Functional Anatomy of the Endocrine Glands

Gross Anatomy and Basic Function of the Endocrine Glands

1. Both the endocrine and nervous systems are major regulating systems of the body; however, the nervous system has been compared to an airmail delivery system and the endocrine system to the pony express. Briefly explain this comparison.

   The nervous system uses rapidly propagated electrical “messages,” whereas endocrine system “messages” (hormones) are liberated into the blood to travel much more slowly to the target organs.

2. Define hormone: A chemical substance liberated into the blood, which alters “target cell” metabolism in a specific manner.

3. Chemically, hormones belong chiefly to two molecular groups, the steroids and the amino acid-based molecules.

4. What do all hormones have in common? They are all chemical molecules that have specific target organs, which they reach via the blood. Like enzymes, they are effective in minute quantities.

5. Define target organ: Organ responding to a particular hormone in a specific way.

6. If hormones travel in the bloodstream, why don’t all tissues respond to all hormones? The proper “hormone” receptors must be present on the plasma membrane or within the cells for the tissue cells to respond.

7. Identify the endocrine organ described by the following statements:

   - thyroid gland
     1. located in the throat; bilobed gland connected by an isthmus
   - adrenal gland
     2. found close to the kidney
   - pancreas
     3. a mixed gland, located close to the stomach and small intestine
   - testes
     4. paired glands suspended in the scrotum
   - parathyroids
     5. ride “horseback” on the thyroid gland
   - ovaries
     6. found in the pelvic cavity of the female, concerned with ova and female hormone production
   - thymus
     7. found in the upper thorax overlying the heart; large during youth
   - pineal body
     8. found in the roof of the third ventricle
8. For each statement describing hormonal effects, identify the hormone(s) involved by choosing a number from key A, and note the hormone’s site of production with a letter from key B. More than one hormone may be involved in some cases.

<table>
<thead>
<tr>
<th>Key A</th>
<th>Key B</th>
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</thead>
<tbody>
<tr>
<td>1. ACTH</td>
<td>a. adrenal cortex</td>
</tr>
<tr>
<td>2. ADH</td>
<td>b. adrenal medulla</td>
</tr>
<tr>
<td>3. aldosterone</td>
<td>c. anterior pituitary</td>
</tr>
<tr>
<td>4. cortisone</td>
<td>d. hypothalamus</td>
</tr>
<tr>
<td>5. epinephrine</td>
<td>e. ovaries</td>
</tr>
<tr>
<td>6. estrogens</td>
<td>f. pancreas</td>
</tr>
<tr>
<td>7. FSH</td>
<td>g. parathyroid glands</td>
</tr>
<tr>
<td>8. glucagon</td>
<td>h. pineal gland</td>
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<tr>
<td>9. GH</td>
<td>i. posterior pituitary</td>
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<tr>
<td>10. insulin</td>
<td>j. testes</td>
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<tr>
<td>11. LH</td>
<td>k. thymus gland</td>
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<tr>
<td>12. melatonin</td>
<td>l. thyroid gland</td>
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### Key A:
8. basal metabolism hormone 1. ACTH
9. mimics the sympathetic nervous system 5. epinephrine
10. regulates blood glucose levels, produced by the same “mixed” gland 8. glucagon
11. directly responsible for regulation of the menstrual cycle 7. estrogens
12. directly involved in milk production and ejection 14. melatonin

### Key B:
1. basal metabolism hormone 19. i. hypothalamus
2. programming of T lymphocytes 21. k. thymus gland
3. regulates blood calcium levels 17. g. parathyroid glands
4. released in response to stressors 4a. a. adrenal cortex
5. drives development of secondary sexual characteristics 5b. b. adrenal medulla
6. regulates the function of another endocrine gland 7c. c. anterior pituitary
7. maintenance of salt and water balance in the ECF 13. c. ovaries

9. Although the pituitary gland is often referred to as the master gland of the body, the hypothalamus exerts some control over the pituitary gland. How does the hypothalamus control both anterior and posterior pituitary functioning?

*Produces “releasing and inhibiting hormones,” which control the production and release of anterior pituitary hormones; forms hormones ADH and oxytocin, which are transported to the posterior pituitary and later released on nervous stimulation from the hypothalamus.*
10. Indicate whether the release of the hormones listed below is stimulated by (A) another hormone; (B) the nervous system (neurotransmitters, or releasing factors); or (C) humoral factors (the concentration of specific nonhormonal substances in the blood or extracellular fluid):

<table>
<thead>
<tr>
<th></th>
<th>1. ADH</th>
<th>2. aldosterone</th>
<th>3. estrogens</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>B</td>
<td>4. insulin</td>
<td>5. norepinephrine</td>
<td>6. parathyroid hormone</td>
</tr>
<tr>
<td>C</td>
<td>7. T₄/T₃</td>
<td>8. testosterone</td>
<td>9. TSH, FSH</td>
</tr>
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</table>

11. Name the hormone(s) produced in inadequate amounts that directly result in the following conditions. (Use your textbook as necessary.)

- estrogen (female) testosterone (male)
- PTH
- ADH
- insulin
- growth hormone (GH)
- progesterone
- thyroxine (T₄)/triiodothyronine (T₃) (thyroid hormone)

12. Name the hormone(s) produced in excessive amounts that directly result in the following conditions. (Use your textbook as necessary.)

- growth hormone (GH)
- T₄/T₃ (thyroid hormone)
- PTH

Microscopic Anatomy of Selected Endocrine Glands (Optional)

13. Choose a response from the key below to name the hormone(s) produced by the cell types listed:

Key: a. insulin  d. calcitonin  g. glucagon  h. PTH  i. glucocorticoids  
     b. GH, prolactin  e. TSH, ACTH, FSH, LH  
     c. T₄/T₃  f. mineralocorticoids

<table>
<thead>
<tr>
<th></th>
<th>1. parafollicular cells of the thyroid</th>
<th>6. zona fasciculata cells</th>
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</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h</td>
<td>2. follicular epithelial cells of the thyroid</td>
<td>7. zona glomerulosa cells</td>
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<tr>
<td>e</td>
<td>3. beta cells of the pancreatic islets (islets of Langerhans)</td>
<td>8. chief cells</td>
</tr>
<tr>
<td>c</td>
<td>4. alpha cells of the pancreatic islets (islets of Langerhans)</td>
<td>9. acidophil cells of the anterior pituitary</td>
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<tr>
<td>i</td>
<td>5. basophil cells of the anterior pituitary</td>
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14. Five diagrams of the microscopic structures of the endocrine glands are presented here. Identify each and name all indicated structures.

- **Thyroid gland**
  - Follicular cells
  - Thyroglobulin colloid

- **Adrenal cortex**
  - Zona glomerulosa
  - Zona fasciculata
  - Zona reticularis

- **Ovary**
  - Antrum of Graafian follicle

- **Testis**
  - Interstitial cells

- **Anterior pituitary**
  - Acidophil
  - Basophil