Overview of Respiratory Tract Histology

The lung is one of several organs that packs a large epithelial surface area into a compact volume. The basic organizational pattern is that of a gland, in which a branching tree of tubes provides continuity from the body's outside surface to a vast number of epithelial cells. Indeed, the respiratory tract begins life as an invagination of epithelial (endodermal) tissue, and embryonic lungs even have the histological appearance of compound, exocrine glands. Only fairly late in development do the cuboidal epithelial cells of the terminal alveoli assume the thin squamous shape that characterizes the lining of mature gas-exchanging air sacs. And some significant secretory function is retained, in the form of cuboidal, surfactant-producing great alveolar cells.

Both in large glands and in the respiratory system, a system of conducting passageways form a branching "tree", with functional units at the end of each twig.

In the respiratory system, the tree's "trunk" is the trachea, larger branches are called bronchi (singular "bronchus"), and smaller branches are called bronchioles. (In a gland, the conducting passages are called "ducts".)

In the lung, the epithelial cells at the ends of all the twigs form "respiratory units", also called alveoli (singular, "alveolus"). (In a gland, the secretory units at the ends of the twigs are also sometimes called "alveoli", which means a small hollow or cavity.)

The conducting passageways of the respiratory system (nasal cavity, trachea, bronchi and bronchioles) are lined by pseudostratified columnar epithelial tissue, which is ciliated and which includes mucus-secreting goblet cells. Incoming particulates (dust, bacteria) adhere to the mucus, which is then swept upward and away by the cilia.

Because the passage of air depends on wide open passageways, the larger respiratory passages (trachea, and bronchi) are supported by skeletal elements in the form of rings made of cartilage. An extensive vascular plexus allows heat-exchange to condition air before it reaches the delicate alveoli.

The respiratory or gas-exchange surface consists of millions of small sacs, or alveoli, lined by a simple squamous epithelium. This epithelium is exceedingly thin to facilitate diffusion of oxygen and CO2. The alveolar walls also contain cuboidal surfactant-secreting cells. The surfactant overcomes the tendency of alveolar walls to adhere to one another (which would obliterate the air space).

As in any gland, each alveolus is enveloped by capillaries. In the lungs, the gas-exchange function of this pulmonary vasculature is critical to organ function and to life itself.

(From: http://www.siumed.edu/~dking2/crr/rsguide.htm)