T cells and COVID Vaccine

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BIOL 302 Intro into Immunology

June 12, 2024

The outbreak of COVID-19 was one that shook the earth; from observing severe COVID-19 symptoms to researching treatment options. The fact that a vaccine to fight against COVID-19 was made in such a short amount of time is truly astonishing, but there are still gray areas regarding the efficacy of this vaccine. For instance, the lack of knowledge on the cellular immunity responses raises the question of how our bodies respond to the COVID-19 vaccine on an immunological level. It can be hypothesized that T cell immune responses, along with neutralizing antibodies, of NAb, are a major factor in protection from COVID-19. What's more, T cells may also protect the body from variants that NAbs do not recognize.

The immune system is composed of many different key players, all with different roles. T cells are a part of our adaptive immunity, which serves to protect the body when the body is exposed to a virus. Part of being in adaptive immunity is having the ability to alter or change in response to a foreign virus. When the body is first exposed to an unknown virus, the innate immune response is the first to kick in, but overtime, the adaptive immune response can become quicker in identifying the virus. More specifically, as discussed in class, T cells are a part of our cellular immunity, which consists of helper T cells (CD4+) and cytotoxic T cells (CD8+). Another important player in our immune response is antibodies, which are produced by B cells. Antibodies have a very important role, and one that is different from T cells; to bind to a virus and prevent it from entering a host cell. Antibodies can prevent infection of SARs-CoV-2 through high concentrations of IgG. This is one reason why vaccinations against certain viruses such as COVID-19 are notably important; not only can vaccinations as a whole provide protection, they can also mitigate especially severe symptoms from a disease.

Another thing to consider is germinal centers, which produce short and long-lived plasma cells and memory B cells. Short-lived plasma cells usually provide low-quality antibodies, while

long-lived plasma cells provide high-quality antibodies, although they take a longer time to form. With this being said, memory B cells may work alongside memory T cells to provide protection against COVID-19.

Memory T cells are a more specific type of T cell and are very important to quickly identifying and signaling protection from a disease. For example, if a variant were to pass unrecognized by NAbs, T cells could play a major role in preventing severe side effects of a disease. This circles back to the question of how T cells provide protection through vaccination from the COVID-19 virus.

As mentioned before, there are a couple of gray areas regarding the efficacy of the COVID-19 vaccine. One gray area is how long the body is protected against COVID-19 once the body has received the vaccine. Studies have shown that NAb titers decrease very quickly, typically within 4 to 6 months, and furthermore, the level of NAb titers needed to sustain protection is currently unknown. (Wherry, 2022) Even further, what happens when variants like the Omicron can get past NAb recognition? Unfortunately, human bodies are left with less protection against variants like Omicron.

So what are the mechanisms of T cells in respect to the body's immunity? As discussed in class, T cells look for peptides (about 8 to 15) to bind to on human leukocyte antigen class one or two molecules. An example of this can be found with helper T cells (CD4+), which can contain different antiviral mechanisms. Unlike NAbs, T cells can bind to other domains which do not provide mutations, which helps T cells remain intact. This is especially beneficial when being confronted by variants such as the Omicron.

There is proof that T cells play a major role in the protection against severe side effects and variants. For example, cancer patients that have a deficiency in B cell populations showed

that CD8+ T cells were related to less severe symptoms. (Wherry, 2022) In regard to producing new COVID-19 vaccines, there is still research that needs to be done in respects to what T cells help fight disease. However, being familiar with the role that T cells play in immunity can boost research and is a great starting point to creating a new and more effective COVID-19 vaccine.

References

1. Wherry, J. E., Barouch, D. H. (2022, August) *T cell immunity to covid-19 vaccines.* Science. https://www.science.org/doi/10.1126/science.add2897