

## Effects of Air Pollution on Respiratory Disease

Asthma, closely associated with air pollution, affects nearly 15 million people in the United States, one-third of them children under 18. Furthermore, much of the lung's development occurs after birth, making infants and young children particularly susceptible to stressors that can cause permanent damage to the lungs.

**Team approach**—The school's team of anatomists, physiologists, cell biologists and immunologists has investigated lung development, injury, cellular interactions, mechanisms of inflammation, immune responses and lung tissue repair for more than 40 years. Basic research studies have led to discoveries about childhood asthma and allergies as well as a greater understanding of the types of air pollutants that cause the most harm.

**Seminal findings**—Veterinary research helped the EPA set the nation's first air quality standards after passage of the Clean Air Act in 1970. Since then, the comparative respiratory biology group has continued to provide essential scientific data to refine those standards. Recent discoveries show that adverse health effects occur in healthy lungs even when they are exposed to levels of pollution at today's established "safe" limits, supporting a proposed update to existing air quality standards.

**Air pollutant ozone causes childhood asthma**—Members of the comparative respiratory biology team showed for the first time that occasional exposure to the air pollutant ozone can change how young lungs develop and how such damage can lead to the onset of asthma.

**Common allergens cause allergic asthma**—Researchers proved that exposure to a common human allergen, the house dust mite, can sensitize young lungs and induce allergic asthma, which can be exacerbated by ozone exposure. Since human lungs continue to develop after birth, this discovery sheds new light on how such sensitization begins.

**Early immune responses associated with childhood asthma**—Faculty are leading integrated studies of the immune response in lungs and airways. These scientists are investigating how certain cells in the immune system of the immature lung develop under the stresses associated with air pollution to cause asthma, upper respiratory allergies and even skin allergies.

**Addressing air pollution challenges in the San Joaquin Valley**—For more than two decades, school faculty and UC Davis colleagues have investigated the biological mechanisms of air pollutant toxicity in the unique environment of California's San Joaquin Valley, a region notorious for polluted urban air and one of the highest childhood asthma rates. This team's scientific progress led to the selection of UC Davis in 2005 as the home of one of only five EPA air quality research centers. Investigators have developed novel methods to determine that specific ultrafine particles, i.e., road dust, diesel soot, fly ash, wood smoke and other sources, result in different degrees and kinds of toxicity in the lungs. These findings can assist regulators in controlling the most dangerous sources of particulate pollution.

**Lung injury and repair**—Long-term studies focused on the toxicology of naphthalene, a component in tobacco smoke, industrial processes and mothballs, have led to a deeper understanding of lung injury and repair.

Next steps: The neural response to air pollution—Physiologists working at the whole system level are exploring how the lung's sensory nerves react to air pollution with hyperresponsiveness and inflammation of the smooth muscle in the airways. This new approach is adding yet another new dimension to our understanding the health effects of air pollution.

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