Endocrine System
Physiology Study Guide, Chapter 11

List of medical roots, suffixes and prefixes

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
<th>Example</th>
<th>Term</th>
<th>Meaning</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>adeno-</td>
<td>gland</td>
<td>adenohypophysis</td>
<td>insipid-</td>
<td>without taste</td>
<td>diabetes insipidus</td>
</tr>
<tr>
<td>andro-</td>
<td>man</td>
<td>androgens</td>
<td>mellit-</td>
<td>sweet</td>
<td>diabetes mellitus</td>
</tr>
<tr>
<td>crin-</td>
<td>to secrete</td>
<td>exocrine</td>
<td>oxy-</td>
<td>swift</td>
<td>oxytocin</td>
</tr>
<tr>
<td>endo-</td>
<td>within</td>
<td>endocrine</td>
<td>para-</td>
<td>around</td>
<td>parathyroid</td>
</tr>
<tr>
<td>exo-</td>
<td>outside</td>
<td>exocrine</td>
<td>somato-</td>
<td>body</td>
<td>somatotropin</td>
</tr>
<tr>
<td>gen-</td>
<td>to create</td>
<td>glocogen</td>
<td>-tocin</td>
<td>childbirth</td>
<td>pitocin</td>
</tr>
<tr>
<td>hormon-</td>
<td>excite</td>
<td>hormone</td>
<td>trop-</td>
<td>turn</td>
<td>thyrotropin</td>
</tr>
</tbody>
</table>

Part I. Clinical Applications

1. Pete is very short for his chronological age of 8. What hormone levels should be checked to determine if he has pituitary dwarfism?

   **Growth hormone**

2. A young girl is brought to the clinic by her father. The girl fatigues easily and seems mentally sluggish. You notice a slight swelling in the anterior neck. What condition do you suspect? What is a possible cause and treatment?

   **Hypothyroidism.** Possible cause is iodine deficiency treated by dietary iodine supplements

3. Mrs. Jackson claims she is not menstruating and reports that her breasts are producing milk although she has never been pregnant. What hormone is being hypersecreted?

   **Prolactin**

4. A patient has hypothyroidism and is confused about its classification. You are asked by the patient to explain the classification of hypothyroidism.

   Thyroid gland disorders affect all major body systems and are among the most common endocrine disorders. **Hyposecretion of thyroid hormone (hypothyroidism)** is classified as **primary, secondary or tertiary** dependent upon the organ that is malfunctioning.

   **Primary hypothyroidism** (most common type): the **thyroid gland** is malfunctioning and results in decreased production of thyroid hormones.

   **Secondary hypothyroidism:** the **pituitary gland** is malfunctioning. The pituitary gland does not create enough **thyroid stimulating hormone (TSH or Thyrotropin)** to induce the thyroid gland to create a sufficient quantity of thyroid hormones.

   **Tertiary Hypothyroidism:** the **Hypothalamus is malfunctioning.** This results in decreased production and/or reduced delivery of **thyroid-releasing hormone (TRH)** from the hypothalamus to the pituitary gland.
5. A friend of yours just found out she has diabetes mellitus. Being the caring, inquisitive, well educated person that you are, you ask what type of diabetes mellitus she has. She said that it was either type I or type II but was not sure and didn’t realize the difference between them. Explain the difference between type I and type II diabetes mellitus and their treatment.

**Diabetes mellitus** type I and type II are a group of metabolic diseases characterized by **hyperglycemia** resulting from defects in **insulin secretion**, **insulin sensitivity**, or both. Both Type I and II will have an elevation of glucose in the blood (**hyperglycemia**) and an increase of glucose loss in the urine (**glucosuria**).

**Type 1 Diabetes or Insulin-Dependent Diabetes Mellitus (IDDM):** Results from a deficiency of insulin, usually due the person’s own immune system (**autoimmune disorder**) destroying the **pancreatic beta cells that produce insulin**.

**Treatment:** As a result the pancreas produces little or no insulin and **insulin injections are required** to prevent death.

**Type 2 Diabetes or Non-insulin-dependent diabetes mellitus (NIDDM):** Results from a lack of sensitivity to insulin, which may be at normal or elevated levels. The symptoms are usually mild and sporadic and the condition may go unnoticed for years before diagnosis. Type II may progress to destruction of the insulin-producing cells, but is still considered Type 2, even though insulin administration may be required.

**Treatment:** Usually controlled and corrected by exercise, proper diet, and weight loss.

**Metformin** (Glucophage) is an oral anti-diabetic drug that improves **hyperglycemia** by (1) suppression of hepatic glucose production (**gluconeogenesis**), (2) increases insulin sensitivity, an (3) enhances peripheral glucose uptake by increasing the quantity of GLUT4 receptors incorporated into the plasma membrane.

6. List the main symptoms for diabetes mellitus, and provide the reason for the occurrence of each symptom. **Hint** – remember the 3 polys.

1. **Polyuria** – Excessive urine production due to high sugar (glucose) content in kidney filtrate, which results in decreased ability to reabsorb water resulting in large volumes of water lost in the urine.
2. **Polydipsia** – Excessive thirst due to large volumes of urine excreted.
3. **Polyphagia** – Excessive hunger because blood sugar cannot be used as a body fuel even though blood levels are high. The hypothalamus controls appetite and if glucose cannot enter the cells of the hypothalamus then the person feels extremely hungry.

7. Explain the values for normal fasting blood glucose levels and normal non-fasting blood glucose. A patient is suspected of having diabetes mellitus and is getting ready to have the following tests to help in determine if they have diabetes mellitus. Explain the following tests: Glucose Tolerance Test and The hemoglobin A1C test.

**Fasting blood glucose levels** is the measurement taken **six to eight hours after the last meal**. It is commonly measured in the morning before breakfast and the normal range is **70 to 100 mg/100 ml** (Note: value can also be given in milligrams per deciliter (dL); 1 deciliter = 100 ml). After eating in a normal individual, blood glucose levels generally do not get above **140 mg/dL**. Thus, **Non-fasting normal blood glucose level ranges between 70 to 140 mg/100 ml** and is dependent on when the person last ate.
**Glucose Tolerance Test:** As demonstrated by the “glucose tolerance curve”, when a normal, fasting person ingests a high glucose containing drink, the blood glucose level rises to 120 to 140 mg/100 ml and falls back to below normal in about 2 hours. In a person with uncontrolled diabetes, the fasting blood glucose concentration is almost always above 100 mg/100 ml and after ingestion of the glucose mixture the glucose level rises even higher (~200 mg/100 ml) and falls back to the starting value only after 4 to 6 hours. The slow fall of this curve demonstrates that either (1) insulin secretion does not occur as in type I diabetes or (2) there is decreased sensitivity to insulin as in type II diabetes. Type I and Type II diabetes can be distinguished from each other by measurements of plasma insulin levels.

The hemoglobin A1C test - also called HbA1C or glycated hemoglobin test, or glycohemoglobin -- is an important blood test used to determine how well your diabetes is being controlled. **Hemoglobin A1C provides an average of your blood sugar levels over a six to 12 week period.** Glycated Hemoglobin is normal at low amounts, however when diabetes is not controlled (meaning that your blood sugar is too high), abnormal high amounts of blood glucose combines with your hemoglobin. Therefore, the average amount of sugar in your blood can be determined by measuring a hemoglobin A1C level. If your glucose levels have been high over recent weeks, your hemoglobin A1c test will be higher. **Hemoglobin A1C Test Results:** For people without diabetes, the normal range for the hemoglobin A1C test is between 4% and 5.6%. Hemoglobin A1C levels between 5.7% and 6.4% indicate increased risk of diabetes, and levels of 6.5% or higher indicate diabetes.

8. The recommended daily allowance (RDA) for iodine is 150 mg/day. Even though only a small quantity is needed each day what symptoms appear if the intake of this mineral is insufficient or there is a complete lack of it in the diet?

Iodine must be available for thyroxine (and triiodothyronine) to be synthesized. Thyroxine deficiencies result in decreased rates of metabolism, decreased body temperature, poor response to physiological stress, and an increase size of the thyroid gland (goiter). People with decreased thyroxine levels usually suffer from sluggishness and weight gain.

9. Even though there has been a great deal of negative publicity about the use of anabolic steroids, many athletes continue to use them as a means of increasing their muscular mass
and improving their endurance and performance. What dangers and health risks are associated with taking anabolic steroids?

The androgens or “anabolic steroids” affect many tissues in a variety of ways. Extreme aggressive behavior and complications such as liver dysfunction, prostate enlargement, infertility, and testicular atrophy are common. The normal regulation of androgen production involves a feedback mechanism, and the administration of androgens may affect the normal production of testosterone in the testes and permanently suppress the manufacture of GnRH by the hypothalamus.

10. Explain what nonsteroidal anti-inflammatory drugs (NSAIDS) are and their mechanism of action. Be sure to give examples of commonly used NSAIDS.

**Nonsteroidal antiinflammatory drugs (NSAIDs)** are a class of drugs that reduce inflammation (pain, fever, and swelling) by interfering with the production of prostaglandins. Mechanism of action: Depends on the NSAID – will Inhibit Cyclooxygenase-1 (COX-1) and Cyclooxygenase-2 (COX-2) enzymes and thus the production of prostaglandins.

Examples: **Aspirin** and **ibuprofen** (Advil, Motrin) are not as specific and inhibit both COX-1 and COX-2 enzymes.

Examples: **Celebrex** and **Vioxx** selectively block the COX-2 enzyme and not the COX-1 enzyme and thus inhibit the production of prostaglandins that often cause the pain and swelling of inflammation. Usually taken for conditions such as arthritis (osteoarthritis and rheumatoid), menstrual pain, acute pain, and hereditary linked polyps in the colon.

**Part II**
1. slower and more prolonged
2. nervous system
3. hormones
4. nerve impulses
5. cardiovascular

**Part III**
1. receptors
2. target cell(s)
3. altering activity
4. stimulating new or unusual activities
5. steroid or amino acid-based activities
6. neural
7. hormonal
8. humoral
9. negative
10. pituitary
11. releasing hormones (specifically the anterior pituitary)
12. hypothalamus
13. neuroendocrine

**Part IV**
1. growth hormone (GH)
2. prolactin (PRL)
3. follicle-stimulating hormone (FSH)
4. luteinizing hormone (LH)
5. thyroid-stimulating hormone (TSH)
6. adrenocorticotropic hormone (ACTH)
7. C
8. B
9. F
10. F
11. G
12. I
13. C
14. H
15. H
16. C
tetraiodothyronine and is used as the 
general term for thyroid hormones which 
includes both tetraiodothyronine and 
triiodothyronine) 30. thyroxine 31. insulin 32. growth hormone 33. estrogen/progesterone 34. thyroxine 35. growth hormone 36. thyroxine 37. parathyroid hormone (PTH) 38. glucocorticoids 39. growth hormone 40. androgens (testosterone) 41. B 42. A, C 43. A, C 44. D 45. E 46. A

Part V

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<tr>
<td>1.</td>
<td>LH or ICSH</td>
<td>7.</td>
<td>TSH</td>
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<td>2.</td>
<td>oxytocin</td>
<td>8.</td>
<td>ADH</td>
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<tr>
<td>3.</td>
<td>ACTH</td>
<td>9.</td>
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<td>4.</td>
<td>GH</td>
<td>10.</td>
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<td>5.</td>
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<td>11.</td>
<td>D</td>
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<tr>
<td>6.</td>
<td>MSH</td>
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<td>15.</td>
<td>B</td>
<td>21.</td>
<td>D</td>
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<tr>
<td>16.</td>
<td>B</td>
<td>22.</td>
<td>A</td>
</tr>
<tr>
<td>17.</td>
<td>B</td>
<td>23.</td>
<td>D</td>
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Part VI

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<tbody>
<tr>
<td>1.</td>
<td>neurotransmitters</td>
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<td>2.</td>
<td>adrenal gland</td>
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<tr>
<td>3.</td>
<td>catecholamines</td>
<td>14.</td>
<td>Grave’s disease</td>
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<tr>
<td>4.</td>
<td>testosterone and GH</td>
<td>15.</td>
<td>thyroid gland</td>
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<tr>
<td>5.</td>
<td>sella turcica</td>
<td>16.</td>
<td>parathormone (parathyroid hormone PTH)</td>
</tr>
<tr>
<td>6.</td>
<td>infundibulum</td>
<td>17.</td>
<td>bones</td>
</tr>
<tr>
<td>7.</td>
<td>ADH and oxytocin</td>
<td>18.</td>
<td>cortex</td>
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<td>8.</td>
<td>tropic hormones</td>
<td>19.</td>
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<tr>
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<td>diabetes insipidus</td>
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<td>sodium and water</td>
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<tr>
<td>10.</td>
<td>gigantism</td>
<td>21.</td>
<td>glucocorticoids</td>
</tr>
</tbody>
</table>
22. islets of Langerhans
23. abdominopelvic cavity
24. insulin
25. glucagon
26. diabetes mellitus
27. androgens
28. estrogens
29. GH
30. thyroid hormone
31. calcitonin
32. FSH

Part VII
1. B
2. A
3. D
4. D
5. B
6. B
7. C
8. Maintain basic circadian rhythms
9. C
10. D
11. D
12. A
13. C
14. C
15. B
16. B

33. LH
34. LH
35. TSH
36. ACTH
37. MSH
38. PRL
39. ACTH
40. adrenal cortex
41. adrenal cortex
42. adrenal cortex
43. adrenal medulla