Lesson Plan

Lesson: Endocrinology: The Thyroid Gland.

Timeframe: Case Study Learning: 2 hours.

Materials needed:

- Textbook: *Essential Endocrinology and Diabetes.* Richard I. Holt and Neil A. Hanley. Desktop Edition with Course Smart.
- Access to Blackboard for classroom organization and assessments.
- Power-point presentation of interrupted case study based on resources available through the National Center for Case Study Teaching in Science, University at Buffalo.
- Student response system (e.g. i-Clicker).

Objectives:

Basic:

1. *Distinguish between thyroxine (T4) and triiodothyronine (T3) and state why T3 is considered the major thyroid hormone.*
2. *List the major steps in the synthesis and secretion of thyroid hormones.*
3. *Explain how iodine deficiency affects thyroid hormone production.*
4. *Describe the endocrine regulation of thyroid hormone secretion and follicular cell metabolism and understand that plasma thyroid hormone concentrations exhibit long- loop feedback negative feedback control on the hypothalamus and anterior pituitary gland.*
5. *Identify the cellular location of thyroid hormone receptors.*
6. *Describe the calorigenic and permissive effects of thyroid hormones, as well as the role of thyroid hormones during growth and the development of the nervous system.*
7. *Define hypothyroidism and hyperthyroidism.*
8. *Identify symptoms associated with low and high levels of thyroid hormone production.*

Advanced:

1. *Evaluate the symptoms of a hypothetical patient and recommend diagnostic tests.*
2. *Analyze patient data and diagnose their disorder as primary or secondary / hypo- or hyper-secretion.*

3. *Explain to your patient the physiological links between their symptoms and either low or high levels of thyroid hormone production.*
4. *Create a treatment plan for your patient.*

Background: Endocrinology is the study of specific endocrine organs, the hormones that they secrete, control of hormone secretion, and target cell responses. This lesson focuses on the thyroid gland and regulation of thyroid hormone secretion by the hypothalamus and pituitary. Concepts of hormonal hyposecretion and hypersecretion will be explored *in class* using a clinical scenario to stimulate student interest and reinforce understanding of hormonal control systems.

The case study used in this lesson is a modified form of case study resources available from the National Center for Case Study Teaching in Science, University at Buffalo, and is appropriate for undergraduate students in biology and physiology. Connections between the learning goals and case-study learning activities will be intentionally stated throughout the class.

Introduction to Lesson: The thyroid gland is part of the hypothalamic-pituitary-thyroid axis that maintains normal levels of thyroid hormones in the body. The thyroid hormones, T3 and T4, play an important role in the regulation of metabolism, including how the body uses proteins, fats and carbohydrates for energy and/or growth. Structural or functional abnormalities in the thyroid gland can lead to under- or over-secretion of thyroid hormones with consequences for energy levels, weight maintenance, growth, heart disease and cognitive functions. The overall objective of this lesson is to identify symptoms associated with hypothyroidism and hyperthyroidism and to understand the physiological links to low or high levels of thyroid hormone production.

Procedure [Time needed, include additional steps if needed]:

Pre-Class Individual Space Activities and Resources:

Steps	**Purpose**	**Estimated Time**	**Learning Objective**
Step 1: Read Chapter 8. of the Wiley Desktop Edition of Essential Endocrinology and Diabetes - the interactive, digital version of the book that has downloadable text and images, highlighting and note taking facilities, book-marking, cross-referencing, in-text searching, and links to references and glossary terms.	Provides factual content on the anatomy and physiology of the thyroid gland.	30-60 min	Basic 1-8 Blooms levels: Remembering/ Understanding
Step 2: Create content notes (cheat sheet) to bring to the case-study learning session.	Supports active reading. Prepares student for class.	30-60 min	Basic 1-8 Blooms levels: Remembering/ Understanding
Step 3: Optional ungraded quiz.	Provides opportunity for self-assessment. Prepare students for graded quiz.	15-30 min	Basic 1-8 Blooms levels: Remembering/ Understanding

In-Class Group Space Activities and Resources:

Steps	**Purpose**	**Estimated Time**	**Learning Objective**
Step 1: Case Study Part I: Review anatomy and physiology of the endocrine system and pituitary regulation of thyroid gland function.	Review key concepts, address questions relating to understanding of anatomy and physiology.	20 min	Basic 1-8 Blooms levels: Remembering/ Understanding
Step 2: Case Study Part II: Data analysis and evaluation of pathophysiology. Diagnose the thyroid disorder in the case study. Explain to the patient the physiological links between their symptoms and the function of their thyroid gland.	Apply understanding of endocrinology to a clinical case study scenario. Analyze and evaluate patient data and explain the relationship between pathophysiology and thyroid dysfunction.	40 min	Advanced 1-3 Blooms levels: Apply/ Evaluate
Step 3: Case Study Part III: Investigate and explain common treatments of Graves Disease. Propose a treatment plan.	Create a treatment plan that outlines strategies to improve patient health by eliminating their disease or by improving / reducing the symptoms of the disease.	30 min	Advanced 4 Blooms levels: Apply/Evaluate/ Create
Step 4: Discussion	Address remaining questions.	10 min	Blooms levels: Understanding/ Apply/Evaluate/ Create

Closure/Evaluation:

Analysis: *Simple technology (i-clicker student response system and notecards) will be used to gauge student understanding and perceptions before, during and after the 120-min class period. The case-study class will end with an additional period for questions and discussion, as well as a metacognitive writing activity (e.g. minute paper).*

Post-Class Individual Space Activities: *Take a graded quiz that requires: i) recall and understanding of the textbook reading material (Learning Objectives 1-10); analysis of clinical data (Learning Objective 11) and; iii) application of endocrinology concepts to explain a clinical case-study scenario (Learning Objectives 12-13).*

Connections to Future Lesson Plan(s): *This lesson models the interactive case-method approach that will be used in future lessons. This lesson plan provides a rough template for every case / class that will be taught during the semester.*