ral structure initially discovered (SN: 8/17/85, p. 102). For example, in the Sept. 30 PHYSICAL REVIEW LETTERS, Leonid Bendersky of the Johns Hopkins University in Baltimore reports the formation of a decagonal phase, which has neatly stacked layers, each showing a nonperiodic, 10-fold symmetry.

Despite the recent flood of research papers devoted to quasicrystals, the theoretical interpretation of the results as a genuinely new crystalline structure remains controversial. In the Oct. 10 NATURE, Linus C. Pauling of the Linus Pauling Institute of Science and Medicine in Palo Alto, Calif., argues that the "icosahedral" structures are really "multiple twins of a cubic crystal."

Pauling proposes that aluminum-manganese alloys, when suddenly cooled, solidify into a cubic form in which each unit contains about 1,120 atoms. About 20 crystals, made up of these cubic units and roughly tetrahedral in shape, could grow out from a central seed to produce an approximate icosahedral shape. Pauling's structure seems to account for the way X-rays diffract from powdered samples of the new materials.

"Crystallographers can now cease to worry that the validity of one of the accepted bases of their science has been questioned," Pauling concludes.

"I'm certainly not convinced that he [Pauling] has the correct explanation for all of the experiments," says Harvard physicist David R. Nelson. "I'm skeptical that his model will account properly for a single-crystal diffraction pattern."

Nelson's comments are typical of the reaction among quasicrystal researchers. Although Pauling's structure seems to work for a powder, consisting of a host of tiny crystals sitting in random positions, it doesn't work, they say, for the distinctive pattern of spots seen in a single-crystal electron diffraction experiment.

"This material really is a quasicrystal," says Steinhardt, "but one that has a lot of defects in it. We'd really like to have a more perfect sample." This would allow researchers to check more closely proposed theories about the structure of the new materials. *—I. Peterson*

Is ozone giving acid rain a bad name?

Ozone, the most plant-damaging gaseous pollutant, decreases photosynthesis and promotes premature leaf aging, a new study reports. The study also suggests that ambient levels of this pollutant, in all but high-elevation areas, may account for much of the U.S. forest damage previously attributed to acid rain.

The study, conducted by researchers at the Boyce Thompson Institute at Cornell University in Ithaca, N.Y., focused on measuring how rates of photosynthesis changed among crop plants (soybeans, wheat and clover) and trees (white pine, hybrid poplar, sugar maple and red oak) exposed to different levels of ozone. Pollutant levels, from 0.02 to 0.14 parts per million (ppm) in air, were "realistic" — characteristic of mean, daylight concentrations actually observed in regions ranging from pristine areas to agricultural regions of the central United States to heavily polluted southern California. Plants were fumigated, either in the field or in controlled laboratory chambers.

Writing in the Nov. 1 SCIENCE, Peter Reich and Robert Amundson report that the ozone vulnerability of a plant species seems to be related to the rate at which gases can enter its leaves — a factor determined by their pores, called stoma. Species with high rates of growth and photosynthesis, such as crop plants, tend to have larger stomal openings — and therefore greater ozone uptake — explains Reich, who is now at the University of Wisconsin in Madison.

In the study, ozone-related declines in photosynthesis occurred among all species and at all concentrations. The rate of damage, however, was unique to each: Clover, wheat and soybeans were most vulnerable; red oak and white pine were least so. For instance, an internal ozone dose of 10 ppm-hr (ppm concentration multiplied by exposure time) brought a 50 percent reduction in wheat photosynthesis and a near 50 percent decline in yield. By contrast, a threefold higher dose to white pine brought only a 10 percent drop in photosynthesis and growth or yield. Finally, although there were no visible signs of acute ozone poisoning (mottled discoloration) in exposed leaves, the time it took a leaf to mature, discolor and drop decreased as ozone exposure increased — suggesting, Reich says, that the pollutant accelerates leaf aging.

When the tests were repeated using water with a pH comparable to that of acid rain, there was no additional decrease in photosynthesis, acceleration in leaf aging or change in plant growth and yield.

These findings came as no surprise to Allen Heagle, a plant pathologist in Raleigh, N.C., who is involved with the four-state, four-year-old National Crop Loss Assessment Network, the nation's largest program studying ozone's effects on plants. "Ozone is clearly the bad guy here," Heagle says. What's more, he says, "In everything we've done with crops here, we find that at ambient levels ozone is much more of a factor [than acid rain]." The big unknown, he says, is how badly ozone is hurting trees, since "there are no studies that have looked at the long-term effects of ozone on trees."

Curbing ozone will be no easy trick, Reich and Heagle point out, since the largest source of the pollutant's chemical precursors is auto exhaust. *—J. Raloff*

Estrogen use raises questions

Estrogen, it seems, may be one of those things some women can't live with and can't live without. Replacing the class of hormones lost as a result of menopause or surgical removal of the ovaries can alleviate the discomforts of menopause and prevent the bone-breaking disease of osteoporosis. But postmenopausal estrogen use is also associated with endometrial cancer, and depending on which of two current studies you believe, it can reduce or increase the risk of heart disease.

While some 2 million to 3 million postmenopausal women in the United States take estrogens daily, scientists are struggling to determine if the practice is ultimately helpful or harmful. In addition to the two studies alternatively associating the hormones with a higher and a lower risk of heart disease, a recent report shows an increased risk of endometrial cancer not just in women currently using estrogens but in past users as well.

The incidence of heart disease in both pre- and postmenopausal women is much lower than it is in men. According to the National Center for Health Statistics in Hyattsville, Md., the heart disease death rate in 1982 among 35- to 44-year-old men was 44 per 100,000, and only 10 per 100,000 among women. In the 65- to 74-year-old range, it was 1,268 per 100,000 men and 568 per 100,000 women. The influence of estrogens has long been suspected as the operative agent. In fact, men who were considered likely candidates for heart attacks were at one time given estrogens as a preventive, until it was shown that the practice put such men at higher risk.

Two studies in the Oct. 24 NEW ENGLAND JOURNAL OF MEDICINE go head-to-head on the heart disease question. One is an analysis of data from the Framingham Heart Study, a collection of medical information regarding the inhabitants of a Massachusetts town. Peter W.F. Wilson and William P. Castelli of the Framingham study and Robert J. Garrison of the National Heart, Lung, and Blood Institute in Bethesda, Md., followed up on 1,234 postmenopausal women who had been questioned between 1970 and 1972 about their estrogen use.

Of these women, 302 had used estrogens after they reached menopause; 932 had not. All were over 50 at the beginning of the Framingham study.

Eight years later, the estrogen users scored better than nonusers on an analysis of various risk factors known to be associated with cardiovascular disease — including blood pressure, weight and the blood level of total cholesterol and its individual components. Despite the apparent advantage, the researchers report that "significant detrimental effects were seen for total cardiovascular disease, coronary