

Immunity in the lung

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The lung encounters a myriad of, potentially foreign, particles on a daily basis. As such, immune cells in this site must gauge whether or not to respond. This choice is partially removed by physical and soluble barriers to infections. Large particles are deposited in the nasopharynx and tonsillar regions and cleared by inertial forces (coughing and sneezing). Further down the respiratory tract foreign particles are captured on the mucociliary surface and propelled back on an “escalator” (via rhythmic movement of microscopic, hair-like, cilia) to the upper airways from where they are expelled. Various antimicrobial compounds also exist within this mucous layer including **collectins** such as **surfactant proteins**, **LBP** (a protein that binds to bacterial **lipopolysaccharide [LPS]** allowing it to be recognised by innate immune cells) and **complement components** that, amongst other effects, bind to bacterial cell walls allowing their uptake by immune cells. Antimicrobial peptides are also secreted into this environment.

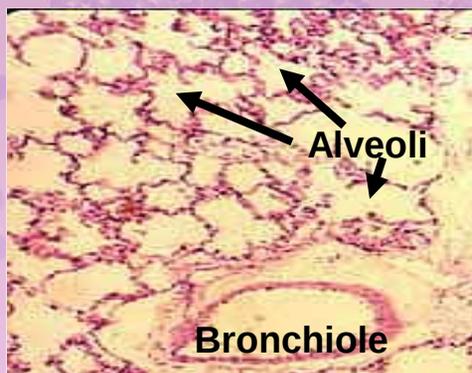


Figure 1. A section through the lower airspaces showing the two smallest terminal branches, the bronchioles and the even smaller alveoli. Note the single cell layer of the epithelium surrounding these airspaces. This facilitates gaseous exchange to red blood cells in blood vessels that are interwoven with these structures. Note also that there are very few other cells in the airspaces.

The alveoli

The alveoli are the terminal branches of the lungs where the majority of gaseous exchange occurs. As such it only houses a small number of immune cells that in mouse and man are comprised almost entirely of **alveolar macrophages**. These macrophages secrete a plethora of anti-microbials including **oxygen metabolites**, **lysozyme**, **antimicrobial peptides** and **proteases**. They also phagocytose and kill microbes. Alveolar macrophages are important for the recruitment of other immune cells when the threat is great by secretion of **cytokines** (**interleukins-1, -6, and tumor necrosis factor**) and **chemokines** (including **interleukin-8**, that recruits neutrophils). They can also process and present antigens to helper and cytotoxic T cells.

Are there any other immune cells in the lungs?

Not in the airspaces as such, though **dendritic cells** are known to project their dendrites into the airway lumen. T cells (predominantly cytotoxic) exist between epithelial cells (**intraepithelial lymphocytes [IELs]**). Some CD4+ helper T cells are found between the airspaces as are collections of B lymphocytes organised into follicles known as **inducible bronchus associated lymphoid tissue (iBALT)**. Some **neutrophils** and rare **mast cells** may also be present, though most cells arrive when they are needed. Note that the epithelial cells can also contribute to lung immunity by secretion of chemokines, cytokines and antimicrobial compounds.