

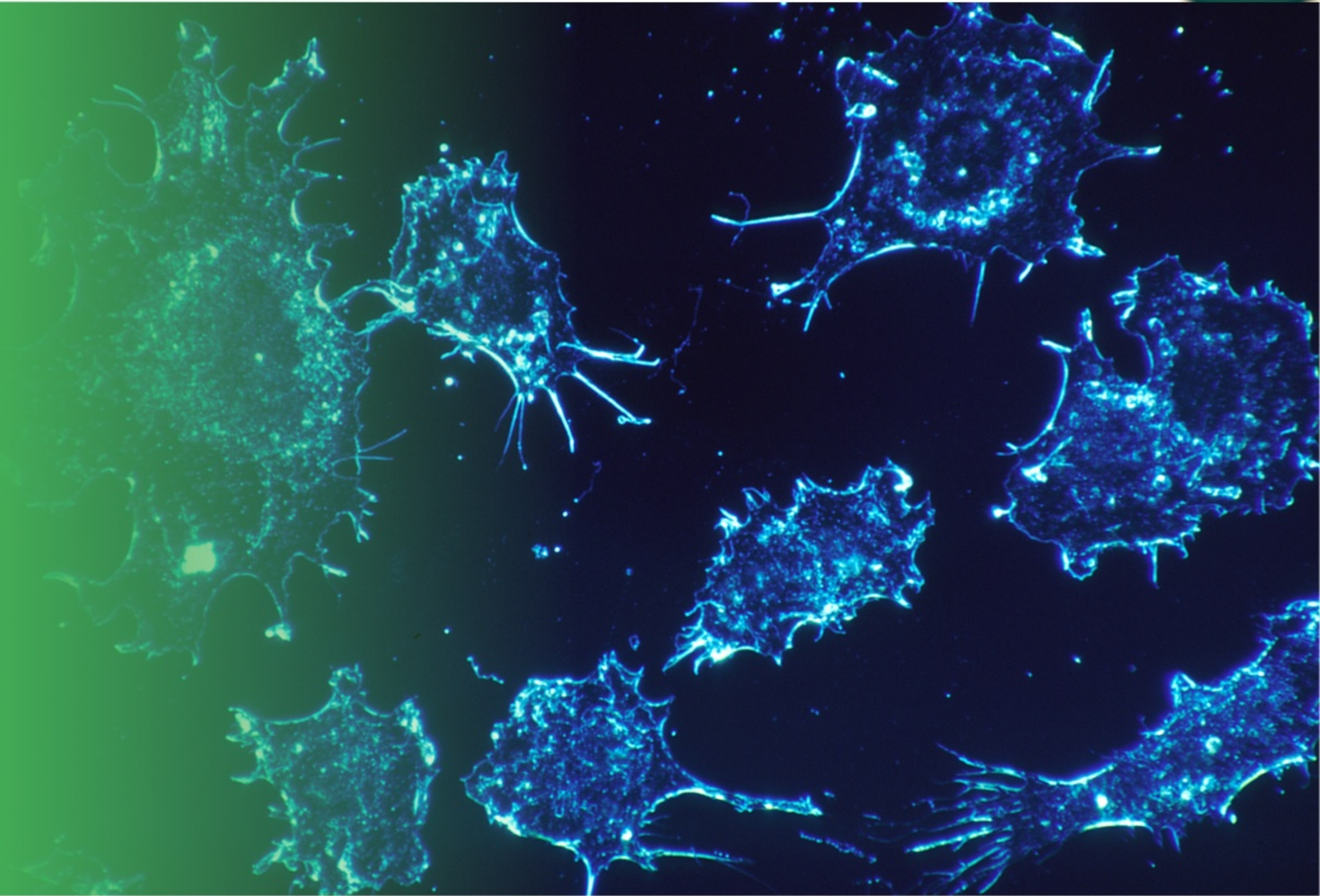
Trained Immunity: The Innate Immune System Remembers

Understanding a Paradigm Shift in Immunology



What is Trained Immunity?

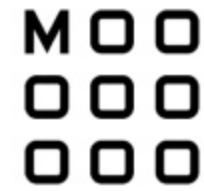
For decades, immunological memory was attributed solely to adaptive immunity. However, trained immunity (TRIM) reveals that innate immune cells can also develop long-lasting functional reprogramming after exposure to stimuli, leading to enhanced, non-specific responses to future challenges.



Mechanisms Behind Innate Memory



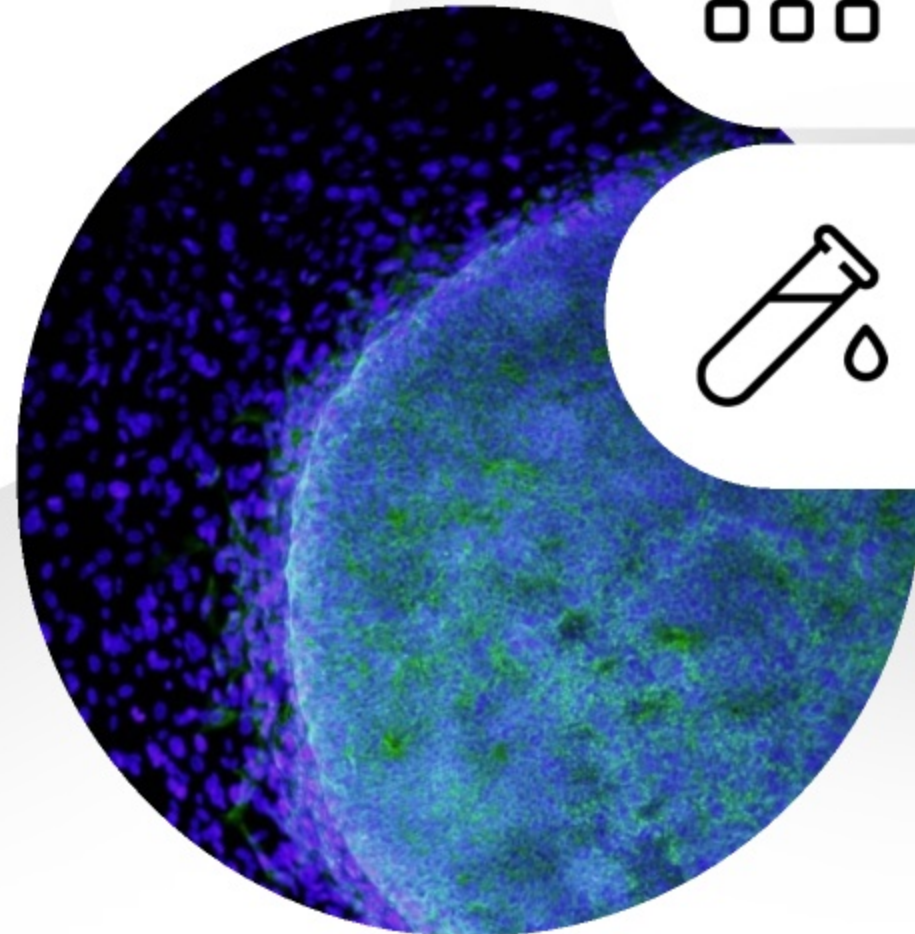
Epigenetic Modifications: Changes in chromatin accessibility, such as histone methylation and acetylation, prime inflammatory genes for rapid activation.



Metabolic Reprogramming: Shifts towards enhanced glycolysis, cholesterol metabolism, and mitochondrial activity provide energy for amplified immune responses.

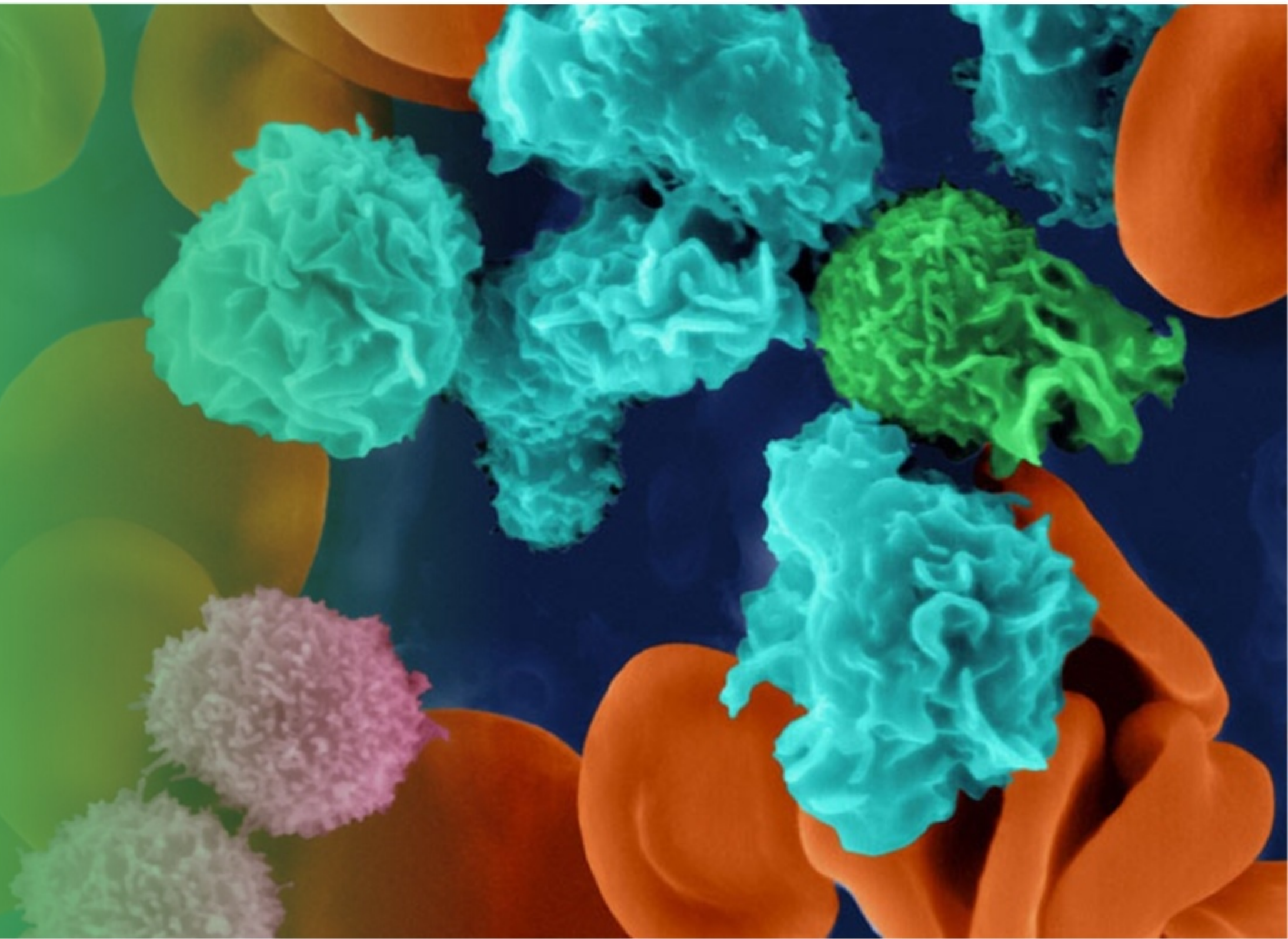


Key Cellular Players: Primarily mediated by monocytes, macrophages, natural killer (NK) cells, and hematopoietic stem and progenitor cells.



Central Trained Immunity

A significant discovery is that trained immunity can occur in hematopoietic stem and progenitor cells within the bone marrow. This 'central trained immunity' explains how long-lasting innate memory persists despite the short lifespan of circulating immune cells, continuously generating hyper-responsive myeloid cells.

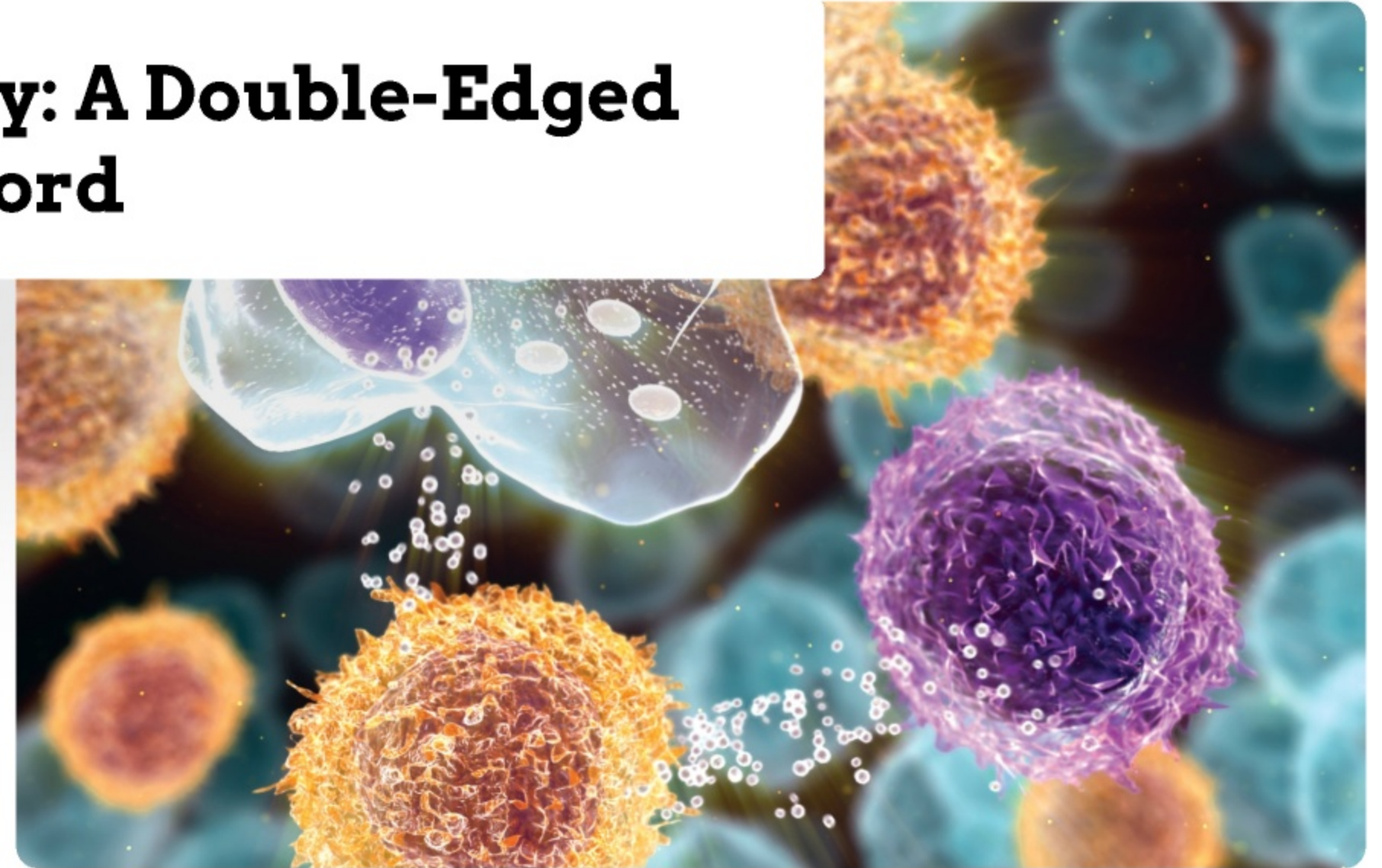


Key Inducers of Trained Immunity

- ➔ Bacillus Calmette–Guérin (BCG) Vaccine: Provides broader protection against various viral, bacterial, and parasitic infections beyond tuberculosis.
- ➔ β -glucans: Compounds derived from fungi that can induce trained immunity.
- ➔ Certain Infections: The infections themselves can trigger long-lasting reprogramming of innate immune cells.



Trained Immunity: A Double-Edged Sword



Protective Roles

Trained immunity offers enhanced defense against infections and holds potential for boosting anti-tumor immunity, demonstrating a crucial protective function.

Maladaptive Consequences

However, persistent inflammatory stimuli can induce maladaptive trained immunity, contributing to chronic inflammatory disorders like rheumatoid arthritis, atherosclerosis, and metabolic diseases.

Maladaptive Mechanisms & Contributing Factors



Persistent Inflammatory Stimuli: Conditions like periodontitis, obesity, diabetes, and chronic stress can induce inflammatory memory.



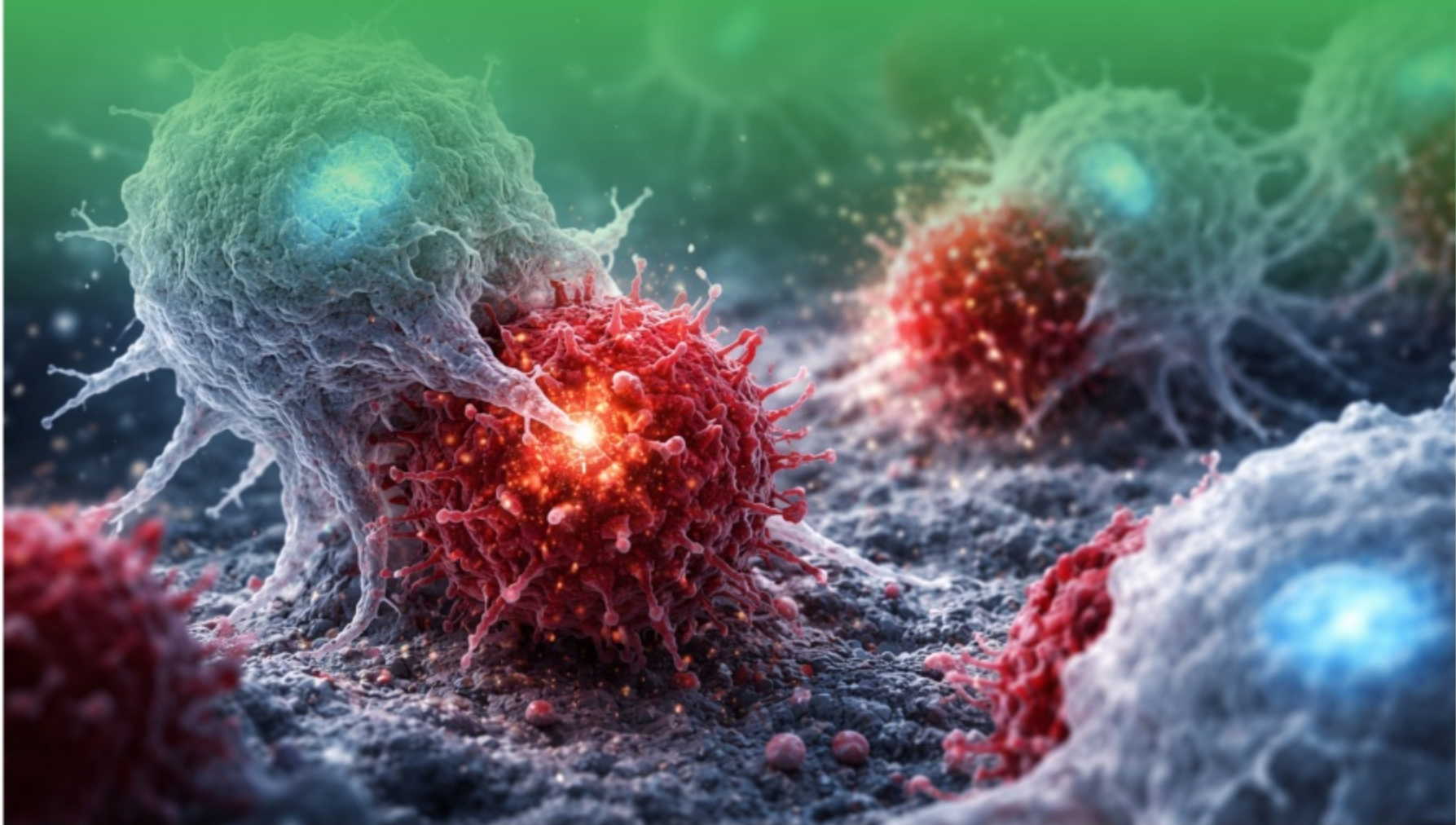
Inflammasome–IL-1 β Axis: Activation of this pathway leads to IL-1 β production, which promotes epigenetic reprogramming and trained myelopoiesis, perpetuating chronic inflammation.

Trained Immunity and Cancer



Trained Immunity and Cancer

Trained immunity has a complex role in cancer. While chronic inflammatory TRIM can promote tumor development, deliberate induction of trained immunity (e.g., with BCG) can enhance anti-tumor responses and is being explored in cancer immunotherapy.



Future Directions & Therapeutic Potential

Harnessing Trained Immunity for Health



Stimulate TRIM

Develop strategies to enhance trained immunity for improved protection against infections and cancer.



Suppress Maladaptive TRIM

Target maladaptive trained immunity to manage and treat chronic inflammatory and autoimmune diseases.



Precision Medicine

Integrate trained immunity principles into personalized therapeutic approaches and vaccine development.



Deeper Understanding

Further research into immunopathology and inflammatory disease mechanisms.





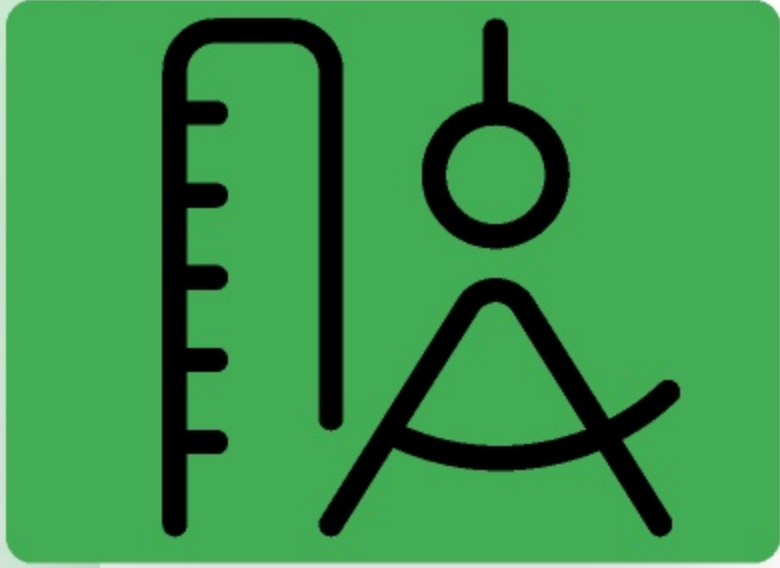
Stimulate TRIM

Develop strategies to enhance trained immunity for improved protection against infections and cancer.



Suppress Maladaptive TRIM

Target maladaptive
trained immunity to
manage and treat chronic
inflammatory and
autoimmune diseases.



Precision Medicine

Integrate trained immunity principles into personalized therapeutic approaches and vaccine development.



Deeper Understanding

Further research into
immunopathology
and inflammatory
disease mechanisms.

Trained Immunity: The Innate Immune System Remembers

Understanding a Paradigm Shift in Immunology



Take this with you. Revisit anytime.

Missed something? Want to explore further?
Scan or click below to open this presentation.
Anytime, anywhere.

[View presentation](#)

