Macrophages

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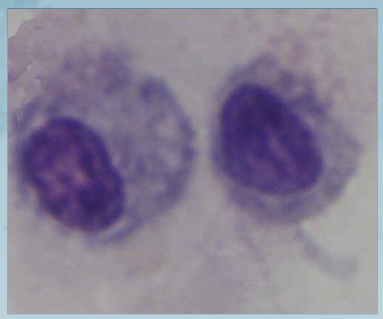
Macrophages are specialised cells involved in the detection, phagocytosis and destruction of bacteria and other harmful organisms. In addition, they can also present antigens to T cells and initiate inflammation by releasing molecules (known as **cytokines**) that activate other cells.

Macrophages originate from blood **monocytes** that leave the circulation to differentiate in different tissues. There is a substantial heterogeneity among each macrophage population, which most probably reflects the required level of specialisation within the environment of any given tissue. This heterogeneity is reflected in their morphology, the type of pathogens they can recognise, as well as the levels of inflammatory cytokines they produce (i.e. **IL-1**, **IL-6**, **tumour necrosis factor alpha**). In addition, macrophages produce reactive oxygen species, such as **nitric oxide**, that can kill phagocytosed bacteria.The heterogeneous nature of these cells may not solely be the result of their differentiation process, but it is likely to be inherited from their monocyte precursors.



Lung macrophages stained with Wright-Giemsa

Macrophages migrate to and circulate within almost every tissue, patrolling for pathogens or eliminating dead cells. The table below describes the location and function of a few different macrophage populations.

Type of macrophage	Location	Function
Alveolar macrophage	Lung alveoli	Phagocytosis of small particles, dead cells or bacteria. Initiation and control of immunity to respiratory pathogens
Kupffer cells	Liver	Initiate immune responses and hepatic tissue remodelling.
Microglia	Central nervous system	Elimination of old or dead neurons and control of immunity in the brain.
Splenic macrophages (marginal zone, metallophilic and red pulp macrophages)	Spleen marginal zone, red and white pulp	Elimination of dysfunctional or old red blood cells.

Macrophages are able to detect products of bacteria and other microorganisms using a system of recognition receptors such as **Toll-like receptors** (**TLRs**). These receptors can bind specifically to different pathogen components like sugars (**LPS**), RNA, DNA or extracellular proteins (for example, **flagellin** from bacterial flagella).