

Introduction to Immunology

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Immunology

What is immunity

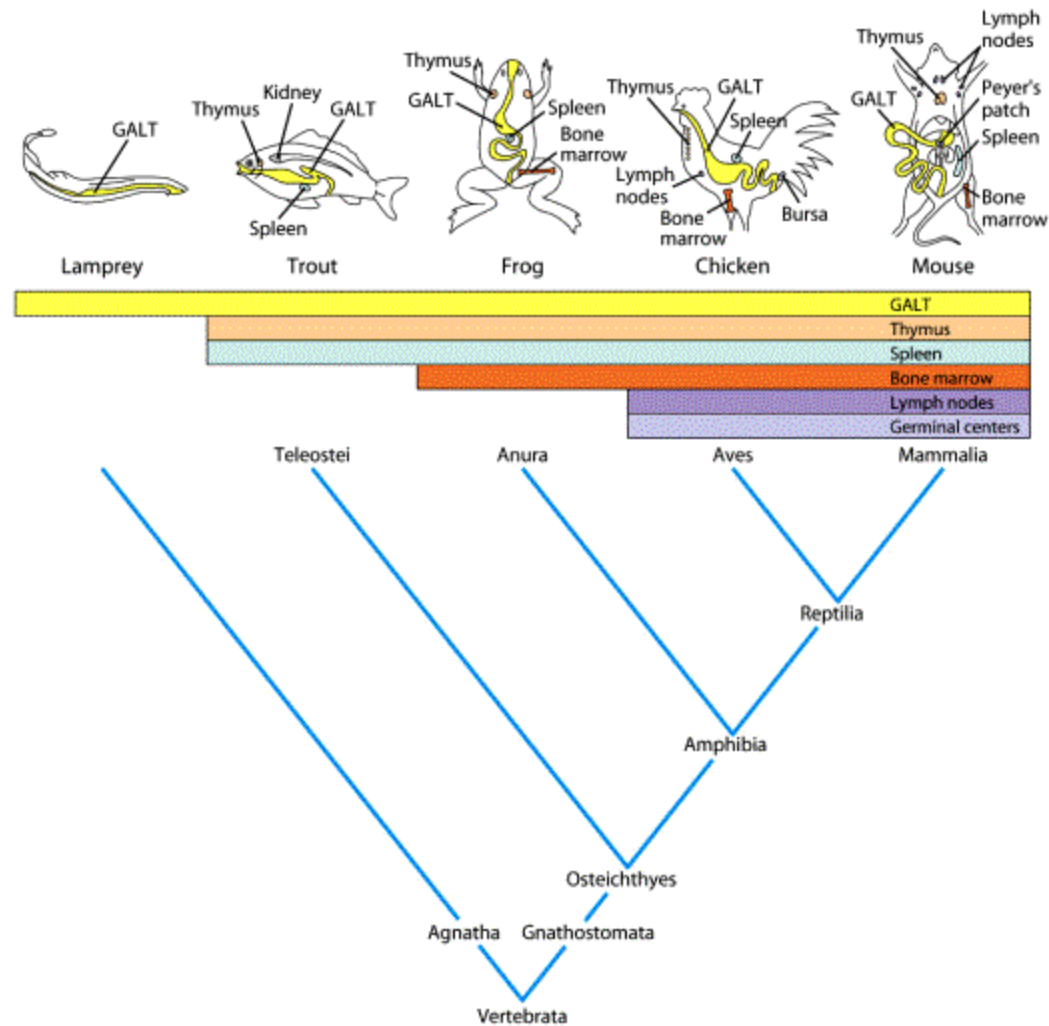
Immunity is that aspect of body's defenses against pathogens (and other foreign material) that acts against specific molecules, usually requiring the immune system to “learn” the properties of specific molecules over a number of days or weeks before mounting an effective response.

- **Immunity means protection from diseases and especially infectious disease.**
- **Cells and molecules involved in such protection constitute the immune system.**
- **The response to introduction of a foreign agent is known as the immune response.**

- **Not all immune responses protect from diseases; some foreign agents, such as allergens cause disease as a consequences of inducing an immune response.**
- **Some individuals mount immune responses to their own tissues as if they were foreign agents leading to autoimmune diseases common to man.**
- **Most individuals do not suffer from autoimmune because they have developed tolerance towards their own (self) tissues.**

Evolution of the immune system

- **Evolutionary pressures**
- **Movement from water to land**
- **Development of extensive hematopoietic system**
- **Emergence of bone marrow**
- **Major histocompatibility complex**
- **Lymphocytes**



Major Milestones in induction of immunity

- **10th- 15th century Chinese and Turks developed variolation.**
- **Edward Jenner, 1798**
- **Louis Pasteur (1870's)- the beginning of immunology as a discipline and origins of the term vaccine**
- **First human vaccination (1885): attenuated rabies virus.**

Variolation

- The Chinese were the first to exploit the observation that survivors of disease did not get re-infected through an early form of vaccination called variolation, which was carried out as early as the 10th century and particularly between 14th and 17th centuries.
- The aim was to prevent small pox by exposing healthy people to matter from the lesions caused by the disease, either by putting it under the skin, or more often, inserting powdered scabs from small pox pustules into the nose.





Jenner's observation of people who had caught cowpox suggested this was true. In 1796 he deliberately infected a boy, James Phipps, with cowpox from an infected cow. When the boy recovered, Jenner injected him with smallpox under his skin. James Phipps did not catch small pox.

Primary lymphoid organs

- **Bone marrow**
- **Thymus gland**

Secondary lymphoid organs

- **Lymphoid nodes**
- **Spleen**
- **MALT**

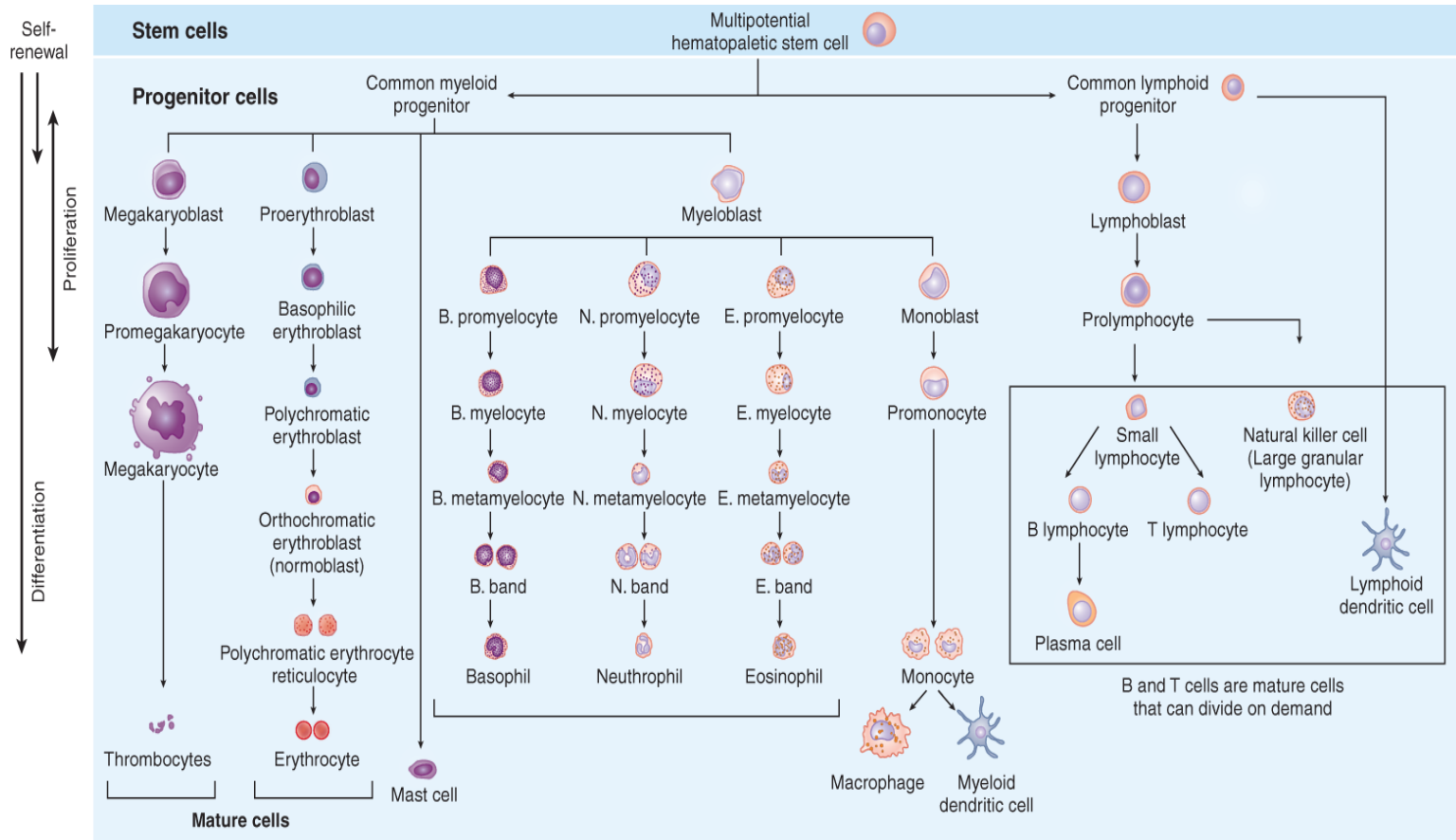
Tertiary lymphoid organs

- Cutaneous associated lymphoid tissue**

Hematopoiesis- source of immune cells

Definition

Formation and development of red and white blood cells.



Source: Bunn HF, Aster JC: *Pathophysiology of Blood Disorders*:
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Overview of Innate and Adaptive Immunity

- The normal individual has two levels of defence against foreign agents.
- Natural or innate is present in neonatal animals and in invertebrates. This is also referred to as non-specific or broadly specific immunity.
- Adaptive or acquired immunity is `confined to vertebrates.

Comparison of adaptive and innate immunity

	Innate	Adaptive
Response time	Hours	Days
Specificity	Limited and fixed	Highly diverse, improves during the course of immune response.
Response to repeat infection	Identical to primary response	Much more rapid than primary infection

Component of the Immune system

Innate

Adaptive

Humoral

Cellular

Humoral

Cellular

Complement,
Interferon, TNF etc

macrophages
Neutrophils

Antibodies, cytokines

T and B cells
other effector cell
and dendritic cells

Identification of the two arms of the Immune system

1883 Metchnikoff and Ehrlich demonstrated cell mediated Immunity

First evidence of cellular phagocytosis.

1890 Behring and Kitasato demonstrated Humoral Immunity

Demonstrated that the non cellular component of blood could transfer immunity to diphtheria from one organism to another.