The immune system is a powerful defensive weapon the body uses to identify and destroy invading organisms like bacteria and viruses. The cells of the immune system constantly patrol the body looking for such invaders. However, this defensive system must be carefully educated to distinguish between foreign material and the body’s own tissues, in order to prevent the immune system from mistakenly attacking its own body.

When this educational system breaks down, it can lead to autoimmune diseases like type I diabetes, rheumatoid arthritis, and multiple sclerosis.

Normally, an intricate system of checks and balances exists that teaches immune cells to distinguish self from non-self. In recent years, work in our lab and others has shed light on some of these mechanisms. Much of this work has focused on the thymus, the organ where certain immune cells, called T cells, develop. The thymus serves as a kind of school for T cells; here, a specialized group of “educator” cells produce a diverse array of many of the body’s own proteins. Any developing T cells that try to attack the self-proteins made by these
educator cells are killed before they can leave the thymus. In this way, the educational system helps rid the body of self-reactive T cells by weeding them out before they graduate. These educator cells require a specialized gene called the Autoimmune Regulator (*AIRE*) in order to produce this diverse sample of self proteins. Individuals who lack a functional AIRE gene produce a much more limited set of self proteins in their thymic educator cells, and thus fail to properly teach their immune system not to attack these self proteins, resulting in severe autoimmune disease.

**Current Work**

Recently we discovered a new population of educator cells that exist outside the thymus, which we termed extrathymic AIRE-expressing cells (eTACs). These cells exist primarily in the lymph nodes and spleen, where immune cells circulate to patrol the body for invading pathogens after leaving the thymus. The discovery of these novel educator cells outside the thymus suggests that this self-educational system may, in fact, extend throughout the rest of the body, hinting at a potential role for ?continuing education? in maintaining immune tolerance to self. These eTACs, which make the same *AIRE* protein seen in the thymus, also produce a diverse array of self proteins that are distinct from the set produced in the thymus, suggesting that the two systems may serve to complement one another. Further, we have found that, as in the thymus, eTACs can directly interact with and delete T cells that recognize such self proteins. This suggests that eTACs may play an important role in getting rid of self-reactive T cells that manage to escape from the thymus, serving as an additional safety net in preventing autoimmune disease.

This work raises a number of interesting questions, and suggests some potentially exciting avenues for future research. By characterizing how these novel cells normally work to prevent autoimmune diseases like type I diabetes, we hope to better understand what goes wrong when the system breaks down, and potentially how to treat and prevent such illness in the future. From a therapeutic standpoint, we speculate that by targeting specific genes or proteins to these eTACs, we may be able to help improve the educational system to better prevent immune cells from attacking the body?s own organs.