Vitamin C and immune protection

The critical question of whether or not vitamin C can activate the immune system against viral infections and, therefore, prevent colds, remains unanswered. Reports about a decade ago credited vitamin C with this ability, but other research suggested the opposite. Now, George Washington University biochemists Gary B. Thurman and Allan Goldstein have found that vitamin C does indeed play a vital role — at least in guinea pigs — in triggering immune responses against infection. The pair presented their findings at the recent annual meeting of the Federation of American Societies for Experimental Biology in Dallas, Tex.

Thurman and Goldstein used guinea pigs in their study because guinea pigs are among the few animals that do not manufacture their own vitamin C. The researchers injected 74 guinea pigs with a tuberculosis bacterium called PPD and divided the animals into two groups. Both groups were fed a special diet deficient in vitamin C, but one of the groups (the control group) received vitamin C supplements in its water, whereas the other group (the experimental group) did not.

Thurman and Goldstein then tested guinea pigs from each group weekly for their cell-mediated immune responses (T cell responses) to the tuberculosis bacterium and also for their ability to make antibodies against sheep red blood cells. (Antibody responses to sheep red blood cells are one of a number of tests used to determine the body's reactions to infections.) Only three weeks after the study started, tissue concentrations of vitamin C in the guinea pigs not getting vitamin C dropped to low levels, whereas tissue concentrations of vitamin C in the guinea pigs getting the vitamin did not. What's more, both the T cell and antibody reactions of the animals getting no vitamin C became very depressed during this time period, whereas those of the animals getting vitamin C did not, and more than twice as many of the guinea pigs getting no vitamin C died during this period as did guinea pigs getting vitamin C. These findings, then, were substantial evidence that the immune system needs vitamin C to fight infections, at least bacterial infections.

But Thurman and Goldstein then sought to obtain more evidence that the immune system needs vitamin C to fight disease. The guinea pigs not getting vitamin C and surviving the injection of the tuberculosis bacterium were then given a modest dose of vitamin C daily for four weeks. The researchers found that at this dose level, it took the animals' immune systems two weeks to start recovering from four weeks without vitamin C and up to three to four weeks to recover fairly well. Thus, immune protection against infections appears to depend on vitamin C, and immune deficiencies due to vitamin C deficiency can be corrected by reintroducing adequate vitamin C to the diet.

How much vitamin C should people consume each day to adequately maintain their immune protection against infections? Thurman and Goldstein are currently studying this question. However, they have already figured out that if their guinea pig study results were extrapolated to humans, the recommended daily allowance of vitamin C — 45 mg per day — is probably 10 to 20 times too low to restore full immune competence to individuals suffering immune deficiencies due to inadequate dietary intake of vitamin C. □

Chemists reveal roach sex appeal

A whiff of laboratory-synthesized chemical traveling on an air stream sets male cockroaches fluttering in mating attempts. The successful synthesis of the sex stimulant of the American cockroach crowns 30 years of research and may lead the way to successful roach control by confusing amorous males.

Identification of the excitant rests on work with 75,000 virgin female cockroaches by Dutch entomologist C. J. Persoons of Centraal Laboratorium TNA. In 1976 Persoons isolated 200 micrograms of the compound and, after a variety of chemical analyses, proposed as the structure a ten-membered ring of the germacrane class. As early as 1948 biologists at the U.S. Army laboratories in Natick, Mass., had isolated traces of active material, but not enough to identify chemically. Excitants from female cockroaches have been called periplanones, after the roaches' formal name, *Periplanata americana*.

While Persoons had the active material in hand, he still could not determine the exact geometry of the molecules. Recently W. Clark Still of Columbia University and collaborators solved the mystery. They synthesized possible structures until they found two mirror-image molecules matching the cockroach material in the chemical analyses. They sent a sample to Persoons, who found one of the compounds as exciting to male cockroaches as the authentic, female-synthesized scent.

In addition to the implications of the successful synthesis for practical cockroach control, the chemical triumph offers new approaches for chemists who want to create other specific molecules containing large rings of atoms, according to the report in the April 30 CHEMICAL AND ENGINEERING NEWS.

It takes only 10^{-7} micrograms of the natural material, or the new synthetic, to excite a male cockroach. Therefore Still calculates that the 10 milligrams he has synthesized could stimulate 100 billion

U.S. Army/Natick Research and Development Lab

Natural female sex pheromone on a piece of filter paper excites male cockroaches.

roaches (that is a roach mass of 10,000 tons). Luckily the compound excites, but does not attract, the insects. So Still says he does not worry about a massive roach invasion of his laboratory.

The chemical synthesized, which is called periplanone B, is the first of three cockroach sex excitants to be made in the laboratory. Persoons, in his massive isolation, also purified 20 micrograms of another excitant, periplanone A. The chemists have yet to synthesize that material and the male-produced sex compound, appropriately named seducin. □

Magnetic dust stays in smokers' lungs

Smokers' lungs appear to do less efficient housekeeping than the lungs of nonsmokers. In the first long-term study tracking magnetic dust inhaled deliberately, five times as much magnetic material lurked after almost a year in the lungs of smokers than in those of nonsmokers. The investigators say that smoking-impaired dust removal may help explain other researchers' findings that cigarette smoking increases the harmful effects of inhaling toxic dusts.

Tracing magnetic dust is just one of the applications of techniques developed to measure magnetic fields from the human body, David Cohen told a colloquium at the Goddard Space Flight Center. At the Massachusetts Institute of Technology's National Magnet Laboratory, Cohen uses a superconducting quantum interference device (called SQUID) to record weak magnetic fields. He has built a chamber with what he calls "brute force shielding"; five shielding layers exclude the earth's magnetic field and other background noise.

Magnetic fields from the human body arise both from internal electrical currents and from contamination with magnetic particles. Cohen says that measurements of magnetic fields around the heads of 10 people show that the electrical activity of the human brain produces a surprisingly uniform and stable magnetic pattern. The heart's electrical activity also pro-