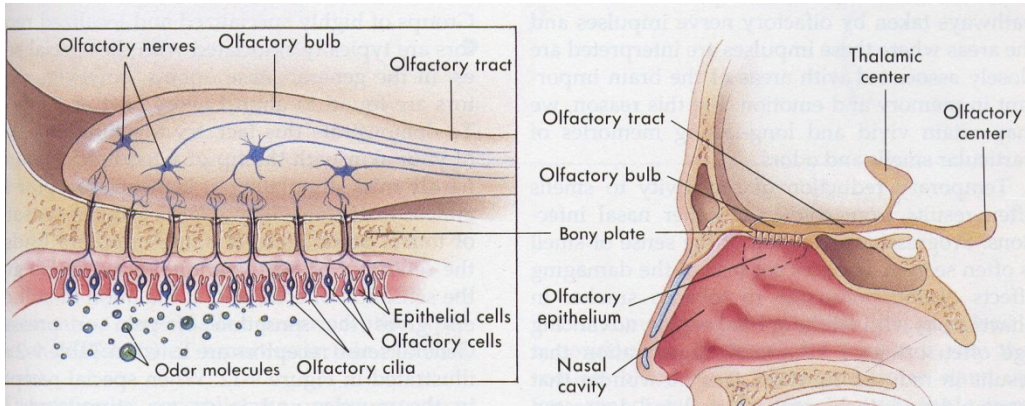
Examine the diagram and answer the following questions.



61. What is the role of the outer ear?
the outer collects sound and funnel it toward the eardrum
62. How do the ear drum and the three bones of the middle ear help with the transmission of sound?
the eardrum and ossicles vibrate to transmit the sound to the inner ear
63. What fills the cochlea of the middle ear to transmit sound?
the cochlea is filled with fluid with vibrates like waves
64. What type of cells are the receptors for sound in the cochlea?
the receptor are special hair cells with are stimulated by the fluid waves and initiate an impulse
65. What is the role of the Eustachian tube?
It equalizes the pressure between the auditory canal and the middle ear
66. What is the difference between static equilibrium and dynamic equilibrium?
Static equilibrium is when the body is not moving and Dynamic Equilibrium is when the head is having angular or rotary movements
66. What major part of the ear has the receptors for equilibrium?
The vestibular apparatus of the semicircular canals
68. Why is it important the three canals to be in different planes?
They respond to the three planes in space so movement in any direction can be detected
69. Where in the brain does the vestibular nerve transmit impulses?
The cerebellum
70. What role if any does sight play in equilibrium.
Vision plays a significant role in balance. Approximately twenty percent of the nerve fibers from the eyes interact with the vestibular system.

Station H: Taste & Smell

Examine the information provided and answer the questions.



71. What type of receptors are taste and smell receptors? (what do they detect)

72. Chemicals must be in solution to stimulate chemical receptors. (TRUE OR FALSE)

73. Where are most of your taste buds located?

74. What are the 5 primary tastes?

75. Humans are able to detect thousands of smells. . (TRUE OR FALSE)

76. Many molecules of an odor are needed to stimulate receptor cells for smell. (TRUE OR FALSE)

77. Where are the smell receptors located?

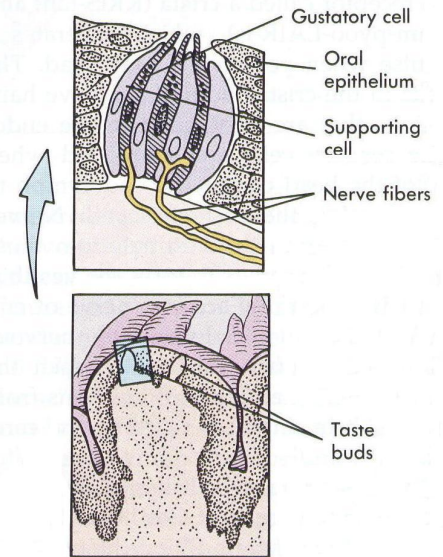
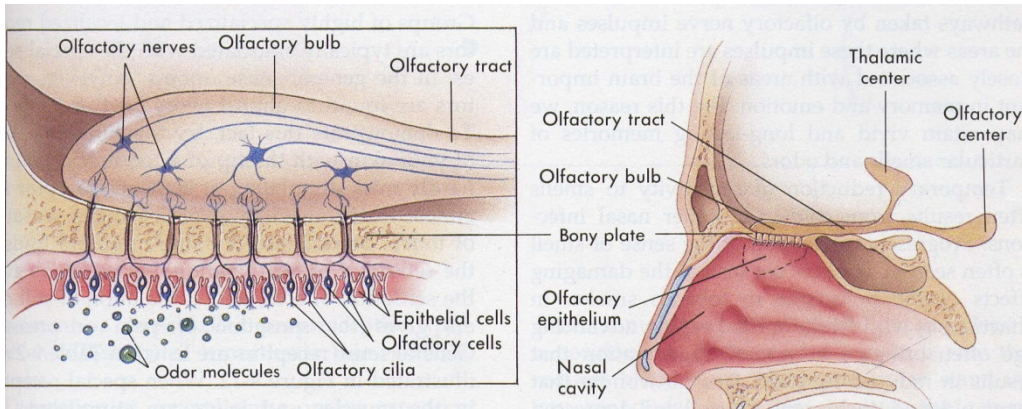
78. Why does a cold affect the taste of food?

79. Why do hot food taste better than cold foods?

80. Why is smells so strongly attached to emotion and memory of events?

Station H: Taste & Smell

Examine the information provided and answer the questions.



71. What type of receptors are taste and smell receptors? (what do they detect)
Taste and Smell are chemical receptors
72. Chemicals must be in solution to stimulate chemical receptors. (TRUE OR FALSE)
TRUE
73. Where are most of your taste buds located?
Most taste buds are on the tongue but some line the surface of the mouth
74. What are the 5 primary tastes? *sweet, sour, bitter, salty, umami*
75. Humans are able to detect thousands of smells. . (TRUE OR FALSE)
TRUE
76. Many molecules of an odor are needed to stimulate receptor cells for smell. (TRUE OR FALSE)
FALSE – only a few molecules are needed to stimulate the hair cells but they must be dissolved in watery mucus
77. Where are the smell receptors located? *Smell receptors are on the top of the nose*
78. Why does a cold affect the taste of food? *Mucus from a cold can cover them so odor chemicals cannot get to them thus reducing ability to smell and smell is perceived as part of taste*
79. Why do hot food taste better than cold foods?
Hot food emit more odors than cold food and smell is perceived as part of taste
80. Why is smells so strongly attached to emotion and memory of events?
The brain region for smell is close to the emotion center (limbic system)

Station I: Endocrine System

For each of the following statements, indicate whether it is True or False. For the false statements, explain why it is false.

81. The endocrine system responds quicker than the nervous system.
82. Exocrine glands are ductless.
83. The endocrine system acts through neurotransmitters called hormones that influence growth, development, and metabolic activities.
84. The specific cells that respond to a given hormone have receptor sites for that hormone.
85. The hypothalamus is the major link between the nervous and endocrine system.
86. A positive feedback system is the most common “turnoff” process for the endocrine system.
87. A negative feedback is a response that opposes the original change – an increase in A will decrease in B. Example is blood sugar metabolism.
88. Hormones are general and can affect several different sights.
89. .All hormones bind to a cell surface receptor on the target cell – they do not enter the target cell.
90. The pancreas is both an endocrine and an exocrine gland

Station I: Endocrine System

For each of the following statements, indicate whether it is True or False. For the false statements, explain why it is false.

81. The endocrine system responds slowly than the nervous system. **TRUE**
82. Exocrine glands are ductless. **FALSE. Exocrine glands have ducts, Endocrine glands are ductless**
83. The endocrine system acts through neurotransmitters that influence growth, development, and metabolic activities. **FALSE. No neurotransmitters – rather hormones**
84. The specific cells that respond to a given hormone have receptor sites for that hormone. **TRUE**
85. The hypothalamus is the major link between the nervous and endocrine system. **TRUE**
86. A positive feedback system is the most common “turnoff” system for the endocrine system. **FALSE. A negative feedback system is most common – positive feedback is very uncommon**
87. A negative feedback is a response that opposes the original change – an increase in A will decrease in B. Example is blood sugar metabolism. **TRUE**
88. Hormones are general and can affect several different sights. **FALSE. Hormones are very specific and will only affect cells that are programmed to receive that specific hormone.**
89. All hormones bind to a cell surface receptor on the target cell – they do not enter the target cell.. **FALSE- some bind to a cell surface receptor on the target cell while others cross the plasma membrane and act on receptors inside the target cell**
90. The pancreas is both an endocrine and an exocrine gland. **TRUE**

Station J: Endocrine Glands

Identify the gland and give its function.

91. Gland A.

92. Gland B

93. Gland C

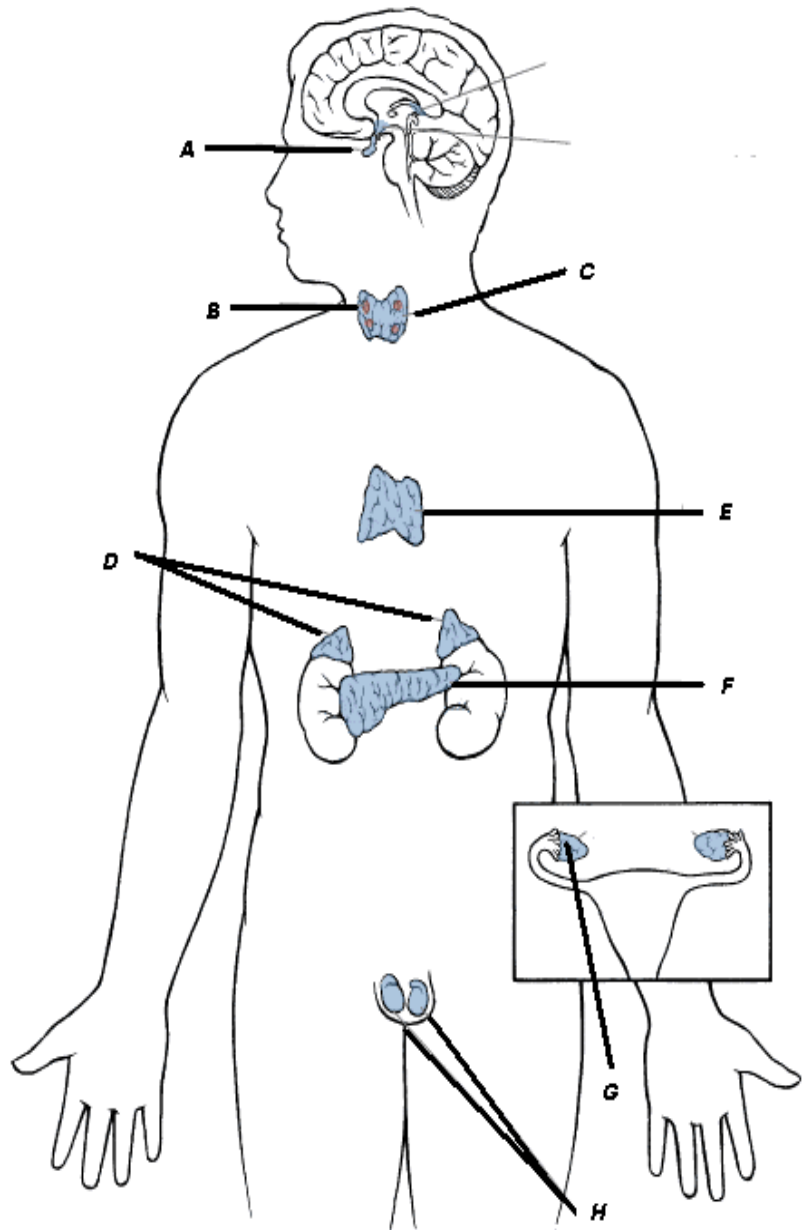
94. Gland D

95. Gland E.

96 Gland F

97. Gland G.

98. Gland H.



99. What region of the brain synchronizes information from the brain and secretes hormones?

100. What small gland in the brain secretes melatonin which regulates our internal clocks and has a large role in our sleep and wake cycles.

Station J: Endocrine Glands

Identify the gland and give its function.

91. Gland A. *Pituitary gland – master gland releases hormones to control other endocrine glands*

92. Gland B *Parathyroid- regulates the amount of calcium in the blood and its absorption by bones*

93. Gland C *Thyroid gland – hormones speed up metabolism and help manage growth and development*

94. Gland D *Adrenal glands – hormones for “fight or flight”, osmotic balance, promote glucose synthesis*

95. Gland E. *Thymus Gland – stimulates T-cell (a type of white blood cell) production in children.*

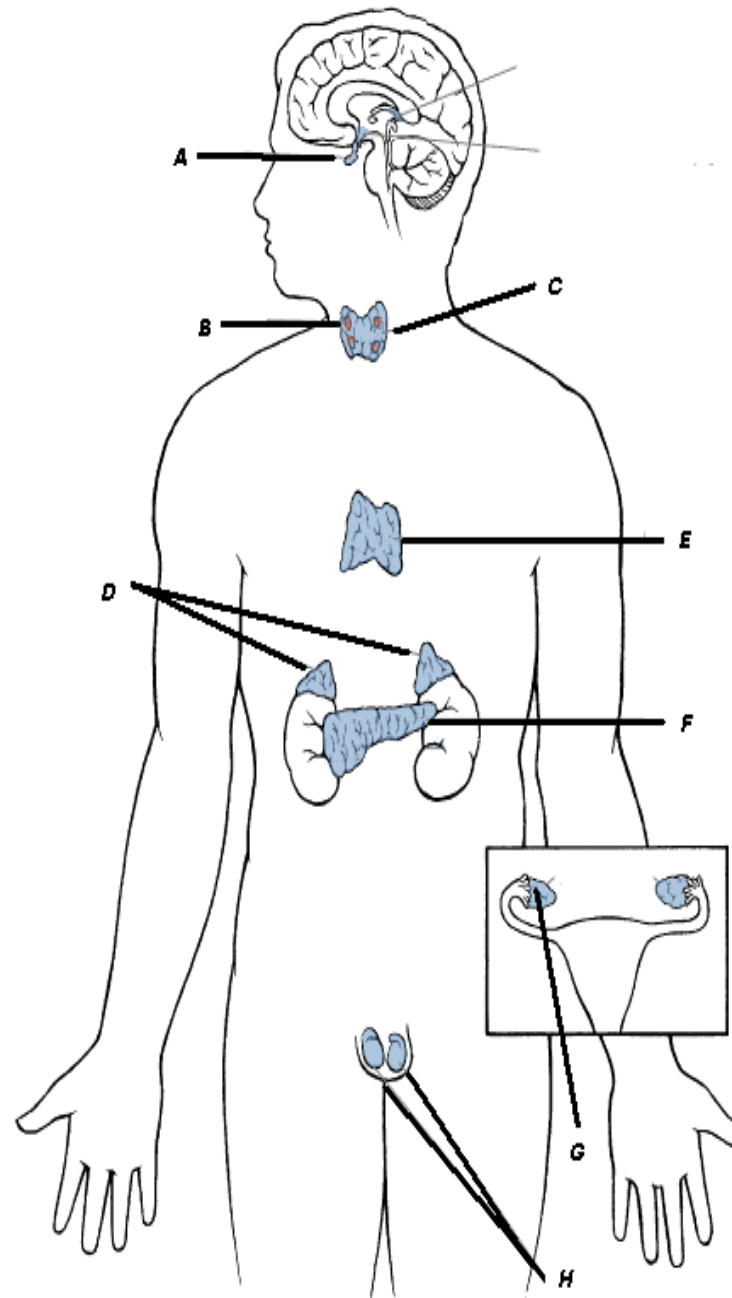
96 Gland F *Pancreas – hormones to control blood sugar levels – using insulin and glucagon*

97. Gland G. *ovaries – produce female sex hormones for reproduction and secondary sexual characteristics*

98. Gland H. *testicles - produce male sex hormones for reproduction and secondary sexual characteristics*

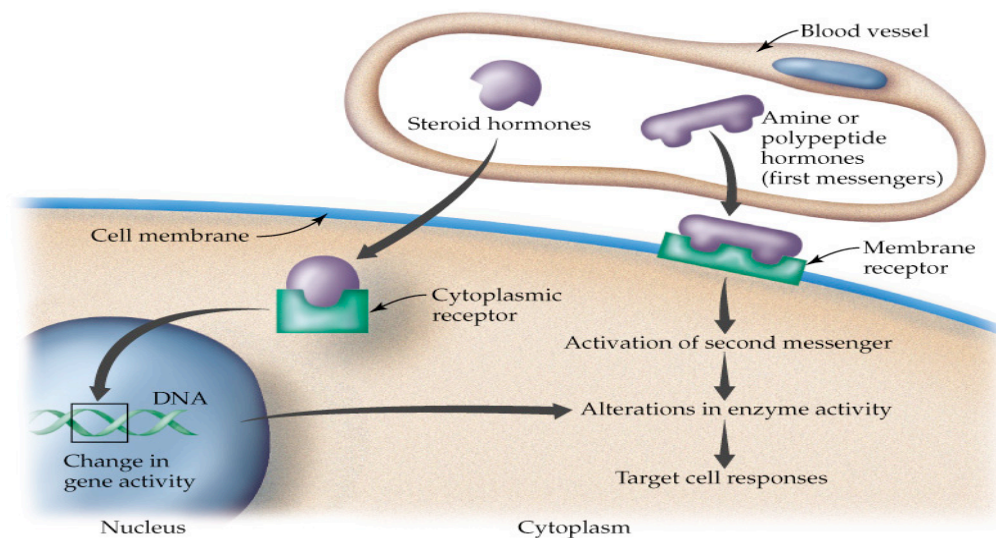
99. What region of the brain synchronizes information from the brain and secretes hormones?
Hypothalamus

100. What small gland in the brain secretes melatonin which regulates our internal clocks and has a large role in our sleep and wake cycles. *Pineal Gland*

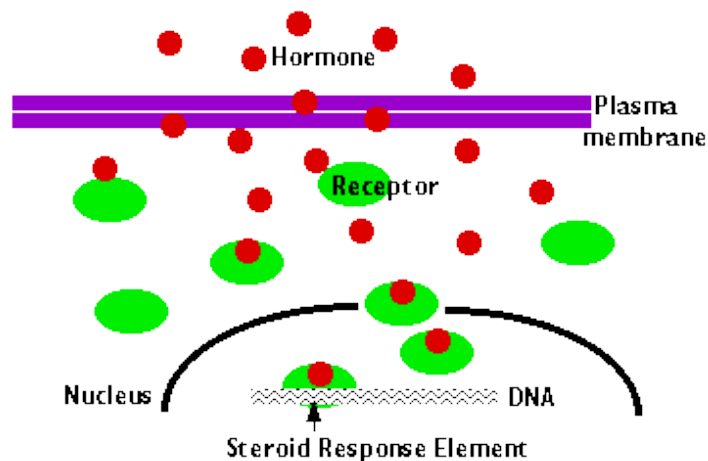
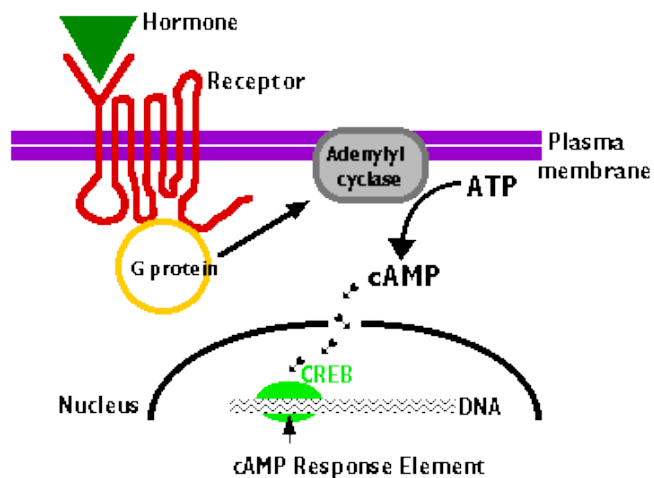


Station K: Mechanism of Hormone Action

101. – 105. Using the diagram, explain the difference in the mechanism of hormone action between steroid and protein derived hormones. (Div. B & C)

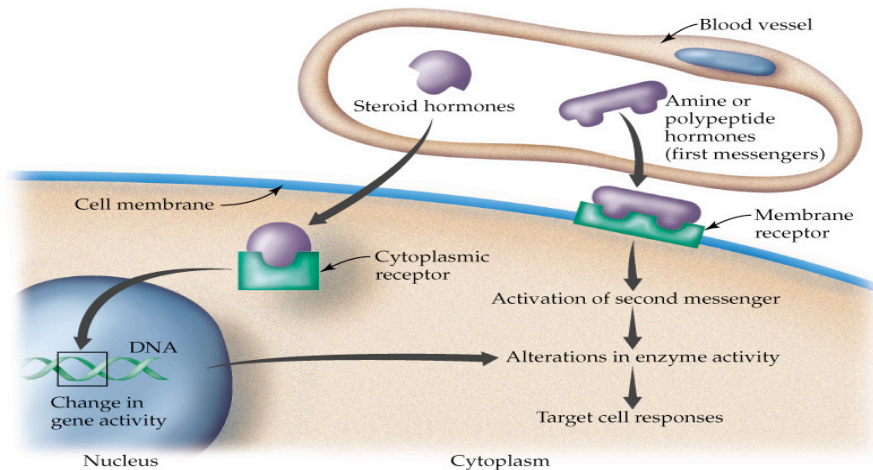


106-110. (Div. C) Explain the two diagrams below. (Div. C)



Station K: Mechanism of Hormone Action

101. – 105. Using the diagram, explain the difference in the mechanism of hormone action between steroid and protein derived hormones.



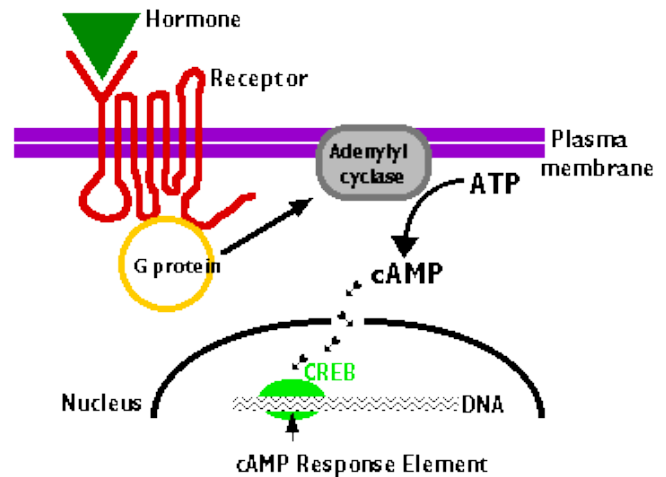
Protein hormones (1st messengers) - bind to receptor on target cell triggering 2nd messenger to affect cell's activity

Steroid hormones - bind to receptors within target cell and influence cell activity by acting on specific genes

106-110. (Div. C) Explain the two diagrams below. (Div. C)

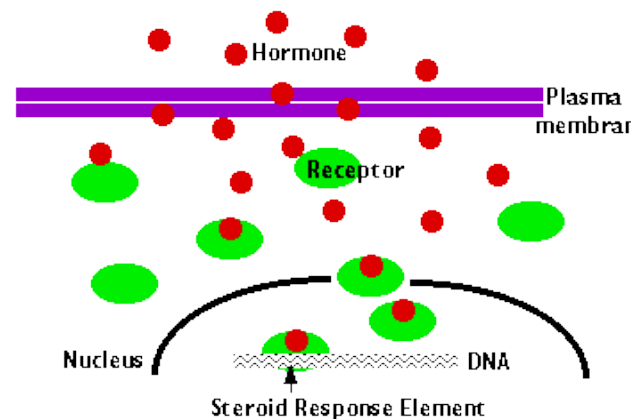
Protein hormones (1st messengers) - bind to receptor on target cell triggering 2nd messenger to affect cell's activity

- hormone (**1st messenger**) does not enter the cell
- bind to receptor on the plasma membrane receptors
- hormone-receptor complex activates G protein
- generates chemical signal (**2nd messenger**) – most common is cAMP and IP₃
- **2nd messenger chemical signal** activates other intracellular chemicals to produce response in target cell
- responses may be phosphorylation, activation of enzymes release of calcium ions into cytosol from ER, turn on transcription factor CREB for protein production.



Steroid hormones – fat-soluble hormones - bind to receptors within target cell and influence cell activity by acting on specific genes

- hormone diffuses freely into cell where cytoplasmic and/ or nuclear proteins serve as receptors
- hormone binds to receptor (hormone-receptor complex)
- complex binds to steroid response element (sections of DNA receptive to the hormone-receptor complex)



STATION L: Hormones and Disorders of the Endocrine System

For Questions 111-115, use the key to match the description with the Name of the Hormone and Gland

- A. Thyroxine – Thyroid**
- B. Epinephrine (adrenaline) & Norepinephrine – Adrenal**
- C. Parathyroid Hormone – Parathyroid**
- D. GH – Anterior Pituitary**
- E. Melatonin – Pineal**

- 111.** Regulates our internal clocks and our sleep-wake cycles
- 112.** Stimulates growth
- 113.** Regulates metabolism and the gland needs iodine to create this hormone
- 114.** Helps regulate the “fight or flight” response
- 115.** Regulates amount of calcium in the blood and its absorption by bones

For Questions 116-120, explain each endocrine disorder.

- 116.** Diabetes mellitus
- 117.** Goiter
- 118.** Giantism
- 119.** Grave’s Disease
- 120.** hypoglycemia

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- 111. Regulates our internal clocks and our sleep-wake cycles **E**
- 112. Stimulates growth **D**
- 113. Regulates metabolism and the gland needs iodine to create this hormone **A**
- 114. Helps regulate the “fight or flight” response **B**
- 115. Regulates amount of calcium in the blood and its absorption by bones **C**

For Questions 116-120, explain each endocrine disorder.

- 116. Diabetes mellitus
a group of disorders caused by an inability to produce or use insulin
- 117. Goiter
enlarged thyroid gland – common causes are iodine deficiency, Grave’s disease Hashimoto’s disease, benign thyroid nodules, thyroid inflammation
- 118. Giantism
hypersecretion of GH during childhood
- 119. Grave’s Disease
an autoimmune disease which is the most common form of hyperthyroidism it can cause a goiter
- 120. hypoglycemia
too much insulin is present and causes hypoglycemia (low blood sugar) and possibly insulin shock