News
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******UT Southwestern researcher studies defense mechanisms used by the lung against its many enemies.

DALLAS--This may be the worst time of year for our lungs. In addition to the cigarette smoke, dust, and other atmospheric pollutants we inhale the year round, in the winter months our lungs must deal with increased numbers of flu viruses and other microorganisms in the air we breathe which can produce pneumonia--the fifth leading cause of death in the United States.

How does the lung defend itself against such airborne hazards? That is the subject of continuing research by Dr. Alan Pierce, professor of internal medicine and chief of the pulmonary disease section at The University of Texas Southwestern Medical School at Dallas. Dr. Pierce recently began a three-year, $166,000 study of lung defense mechanisms funded by the National Heart, Lung, and Blood Institute.

Interest in this area of research has increased as the list of airborne hazards has grown to include such things as cigarette smoke and asbestos (both of which are thought to cause lung cancer) and Legionnaires' disease (a form of pneumonia). A better understanding of the lung defense mechanisms may lead to advances in the prevention and treatment of such lung diseases.

Dr. Pierce explains that the first of the lungs' four major lines of defense is the nose, which filters out most of the larger particles suspended in the air we inhale. Convoluted nasal passages swirl the air as it streams through the nose, creating turbulence and small eddies so that the particles are deposited on the moist, sticky surface of the mucous membrane. The particles then are eliminated along with the mucus by sneezing or nose-blowing or else are swallowed and excreted in the bowel contents.

Besides acting as a highly efficient filter, the nose conditions incoming air by warming and adding moisture to it, which is another reason it is much healthier to breathe through the nose. Obviously, when cigarette smoke is inhaled through the mouth, this important protective mechanism is bypassed.

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first add lung defenses

According to Dr. Pierce, the lungs' second line of defense is the "mucociliary escalator," which uses mucus and hair-like structures called cilia to transport bacteria and other harmful particles up the respiratory tract, like an escalator transports people up from one floor to the next. This is how it works: A blanket of mucus lines the lungs and windpipe, overlying millions of cilia whose synchronized waving motion propels the blanket upwards to the throat. (Smoking impairs this clearance mechanism by partially paralyzing the cilia.) Thus, when airborne particles slip past the nose, they usually are trapped in a stream of continuously moving mucus, which carries them back up the windpipe to a point where it is either swallowed and eliminated or else coughed up.

When someone with a respiratory infection coughs, sneezes, or even whistles, they are spraying an infectious aerosol into the surrounding air that may be inhaled by nearby individuals, possibly spreading the infection. Concerts and other large, indoor gatherings in poorly ventilated rooms provide excellent conditions for airborne transmission of disease-producing microorganisms.

Although the nose and mucociliary escalator screen out most foreign particles, a few do reach the tiny air sacs deep in the lungs. There the third and fourth lines of defense provide protection. Killer cells called phagocytes engulf and destroy the foreign particles. And substances called complement and antibodies augment this process by attaching to the particles, thus making them better targets for the killer cells.

These last two lines of defense are the ones that concern Dr. Pierce in his current study. He says the goal of the research project is "to further elucidate the roles played by the phagocytes, antibodies and complement in defending the lungs against the common pneumonia-producing bacteria."

Problems occur in the lung when the phagocytes are unable to digest the foreign particles--as is the case with asbestos--or when microorganisms proliferate faster than they are eradicated. Pneumonia is defined as any acute infection of the air sacs of the lung. It is caused by a variety of bacteria, viruses and other microorganisms. Legionnaires' disease, for example, is a form of pneumonia produced by a bacteria that apparently is found in certain dusty environments.

Dr. Pierce recommends that the elderly and those with chronic disease take a newly developed vaccine for pneumonia called Pneumo-vax, which he says is approximately 80 percent effective against the 14 most serious and most common strains of bacterial pneumonia. The vaccine stimulates production of antibodies against those 14 bacterial strains.

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