

Barbara's Thyroid:

How Negative Feedback Can Be Positive

by

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Part I – Feedback and Dysfunction

Questions

1. Explain negative feedback in your own words, then diagram an example, either biological or non-biological, that illustrates the concept.
2. Explain positive feedback in your own words, then diagram an example, either biological or non-biological, that illustrates the concept.
3. Draw the hypothalamic-pituitary-thyroid axis showing negative feedback control points.
4. Looking at your diagram for Question 3, explain which organs would be dysfunctional in the case of primary, secondary or tertiary thyroid disorder.

Primary:

Secondary:

Tertiary:

Part II – Barbara’s Thyroid

Barbara, a 46-year-old woman, is sitting in the waiting room of her physician’s office. She is returning for an annual check up after her recent battle with breast cancer. It seems as if the cancer treatment has been successful and she is now cancer free. During the examination the doctor finds nothing to suggest that any tumors have returned. However, Barbara has not been feeling well lately. She tells the doctor that she has been feeling abnormally cold and that she has gained about 20 pounds over the past few months. In addition, she now suffers from overall fatigue. Barbara insists that she has not changed her activities or diet and has no idea why the sudden changes have occurred. The physician feels Barbara’s neck and doesn’t find any signs of swelling. He then orders a series of blood tests. The results of these tests are listed below.

<i>Test</i>	<i>Result</i>	<i>Normal Range*</i>
Serum thyroxine (T ₄) (ug/dl)	2.2	5.0–12
Thyrotropin (TSH) (μU/mL)	0.2	0.5–5
Serum Triiodothyronine (T ₃) (ng/dl)	33	70–195
Thyroid Stimulating Immunoglobulin (TSI)	Normal	< 1.3
Hematocrit (%)	39	36–47
Hemoglobin (g/100 ml blood)	13.4	12–16
Glucose (mg/dl)	92	70–105
Sodium (mmol/L)	137	136–145
Potassium (mmol/L)	4.2	3.5–5.0

* Normal values taken from: <<http://www.merckmanuals.com/professional/appendixes/normal-laboratory-values/blood-tests-normal-values>>

Use the information above paragraph along with the test results, your textbook and lecture notes to answer the questions below. You may also find the following links from the American Thyroid Association helpful.

- <https://www.thyroid.org/thyroid-information/>
- <https://www.thyroid.org/hypothyroidism/>
- <https://www.thyroid.org/thyroid-function-tests/>
- <https://www.thyroid.org/goiter/>

Questions

1. Is Barbara’s thyroid functioning properly? If not then is she suffering from hypothyroidism or hyperthyroidism? Explain your answer.
2. What are some things that could cause low levels of T₃ and T₄?
3. What are some things that could cause low levels of TSH?

4. Why does Barbara feel cold?

5. Why has she gained weight?

6. Are there any other symptoms she is likely experiencing that are not listed here?

7. What do you think is the underlying cause of all these symptoms in Barbara? What is wrong with her?

8. A TRH stimulation test involves measuring basal TSH levels and then measuring again after an injection of TRH. This test is often not necessary for thyroid patients, but would it be beneficial in diagnosing Barbara's condition? Explain why or why not.

9. Some patients with thyroid or thyroid hormone problems develop a goiter. List two possible causes of this goiter.

10. Barbara does not have a goiter at the moment. If her condition continues unchecked will she develop one?

11. Extrapolate the knowledge you have of the hypothalamic-anterior pituitary-thyroid axis to explain how anabolic steroid (testosterone) abuse would lead to testicular atrophy.