Emphysema drugs may boost lung damage

Results from a laboratory experiment hint that two drugs commonly used to treat emphysema may actually enhance the progression of this chronic lung disease, which often afflicts cigarette smokers. Scientists caution, however, that the results are based on *in vitro* studies and thus cannot be used at this time to make recommendations for treating people with emphysema.

Emphysema involves chronic irritation of the bronchial tubes and irreversible damage to the tiny air sacs in the lungs where the exchange of oxygen and carbon dioxide takes place. No cure exists, but physicians often prescribe bronchodilator drugs to widen bronchial tubes and ease labored breathing.

At last week's World Conference on Lung Health in Boston, British researcher Robert A. Stockley reported that two of these bronchodilator agents – theophylline and terbutaline – appeared to boost the activity of many white blood cells called neutrophils in a test-tube experiment. Neutrophils normally help fight bacterial infections, but they may do more harm than good when converging on inflamed lungs.

Stockley and David A. Lomas, who collaborated on the study at the Lung Immunobiochemical Research Laboratory in Birmingham, England, suggest these two drugs may increase the number of neutrophils drawn to the lungs, where they can release elastase, an enzyme that can damage the air sacs. Researchers know that lung tissue inflamed by tobacco smoke or other irritants attracts neutrophils circulating in the bloodstream, a process that can lead to emphysema. If the bronchodilators increase the number of neutrophils traveling to the lung, they might actually increase the severity of established lung disease, Stockley and Lomas say.

The researchers obtained blood samples from healthy, nonsmoking volunteers, isolated the neutrophils and bathed some of these cells in either theophylline or terbutaline. On one side of a synthetic membrane they placed the neutrophils; on the other side they placed a protein known to lure neutrophils. Lomas and Stockley discovered that the number of neutrophils traveling through the membrane was 33 percent greater in theophylline-treated cells than in untreated cells, and terbutaline boosted neutrophil migration by 26 percent over untreated cells.

These emphysema drugs "may possibly make the disease worse," comments A. Sonia Buist, a pulmonary researcher at the Oregon Health Sciences University in Portland. However, she emphasizes, drugs that encourage neutrophils to migrate in a test tube will not necessarily cause more neutrophils to cluster in the lung tissue of emphysema patients. Buist is president of the American Thoracic Society in New York City, which cosponsored the meeting with the American Lung Association.

Lomas says his team plans clinical studies to determine whether theophylline and terbutaline indeed boost the numbers of neutrophils in the lung tissue of emphysema patients. In addition, he says, the researchers must determine whether patients who have used these drugs show more severe lung damage than patients who have not.

– K.A. Fackelmann

Caterpillar call-of-the-wild aims at ants

Butterfly caterpillars don't have it easy. Some become victims of parasitic wasps and flies, which inject their eggs into the juicy larvae. These caterpillars suffer slow deaths as wasp hatchlings consume them from the inside out. Others get swept from their leafy perches by low-flying adult wasps in search of fast food.

But many caterpillars in the families Riodinidae and Lycaenidae – which metamorphose into the beautiful, widely distributed butterflies commonly called "metalmarks" and "blues" – don't have these problems. They live in relative comfort by surrounding themselves with bodyguard ants. They appease the ants by secreting sugary fluids; the ants, in turn, keep predators at bay.

But how do they attract the ants in the first place? It took a dedicated entomologist with a tiny microphone to find out.

Philip J. DeVries of the University of Texas in Austin used a custom-designed recording system to tape the sounds made by riodinid caterpillars of the species *Thisbe irenea*. When he held the microphone against the surface upon which a caterpillar was walking, he detected a simple, repeated vibratory pulse. These were not footsteps, however. The sounds were made by the rapid tapping of tiny body structures, called vibratory papillae, against the surface.

Until now, the purpose of vibratory papillae has remained a mystery, but DeVries finds that the rhythmic drumming of these tiny appendages attracts ants. Indeed, the roughly 16-pulse-per-second, 896-hertz signal closely resembles some vibratory messages that other entomologists have identified as a component of ant communication. DeVries' study points to the intriguing possibility that some insects have evolved calls designed to summon unrelated species into symbiotic relationships.

In laboratory experiments and field studies in Panama, DeVries showed that caterpillars whose papillae he had surgically removed failed to produce calls and were tended by significantly fewer ants. Listening to 13 other riodinid species bearing vibratory papillae, he recorded calls similar to those of *T. irenea*. "Prior to this report, sound production was unknown from butterfly caterpillars, nor was it known from any symbiotic association with ants," DeVries writes in the June 1 SCIENCE.

His recordings of 44 other neotropical caterpillars, none of which associate with ants, revealed no vibratory signals. Interestingly, however, the entomologist did detect vibratory signals from 23 other ant-associated caterpillar species bearing no vibratory papillae. How these species produce calls remains unknown, he says.

"It's a pretty neat paper," says Robert Robbins, an entomologist specializing in caterpillar-ant relations at the National Museum of Natural History in Washington, D.C. He says entomologists have suspected that vibratory papillae may have a signaling role, and that caterpillars actively recruit protective coteries of ants rather than simply waiting for them to arrive. "This puts a lot of random observations into perspective," Robbins says. "And it may open up all kinds of research into kinds of mutualism based on sound communication." *– R. Weiss*

Bits of uncertainty: Quantum security

The trouble with sending a secret message is that the recipient must have a key for deciphering it. This means the two parties must initially either meet in person or risk sending the key by some less secure communications channel, and that invites interception. Inspired by an idea first proposed nearly a decade ago, a group of researchers has now designed and constructed a device that uses the uncertainty principle of quantum physics to provide a safe but public means for transmitting vital, secret information.

The device uses extremely faint flashes of light – only one photon per flash – to carry messages. Each photon has a certain linear polarization (whether the electric field associated with the light is oscillating horizontally or vertically) and a certain circular polarization (whether the electric field is rotating in a right-handed or left-handed sense about its direction of travel). According to the uncertainty principle, there's no way to measure a photon's linear and circular polarizations simultaneously. Measuring one disturbs the other.

A sender can use the polarizations of individual photons to send a sequence of signals to the receiver, randomly choos-