

Q: How has the perceived purpose of the "immune system" changed over the last 75 years

Google AI answer:

Over the last 75 years, the perceived purpose of the immune system has evolved from a simple "self vs. non-self" defense mechanism focused on fighting external germs to a complex, integral system responsible for maintaining **tissue homeostasis, repairing damage, regulating metabolism, and sensing internal danger**.

This "Copernican revolution" in immunology has shifted focus from purely adaptive immunity (lymphocytes) to the central role of innate immunity and its interaction with the environment.

Here is how the perception has changed:

1. The 1950s–1970s: The "Self vs. Non-Self" Era

- **Perceived Purpose:** To defend the body specifically against external invaders (bacteria, viruses) and distinguish foreign agents from the body's own tissues.
- **Key Focus:** Immunochemistry and clonal selection theory. Frank Macfarlane Burnet and Peter Medawar identified "acquired immunological tolerance," proposing the immune system learns to accept self-antigens during development.
- **Limitation:** This theory could not fully explain why the immune system attacks itself in autoimmune diseases or fails to reject cancer, leading to its eventual refinement.

2. The 1980s–1990s: The "Danger" Paradigm

- **Perceived Purpose:** The immune system does not just react to "non-self," but specifically to **danger signals**—stressed, necrotic, or injured cells.
- **The Shift:** Charles Janeway recognized the "dirty secret" of immunology: adaptive immunity needs the innate immune system to signal that a threat is present.
- **Key Discovery:** Pattern recognition receptors (like Toll-like receptors) were found to detect Pathogen-Associated Molecular Patterns (PAMPs) and Damage-Associated Molecular Patterns (DAMPs).

3. The 2000s–Present: Homeostasis and "Inflammaging"

- **Perceived Purpose:** The immune system is now viewed as a "sentinel" of homeostasis, balancing defense with repair.
- **Innate Immunity Center Stage:** The last 50 years have highlighted that innate immunity (macrophages, neutrophils) works in parallel with adaptive immunity (T and B cells).
- **The Role of Aging (Immunosenescence):** The purpose of the immune system changes with age, leading to a state of chronic, low-grade inflammation known as "inflammaging".
- **Systemic Interaction:** The immune system is now recognized as being crucial for tissue regeneration, managing the microbiota, and even regulating metabolism, moving far beyond just "killing germs".

Summary of Key Paradigm Shifts

Feature	1950s–1970s View	2020s View
Primary Goal	Protect against foreign invaders	Maintain tissue homeostasis/repair
Trigger	Non-self (foreign) antigens	Danger signals (DAMPs/PAMPs)
Core Components	Antibodies/Lymphocytes (Adaptive)	Innate immunity interacting with Adaptive
Cancer View	Unrecognized by immune system	Actively managed by surveillance (when functional)
Self-Attack	Anomaly	Failure of regulation (autoimmunity)

In essence, the immune system is no longer viewed as an "army" that is either active or asleep, but as a dynamic regulatory network that constantly monitors and maintains the body's internal state.