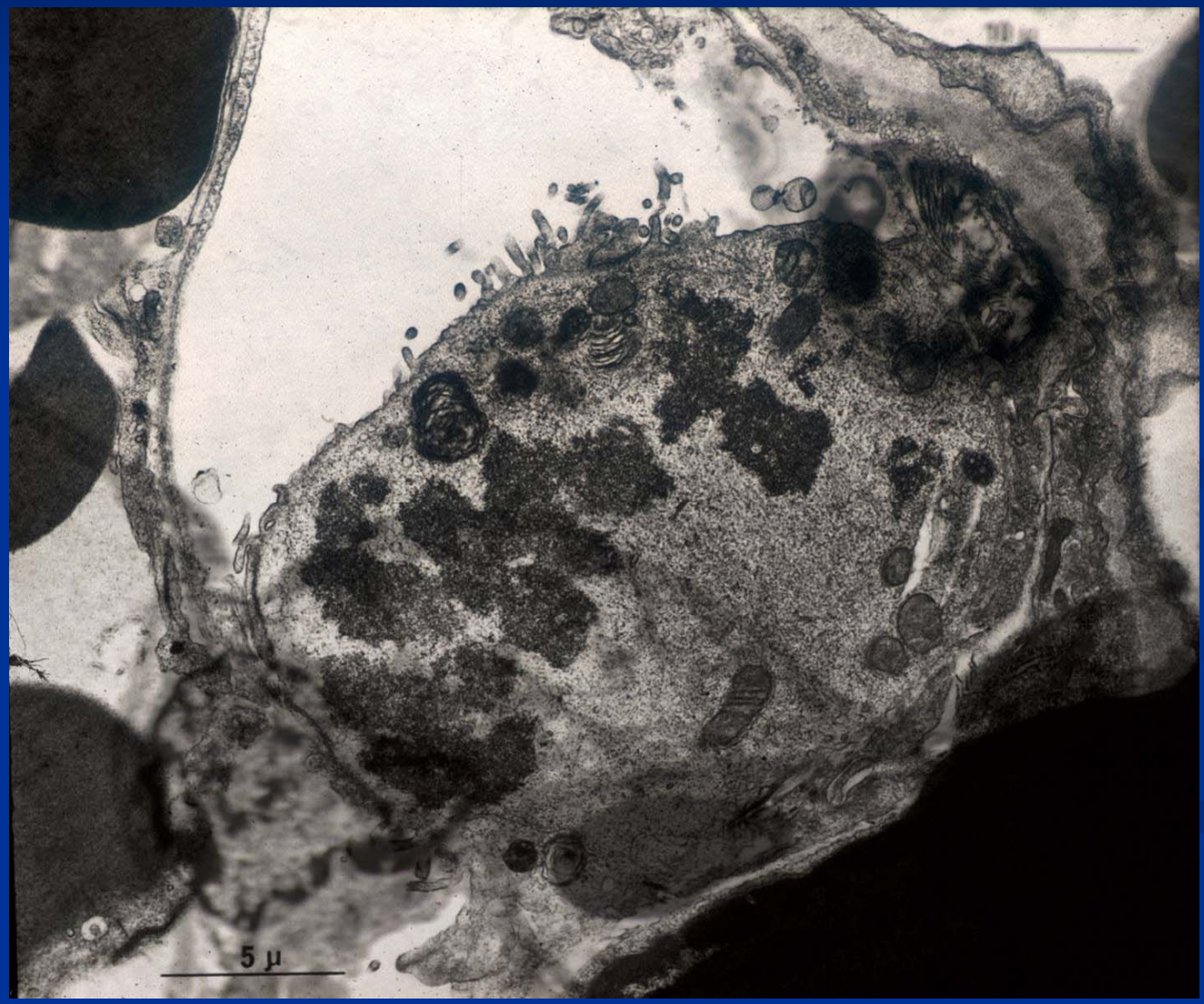
Alveolar Epithelial Cells

- Type 1 pneumocytes (membranous)
  - Flat/squamous
  - Nucleus protrudes into the alveolar lumen
  - 97% of the alveolar surface
  - Do not divide
- Type 2 pneumocytes (granular)
  - Cuboidal
  - Microvilli
  - Secrete surfactant – lamellar bodies -
  - Progenitor cell
- Are phagocytic

Proliferating Type II Cell



Endothelial Cells

- Gas exchange function
- Attenuated, large surface area
  - Highly susceptible to injury, e.g. oxygen, radiation, endotoxin
- Metabolism of endogenous and exogenous compounds
- Progenitor cells

Macrophages

- Alveolar
- Interstitial
- Intravascular – pigs, ruminants, cats, horses, marine mammals – similar to Kupffer cells in liver

Macrophages

- Play important roles in
  - Host defense – phagocytosis – can eliminate bacteria without inflammation
  - Inflammation – cytokines release, etc
- Specific receptors
  - Fc for antibody
  - Complement
  - TNF
  - CD40
  - Toll-like - recognition of microbial components
  - FAS – for apoptotic cells
  - "Scavenger"

Macrophages

- Alveolar
  - Live for a few days
  - Can increase in a few hours by cell division and recruitment from interstitium
  - Removed by mucociliary escalator
- Interstitial
  - From bone marrow/blood monocytes
  - Live for weeks/months
  - Enter alveolus or removed via lymphatics

Immune System

- T-lymphocytes in respiratory epithelium
- T and B cells in mucosal lamina propria
- Plasma cells in mucosa produce IgA
- Dendritic and other APC cells
- Organized lymphoid tissue (MALT: BALT and NALT) – covered by M-cells (modified epithelial cells)
- Draining lymph nodes

Immune System

- Airways - IgA – prevents attachment and absorption of antigens (immune exclusion)
- Lung - IgG (also IgE and IgM) – promotes uptake and destruction of inhaled pathogens by phagocytic cells (immune elimination)
  - IgG – acts as opsonizing antibody for alveolar macrophages and neutrophils

Additional Components of the Lung

- Other cell types
  - Mast cells
  - Neuroendocrine cells (airway epithelium
- Collagen
  - Type IV – basement membrane
  - Type III – increases early after injury
  - Type I – increased late after injury
- Elastic fibers

Portals of Entry into the Respiratory System

Aerogenous (air)	Virus, bacteria, *Chlamydophila*, fungi, toxic gases, and pneumotoxicants
Hematogenous (blood)	Virus, bacteria, fungi, parasites, toxins, and pneumotoxicants
Direct extension	Penetrating wounds, migrating awns, bites, and ruptured esophagus or perforated diaphragm (hardware)