Humans are equipped with a powerful immune defense mechanism designed to resist infectious pathogens and cancers. Normally the immune system is tightly regulated. However, certain genetic and/or environmental conditions may produce a misdirected immune response generated against self tissues. This pathological process, termed autoimmunity, includes a broad spectrum of disorders that can affect virtually all parts of the human body.

### Multiple Sclerosis

The myelin sheath of oligodendrocytes wraps the axons of the central nervous system (CNS), acting as an insulator that enhances the propagation of electrical signals. Multiple sclerosis (MS) is a chronic disease characterized by the destruction of CNS myelin and often the underlying axons. Its pathology has hallmarks of an autoimmune disorder, including an inflammatory response with breakdown of the blood-brain-barrier and leukocyte infiltration into the nervous system. MS is accompanied by an array of physiological changes to the blood vessel endothelia, resident central nervous system cells, and cells of the immune system.

### Graves' Disease

The thyroid gland specializes in the production of thyroid hormone (TH), a tyrosine-based molecule that exists in two major forms, triiodothyronine (T3) and thyroxine (T4). These multifunctional regulators are involved in metabolism, protein synthesis, temperature homeostasis, development, and more. The production of TH is regulated by thyroid-stimulating hormone (TSH) produced by the anterior pituitary gland. Graves’ disease is an autoimmune disorder characterized by hyperthyroidism. It results from the production of autoantibodies that target and activate the TSH receptor leading to the overproduction of TH.

### Type 1 Diabetes

The islets of Langerhans are made up of clusters of endocrine cells found throughout pancreatic tissues. They contain specialized cell types such as the glucagon-secreting α cells and somatostatin-secreting δ cells. Also found in the islets of Langerhans are the β cells, producers of insulin and critical regulators of glucose homeostasis. Type 1 diabetes is characterized by the loss of β cells and the consequent inability to adequately regulate glucose levels without supplemental insulin. Early stages of the disease are accompanied by leukocyte infiltration into the islets, followed by destruction of the vast majority of β cells by the time of symptom onset.

### Rheumatoid Arthritis

Rheumatoid arthritis is a chronic, systemic inflammatory disorder. Although it has the potential to affect various cell and tissue types, it is known primarily for its association with deterioration of the joints. It is characterized by an inflammatory response that includes hyperplasia of the synovial lining and immune cell infiltration. As the disorder progresses, pannus tissue invades the joint, accompanied by the destruction of articular cartilage and erosion of the underlying bone.