Name: _____ Date:_____

Case Study - A Grave Problem with the Endocrine System

Introduction: A Mysterious Decline in Health

Greta, a 20-year-old college student, had always been active and energetic. Over the past few months, however, she noticed a troubling array of symptoms. She experienced fatigue, unexplained weight loss despite an increased appetite, and heart palpitations. She even noticed her hair was thinning!

Greta also felt unusually anxious, and her hands trembled during even minor tasks. She would wake at night with muscle cramps. Occasionally, she would feel very hot and her skin would be warm to the touch.

She also observed a slight swelling at the base of her neck and a peculiar protrusion of her eyes, which friends and family began to notice. Her little brother started calling her "Googly-eyed Greta," which was the final straw. She decided to see her doctor.

Diagnosis: A Visit to the Doctor

At her primary care appointment, Greta detailed her symptoms. Her doctor noted the swelling in her neck and the prominence of her eyes (a condition called **exophthalmos**). A physical examination revealed an enlarged thyroid gland, also called a **goiter**. She also had a rapid, irregular heartbeat.

Suspecting an underlying thyroid condition, the doctor ordered several tests, including:

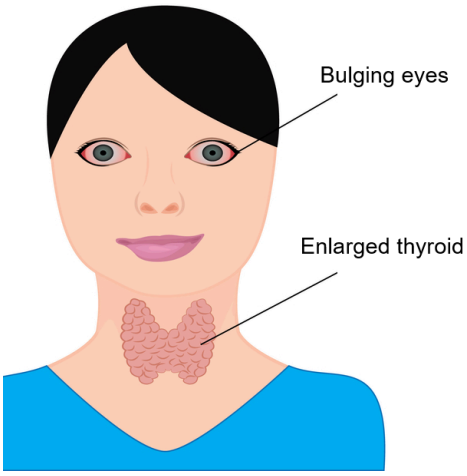
Blood tests to measure thyroid hormone levels (T3 and T4) and thyroid-stimulating hormone (TSH). TSH is the pituitary hormone that activates the thyroid gland.

> In Greta's case, her T3 (triiodothyronine) and T4 (thyroxine) were elevated, but her TSH levels were low.

Radioactive iodine uptake test to assess thyroid function. The test involves ingesting a small amount of radioactive iodine and then scanning the thyroid to measure how much iodine was absorbed.

> Greta's scan showed that her thyroid had a high uptake of the iodine, indicating that the gland was overactive.

The results confirmed the diagnosis: Greta had **Grave's disease**, an autoimmune disorder characterized by **hyperthyroidism**, or an overactive thyroid gland.



1. What were Greta's initial symptoms?

2. What is exophthalmos?

3. What is a goiter?

4. What did blood tests reveal about Greta's thyroid hormones?

5. What did the radioactive iodine test reveal about Greta's thyroid?

6. What was Greta's diagnosis?

The Endocrine System and Grave's Disease

The endocrine system is a network of glands that produce and regulate hormones essential for maintaining homeostasis. Two key players in this system are the pituitary gland and the thyroid gland, which work closely together to regulate metabolism and other vital functions.

The **pituitary gland**, often referred to as the "master gland," is a pea-sized structure located at the base of the brain. It secretes numerous hormones, including **thyroid-stimulating hormone (TSH)**, which regulates the activity of the thyroid gland. Under normal conditions, the pituitary gland releases TSH when thyroid hormone levels in the blood are low, signaling the thyroid to produce more T3 and T4.

In **Grave's disease**, the thyroid gland becomes overactive, but the pituitary gland is not at fault. Instead, the immune system produces abnormal antibodies called **thyroid-stimulating immunoglobulins**. These antibodies mimic TSH, overriding the pituitary gland's normal regulation and causing the thyroid to produce excessive amounts of T3 and T4. These hormones control metabolism, energy levels, and heart rate.

As a result, the pituitary gland reduces its production of TSH in response, but the TSIs continue to stimulate the thyroid, maintaining the hyperthyroid state.

This dysregulation leads to the hallmark symptoms of Grave's disease, such as weight loss and bulging eyes.

7. What is the function of the endocrine system?

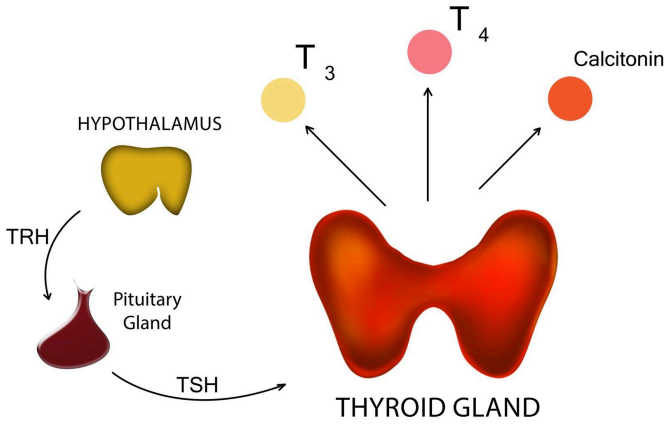
8. What hormone is released by the pituitary gland?

9. What causes the thyroid to produce excess T3 and T4 in patients with Graves disease?

10. What do T3 and T4 regulate?

11. Why does the pituitary gland reduce production of TSH?

12. Why is Graves considered an autoimmune disorder?



Treatment and Patient Outcome

Greta's treatment plan focused on restoring her thyroid hormone levels to normal and managing her symptoms. Her course of treatment included:

- **Antithyroid medications** block the thyroid from using iodine to make hormones.
- **Beta-blockers** are medications that block the effects of hormones. They may help to control irregular heartbeats, tremors, and anxiety.
- **Radioactive iodine therapy**, a treatment that destroys overactive thyroid cells, leading to a gradual reduction in thyroid hormone levels. As the thyroid shrinks, symptoms will decrease.

Over the next several months, Greta's symptoms began to improve. The swelling in her neck reduced, her heart rate normalized, and she regained her energy. However, the radioactive iodine therapy eventually caused **hypothyroidism**, a common side effect, requiring her to take lifelong thyroid hormone replacement therapy.

Greta adjusted well to her new routine and was grateful for her improved quality of life. Regular follow-ups with her doctor ensured that her hormone levels remained stable, and she resumed her graduate studies with renewed vigor.

13. What are beta-blockers?

14. What was a side effect of radioactive iodine therapy?

15. Summarize the relationship between the pituitary gland and the thyroid and their roles in regulating T3 and T4.

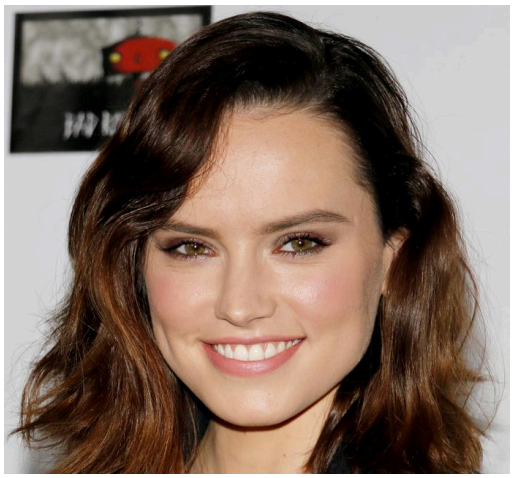
In the News…

In August 2024, actress Daisy Ridley revealed her diagnosis of Graves' disease, an autoimmune disorder affecting the thyroid gland. She began experiencing symptoms after completing her role in the film "Magpie." She is also known for her role as Rey in the Star Wars franchise.

Initially attributing these symptoms to stress from the demanding role, Ridley consulted an endocrinologist, who diagnosed her with Graves' disease. Women's Health

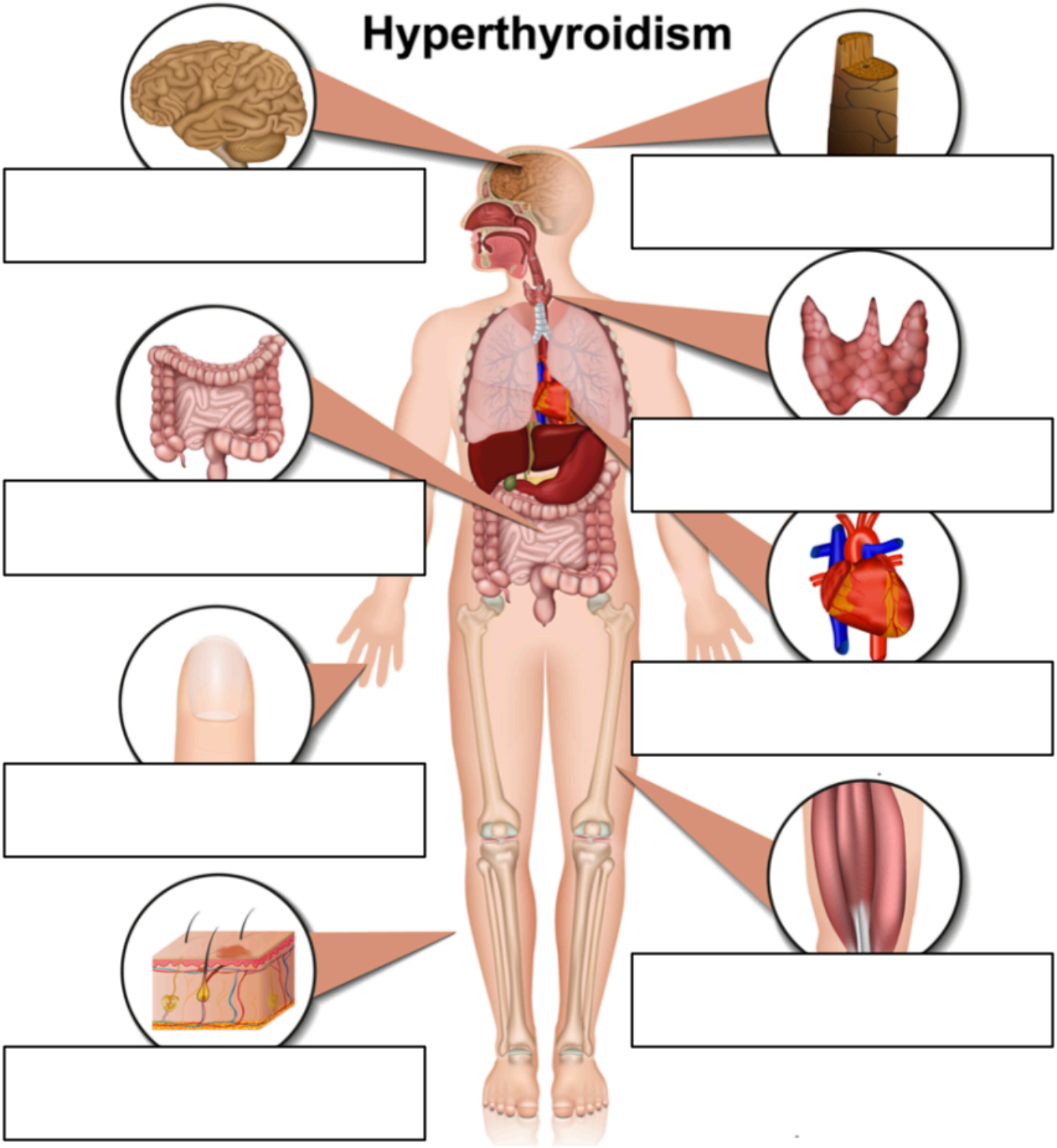
When she described to her endocrinologist her symptoms, which included a racing heart rate, weight loss, fatigue, and hand tremors, the doctor mentioned that the feeling of Graves' is often referred to as "tired but wired."

Ridley joins other public figures, such as Wendy Williams and Missy Elliott, in speaking openly about living with Graves' disease, advocating for greater awareness and understanding of the condition.



16. What is meant by "tired but wired"?

Label the Infographic using symptoms described in the case study.



Hair Loss	Muscle Cramps	Hair loss	Heart palpitations
Hot skin	Enlarged Thyroid	Fatigue	Weight Loss