

The first lines of defense offered by immune systems help prevent pathogens from gaining entrance to the body.

For example, an outer covering, such as skin or a shell, blocks entry by many pathogens. Sealing off the entire body surface is impossible, however, because gas exchange, nutrition, and reproduction require openings to the environment.

Secretions that trap or kill pathogens guard the body's entrances and exits, while the linings of the digestive tract, airway, and other exchange surfaces provide additional barriers to infection.

If a pathogen breaches barrier defenses and enters the body, the problem of how to fend off attack changes substantially. Housed within body fluids and tissues, the invader is no longer an outsider. To fight infections, an animal's immune system must detect foreign particles and cells within the body. In other words, a properly functioning immune system distinguishes nonself from self. How is this accomplished? Immune cells produce receptor molecules that bind specifically to molecules from foreign cells or viruses and activate defense responses. The specific binding of immune receptors to foreign molecules is a type of molecular recognition and is the central event in identifying nonself molecules, particles, and cells.

- ▶ Skin
- ▶ Mucus membranes
 - Tissues that protect the interior surfaces of the body that may be exposed to pathogens
 - Secrete MUCUS—a sticky fluid that traps pathogens

