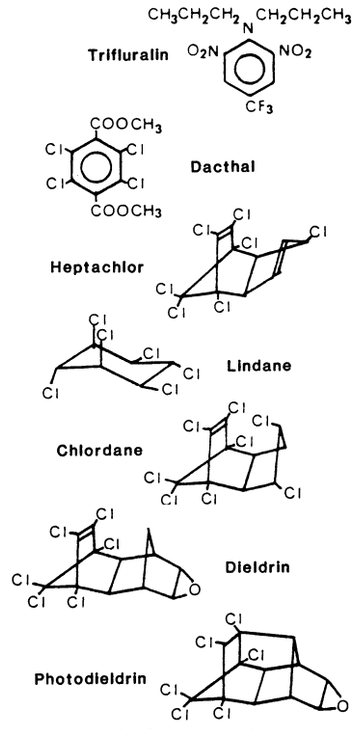
Getting wind of air model errors

True or false: When molecules evaporate, the movement of their vapor form depends almost solely on atmospheric stirring caused by turbulent winds and very little on various properties of those molecules, such as size and shape. In classic theories and models of atmospheric science, that statement is assumed to be true. Now, however, Dwight E. Glotfelty and Alan W. Taylor of the U.S. Department of Agriculture in Beltsville, Md., along with William H. Zoller of the University of Maryland at College Park, "question the validity of this assumption." After conducting field experiments, which are described in the Feb. 18 SCIENCE, Glotfelty and cohorts conclude that molecular weight and size do play a "significant role" in the atmospheric dispersion of vapors. Glotfelty says his findings could have "major implications" for research on the fate of air pollutants and for atmospheric chemistry in general, but he readily admits that they first must be independently confirmed. "I'm certain [the findings] will be controversial," he says, because "there's massive evidence" that supports the classic atmospheric science theories.

According to those classic theories, molecular diffusion — a spontaneous component mixing in which small, light gas molecules move faster than the large, heavy ones — is considered insignificant compared to transport by wind currents, which can carry gaseous molecules 1,000 to 10,000 times faster than they can move on their own. Therefore, most models of atmospheric transport ignore the diffusion factor.

But Glotfelty says that data obtained with those models "may be in serious error." He and associates measured the vertical concentration profiles — concentrations at 12 different heights between 10 and 190 centimeters — of the vapors of seven pesticides in air over treated agricultural fields. Samples were collected at various intervals for up to 50 hours after pesticide application. The results of sample analyses indicate that a component's rate of profile depletion — disappearance from the vertical sampling column — could be correlated to its weight and size or complexity in general. The relatively simple, planar, single-ringed pesticides disappeared more quickly than the chlorine-containing and more complex ones. The researchers were able to rule out photochemical reactions and other factors that also could have explained their observed profile depletions. —*L. Garmon*



Glotfelty et al./Science

The seven pesticides are ranked in order of depletion from sampling column: Trifluralin disappears first, photodieldrin last. (All except photodieldrin are EPA-approved for pest-control uses.)

Meteorite study stirs debate over earth's amino acids

A meteorite is so sensitive to contamination that 10 wet fingertips touched lightly to its porous surface probably would leave behind more amino acids — the building blocks of proteins — than would be extracted from the rest of the rock. Last year, when two researchers reported they had taken another look at the Murchison meteorite, which landed in Australia in 1969, they took special pains to describe their methods for protecting against fingerprint contamination and for extracting amino acids tightly bound into the uncontaminated part of the stone. Now, a group of researchers, many of whom worked in the early 1970s on the original analysis of the stone, suggest in the Feb. 10 NATURE that it is "probable" that the sample used by Michael H. Engel of the University of Oklahoma in Norman and Bartholomew Nagy of the University of Arizona in Tucson was contaminated not by fingerprints but by microbes, and that their results are due to the presence of terrestrial microbes in the stone.

The debate is of interest because Engel and Nagy found that the optical bias — the direction in which the amino acids rotate light — of some amino acids widely found in living systems may have been determined in space rather than on earth (SN: 5/8/82, p. 310). This could mean that when life evolved, one form of amino acids, which exist in mirror image, was already preferred through extraterrestrial processes. The results challenged the conclusions of previous studies that showed that the amino acids in the meteorite rotate light in opposite directions to the same degree, canceling out their optical signals. A long-standing puzzle in efforts to unravel how life originated is: why do nearly all biological systems prefer the form of amino acid that rotates light to the left rather than its optical twin, which rotates light to the right?

In the recent paper, Jeffrey L. Bada of Scripps Institution of Oceanography in La Jolla, Calif., and John R. Cronin of Arizona State University in Tempe and others argue that Engel and Nagy did not shave off enough of the outer portion of the meteorite to ensure a pure sample. The "'interior fragments' on which their analyses were done must have contained material that originated as close as 1.4 mm to the original surface, that is, well within the expected zone of terrestrial contamination," they write. They add that if contaminating amino acids can penetrate 8 millimeters into the stone, then the 50.9-gram stone used by Engel and Nagy contained a "clean core" of only 6.6 grams. Also, they contend, while Engel and Nagy claim that certain amino acids indicating terrestrial contamination are absent, these amino acids (plentiful in fingerprints) are of only "average abundance" in likely microbial contaminants such as proteins and bacteria, and that they are prone to decompose during some laboratory procedures.

In the same issue of NATURE, Engel and Nagy reply that in their original paper, they cautioned that contamination of the Murchison meteorite is a "serious possibility." In response to the criticism that too much of the surface remained on their sample, Nagy says that the amino acids in the clean innermost portion display the same optical bias, rotating more light to the left. "I am trying to be conservative and cautious," he told SCIENCE NEWS. "I by no means want to imply that there is no possibility of contamination." He and Engel are pursuing their analyses of the amino acids, he says, and urge other scientists to do the same. While the early studies show that the optical signatures of the amino acids are almost balanced, he says there are no numerical data that show actual values for the leftward rotation of light in the amino acids.

Nagy and Engel charge that the critique is "speculative" and that more research is needed. One co-author of the critique, James G. Lawless of NASA Ames Research Center in Moffett Field, Calif., discourages such studies. "A large literature already exists that shows that their findings are not in the mainstream," he says. The Engel-Nagy paper is the only one to describe such findings, he says, except for studies of meteorites that are "well known to be contaminated." —*C. Simon*