



Ozone Mode of Action

Sabine Lange, Ph.D.

Toxicology Division

Texas Commission on Environmental Quality

Sabine.Lange@tceq.texas.gov

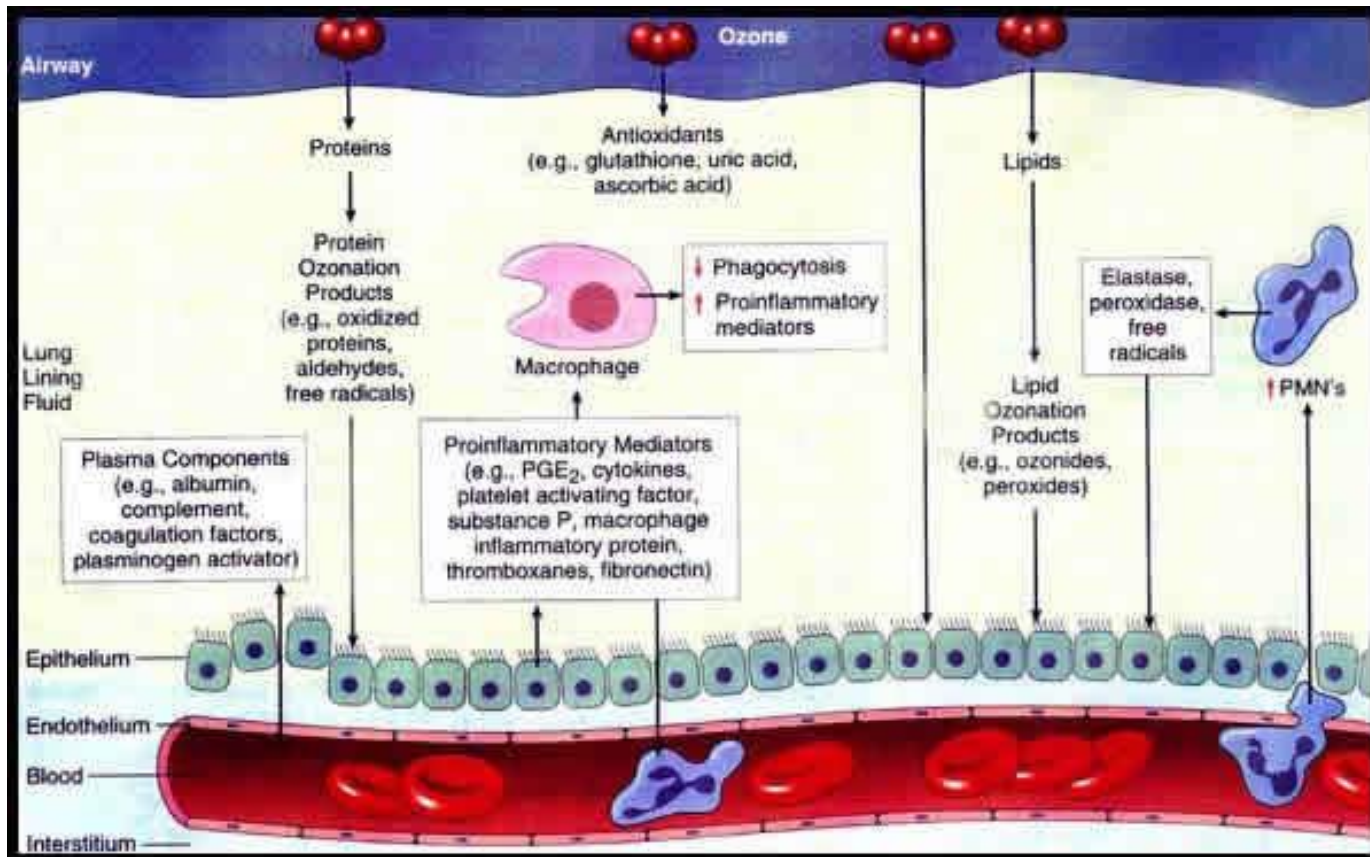


Ozone Dosimetry & Uptake

- Ozone is a highly-reactive, poorly water soluble gas at room temperature, and it is a respiratory toxicant;
- Ozone is scavenged by ventilation systems and indoor surfaces, and therefore is primarily an outdoor pollutant
- ~50% reacts in the head (nose, mouth, pharynx), ~7% in the larynx/trachea and ~43% in the lungs (little in the alveolae). More in alveolae with exercise
- The respiratory tract lining fluid contains antioxidants (primarily ascorbic acid, glutathione, and uric acid) that can react with ozone and prevent it from producing damaging secondary reaction products

Ozone Reactions in the Respiratory Tract

- In the respiratory tract ozone diffuses across and reacts with constituents of the epithelial lining fluid (ELF)



Source: <http://www.epa.gov/apti/ozonehealth/population.html>

Ozone Mode of Action

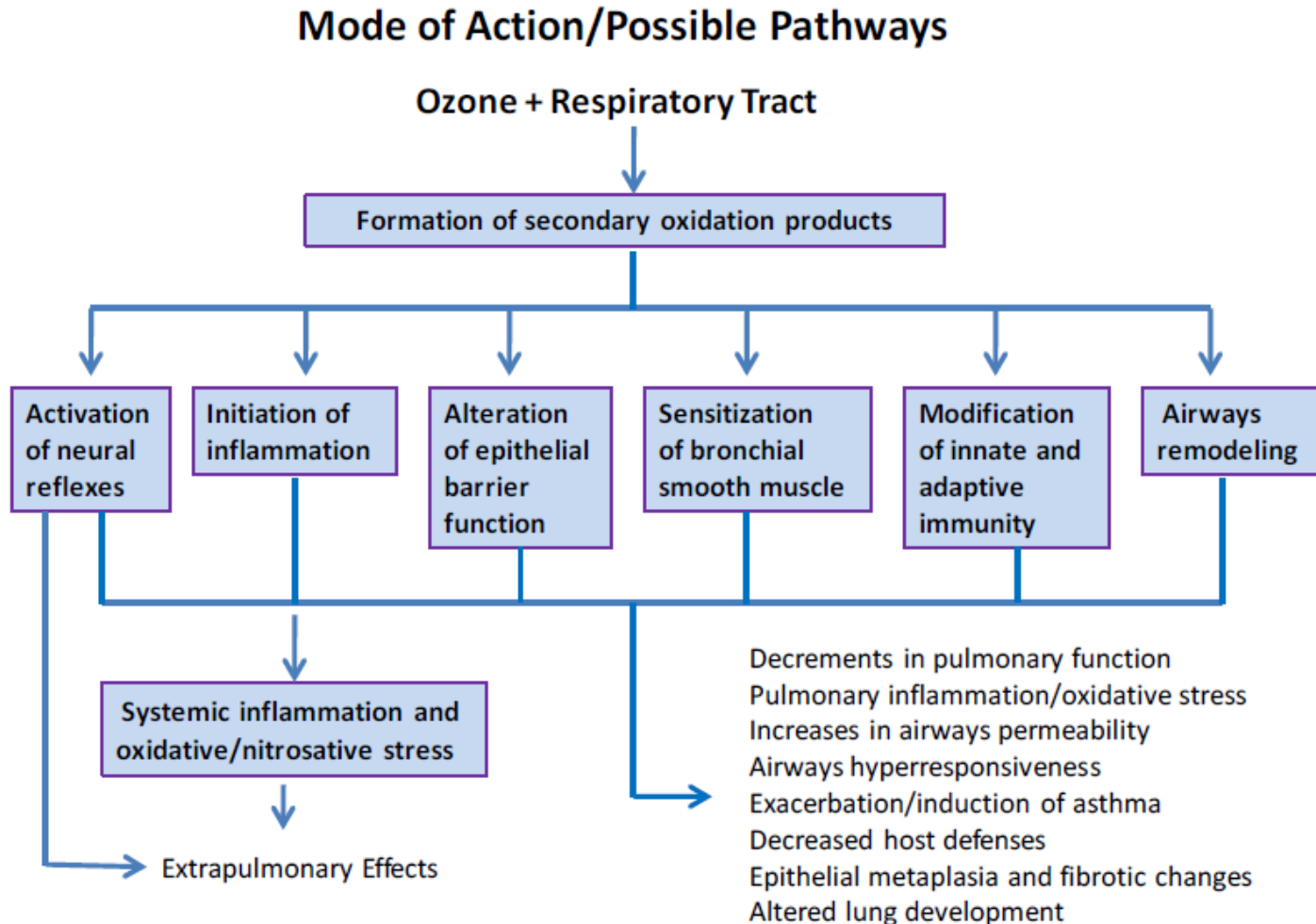


Figure 5-8 The modes of action/possible pathways underlying the health effects resulting from inhalation exposure to O₃.



Summary of MOA

- Ozone is a respiratory toxicant that reacts with antioxidants, proteins, and lipids in the respiratory tract lining fluid
- Ozone (or, more likely, its secondary reaction products) cause several respiratory effects:
 - Nervous system activation → spirometric effects
 - Inflammation
 - Increased epithelial permeability
 - Airway hyper-responsiveness
- The mechanisms of antioxidant depletion of ozone suggest a threshold of ozone-induced respiratory effects
- Uncertainties in the data include relating experimental doses to ambient doses



References

- US EPA. 2013. "Integrated Science Assessment for Ozone and Related Photochemical Oxidants (Final)." National Center for Environmental Assessment (NCEA). EPA/600/R-10/076F. 1251p., February.
- Mudway, IS; Blomberg, A; Frew, AJ; Holgate, ST; Sandstrom, T; Kelly, FJ. 1999. "Antioxidant consumption and repletion kinetics in nasal lavage fluid following exposure of healthy human volunteers to ozone." *Eur. Respir. J.* 13:1429-1438.
- Mudway, IS; Kelly, FJ. 2004. "An investigation of inhaled ozone dose and the magnitude of airway inflammation in healthy adults: Online data supplement." *Am. J. Respir. Crit. Care Med.* 169:1089-1095.