Abstract:
- There are two different types of thyroid hormones, T3 and T4. These two types mostly differ in their concentrations and potencies, with T3 being approx. 3x more potent than T4 and T4 being approx. 4x more prevalent in the bloodstream. T4 is transformed into the more active version, T3.
- Both of these hormones play major roles in the development, growth, metabolism, and physiological function in virtually all tissues.
- Graves’ Disease is an autoimmune disease that causes the thyroid gland to overproduce T3 and T4.
- The most obvious symptoms of Graves’ Disease include protruding eyes and a swollen neck.

Background: Graves’ Disease
- A form of hyperthyroidism in which the thyroid gland produces excess amount of T3/T4 hormones.
- The bodies immune system perceives the thyrotropin receptor as foreign and produces antibodies, known as thyroid-stimulating immunoglobulins (TSI), against the receptor.
- The receptors mistake TSI for the normal thyroid stimulating hormone. In response, the thyroid gland begins secreting excess T3 and T4 hormones.[7]
- Symptoms:[6]
  - Nervousness
  - Palpitations
  - Sweating
  - Heat intolerance
  - Weight loss
  - Fatigability
- Notable Clinical Presentation:[6]
  - Ophthalmopathy: protruding/swollen eye due to inflammation in the orbital
  - Goiter: enlarged thyroid

Future Research:
- Antithyroid oral methimazole hinders the synthesis of T3 and T4 production by interfering with the formation of iodotyrosines in the thyroglobulin. Adverse side effects have been reported that include liver injury.[9]
- Instead of oral treatment, ointments may be an effective alternative that are much safer. [9] It is believed that application to the skin can avoid any adverse effects to the gastrointestinal tract and liver.[9]
- The study concluded that the ointment has similar benefits while reducing the amount of adverse effects. However, a small study sample was used, so further research should be done.[9]

Synthesis:
- Both variants of thyroid hormone are produced in and secreted by the thyroid gland while under constant regulation by a negative feedback system that includes the hypothalamus, and the anterior pituitary gland.[6]
- The synthesis of the Thyroid Hormones (TH) begins with the secretion of Thyrotropin Releasing Hormone (TRH) which binds to the TRH receptors in the anterior pituitary gland. This presents mono iodinated tyrosine residues that are enzymatically coupled to form T3 and T4. [10]

Normal Mode of Action: (Liver)
- Thyroid Hormones play vital roles in the normal functions of the liver, including the regulation of lipogenesis, lipolysis, and many of the oxidative processes that take place locally.[11]
- T3 creates a stimulating effect on lipogenesis, which is the creation of lipids, and lipolysis, which is the destruction of lipids.
- TH regulates these processes by controlling the enzymes that activate or deactivate them. They control these enzymes by either directly having an impact on the enzyme or by impacting something else that impacts the enzyme.[19]
- Malic enzyme, for example, is an enzyme that creates lipids (lipogenic) and receives two signals from TH. The first is a direct stimulation by T3, and the second is a reaction from other gene products that are regulated by T3.[11]