

How do Parasites Escape from the Immune System?

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ABSTRACT

This article focuses on the clever tactics parasites employ to evade their host's immune system and cause an infection. Essentially, a parasite is an organism that relies on another organism—the host—for its food and survival needs. Medical parasitology specifically covers protozoa, helminths, and certain types of arthropods. When parasitic diseases strike, they trigger immune responses in the host aimed at getting rid of the invaders. However, parasites have also developed a range of effective strategies to fend off these immune attacks and manage to thrive within the host. This article compiles all available information on how parasites manage to avoid being targeted by the host's complement immune system, even in challenging conditions, and explains the mechanisms behind this immune evasion.

Keywords: Escape the immune system, Immune system, Mechanism, parasites, Protozoa, Helminths

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Introduction

Parasites are organisms with complex cells that live on or inside another living thing, known as a host, and depend on that host for food. These creatures can be simple, single-celled beings (like protozoa) or more complex, multi-celled organisms (like metazoans) (1, 2). In humans, we often group parasites based on the illnesses they cause, recognizing three main types: endoparasites, which include protozoa and worms, and live inside the body; and ectoparasites, such as mosquitoes, lice, flies, bedbugs, ticks, and fleas, which feed on the host's blood or other substances (3). This review highlights the key methods parasites use to control, weaken, and withstand the host's immune defenses. We will explore some of these methods below.

Helminthes Escaping Strategies

Helminths, or parasitic worms, are quite common and can make humans their home. They spread through contaminated water, food, soil, or by latching onto animals (4). Several researches have reported how helminths operate and how significantly they affect the hosts' immune systems. Helminths really effect the production, movement, function, and development of cytokines in both the adaptive and innate immune systems. The ways these worms mess with immune cells are pretty diverse. For instance, helminths release an enzyme protease, which can break things down or interfere with activation processes. They also release ligands that attach to specific receptors on cell surfaces, which then trigger reactions inside the cells. This type of worm can trigger the body to produce mucus, encourage the cells that line tissues to move around within those mucous membranes, and alter how those cells react to the immune system. Helminths are able to create proteins including cytokines and chemokines. Additionally, helminths can alter the host's RNA, decrease the function of specific genes, inhibit a wide range of immune responses in their hosts, or even alter the genetic code to render the host incapable of using it. (5).

Protozoan Parasite Escaping Strategies

Many infections triggered by these protozoa tend to become long-lasting because the host's immune defenses and the parasites have co-evolved together over time. For these harmful protozoa to spread and survive, they rely heavily on their ability to either bypass or break down the host's natural and learned immune responses (6,7).

Protozoan parasites have developed some clever ways to escape the immune system:

One method is called 'antigenic covering'. It's basically the parasite's ability to protect itself by wrapping itself in a layer of antigens, making it harder for the immune system to recognize and attack it.

Another tactic involves the parasite acquiring a coat made of antigen-antibody complexes or non-harmful antibodies. This coat acts like a shield,

strongly preventing the immune system's specific antibodies or lymphocytes from binding to and targeting the parasite's surface antigens.

Where Protozoa Live Inside Cells: Many protozoan parasites make their home inside host cells (they're intracellular). This spot acts like a safe haven, shielding them from the host's immune defenses. By hiding their antigens within the cell, they can avoid being detected by the immune system (4,7).

Changes in antigens: The antigens found on the surface of many protozoa actually change throughout the course of an infection. Parasites that develop these new antigens can then escape the host's immune system, which was primed to target the original ones. Immunosuppression: Generally speaking, protozoan infections tend to weaken their host's immune system to some degree. This weakened response makes it harder for the immune system to spot and react to variations in the protozoa's antigens. Ultimately, this can reduce how effectively the immune system works, which may limit the parasite's growth or even help clear the infection (8, 9).

Conclusion

Based on this review, it's clear that parasites have developed numerous ways to escape their host's immune system. These tactics mainly involve altering the host's immune response, allowing them to successfully survive and thrive in different hosts.

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