Cholesterol/oxides debate isn't over

In recent years researchers have accumulated a growing body of evidence linking oxidized cholesterol and the development of artery-clogging atherosclerosis. Most of the cholesterol in fresh animal products is nonoxidized. The oxygen-based reactions that convert cholesterol to its oxides speed up dramatically once meats or animal products (including oils and eggs) are heated. And even the refrigeration or freezing of cooked cholesterol products will not slow oxidation back to the precooked rate, a finding suggesting that eating leftovers could be considerably more harmful than eating freshly cooked food. A number of researchers now suspect that from the standpoint of heart disease, these oxides may be far more dangerous than fresh cholesterol (SN: 5/4/85, p.278).

But data from an 11-week experiment with rabbits at the University of Wisconsin in Madison now suggest the opposite. Says Stephen L. Taylor, "Our study very clearly shows that cholesterol causes more [atherosclerotic] lesions and more severe lesions than do cholesterol oxides." Not surprisingly, he adds, "our work has caused a great deal of consternation among all those others [in cholesterol/oxides research]."

The rabbits were fed 166 milligrams per kilogram of body weight daily of oxide-free cholesterol, cholesterol oxides only, a mix of both, or neither. Afterwards the researchers surveyed the entire arterial tree of each animal for signs of atherosclerosis. All rabbits, even those receiving no cholesterol or cholesterol oxides, developed some atherosclerosis. However, the animals receiving a diet laced with pure cholesterol developed the most severe and invasive lesions, according to a report in the November ATHEROSCLEROSIS. Those receiving a diet with both cholesterol and its oxides developed somewhat less atherosclerosis. And those whose diets included the oxides but no pure cholesterol developed only slightly worse atherosclerosis than those receiving neither cholesterol nor its oxides.

"We're not quite sure why our findings differ so dramatically from everyone else's," Taylor says. But one difference, he says, may be the way the sterols (cholesterol and/or its oxides) were delivered — throughout the day as part of the entire diet, not in one huge dose.

Another possible difference, he says, is the degree to which his sterols were purified. His "cholesterol only" dose contained less than 1 percent impurities. In some earlier studies, he says, contamination of a sterol dose could be as high as 38 percent.

"What our data indicate," Taylor says, "is that the process of atherosclerosis has been slowed down in the case of the cholesterol oxides, not speeded up." As a result, he believes "attention should be refocused on the real problem — cholesterol."

Several other researchers believe the jury is still out on the relative atherogenicity of oxides. For example, Fred A. Kummerow, a food chemist at the University of Illinois in Urbana-Champaign, says that although "this work appears to have been carefully done, I have a hard time accepting its findings." He says his own work in chickens has just as convincingly shown that some oxides — such as 7 keto-cholesterol — are far more atherogenic than cholesterol.

C. Bruce Taylor, who retired from cholesterol/oxides research at the Veterans Administration Medical Center in Albany, N.Y., also finds the Wisconsin study unconvincing. He criticizes its failure to survey how the animals managed their sterol supplements with blood-cholesterol measurements, and the omission in the oxides dose of cholestane triol — a cholesterol oxide now known to be highly atherogenic.

Moreover, points out Paul B. Addis at the University of Minnesota in St. Paul, though it's not uncommon to use rabbits in these studies, their inability to metabolize these sterols makes them a poor model of human atherogenicity. In sum, he says, "I think more research is needed to resolve this issue."

How salt cures

For millennia, cooks have used salt to preserve meats and other perishables. But to this day the scientific understanding of how salt inhibits food spoilage is still sketchy, says microbiologist Robert L. Buchanan at the U. S. Agriculture Department's Eastern Research Center in Philadelphia.

Because of concern about the risk of high blood pressure that salt may pose, the federal government is trying to get processed-food manufacturers to reduce the sodium chloride they use by 25 percent. It has become the job of Buchanan and his coworkers to find out how salt, and its reduction, might affect this food's safety.

Recent findings by the group indicate that because high levels of salt are toxic to most cells, bacteria settling on salted meat will absorb the salt and then have to spend a lot of energy pumping it out again. In some bacteria, this salt-mediated energy drain has been high enough to make them shut down nonessential activities, like producing toxins.

Buchanan has also found that sodium chloride reduces bacteria's ability to feast, further exacerbating the energy drain. An incubation medium containing 4 or 5 percent salt will reduce the bacteria's uptake of the nutrient glucose by 50 to 75 percent. When the salt level is lowered to 2.5 percent, he says, glucose uptake is inhibited by only about 20 percent. Under study is whether salt also alters the success of negatively charged bacteria in adhering to positively charged meat surfaces by a process analogous to short circuiting.

Smoking out B-vitamins' role in lungs

Research by Carlos Krumdieck and his colleagues at the University of Alabama at Birmingham (UAB) has shown that several components of cigarette smoke can affect vitamins. Nitrous oxide, for example, can break down vitamin B_{12}; other smoky pollutants can inactivate folic acid, another B vitamin. Such findings led Krumdieck to suspect that smoking might generate localized areas of B-vitamin deficiency in the lungs of persons who are otherwise vitamin sufficient.

To test this, he gave longtime smokers — people who had puffed at least a pack a day for 20 years — high-dose supplements of these vitamins. His just-completed double-blind study involving 88 men not only indicates that cigarette smoke affects B-vitamin levels in the lung, but also suggests a link between this localized vitamin deficiency and lung cancer in smokers. The results were reported in Washington, D.C., last week at a Bristol-Myers Co. briefing.

The study focused on sputum, coughed up respiratory secretions that contain cells sloughed off from deep in the lung. Initially, each smoker "had abnormal sputum smears," explains Charles E. Butterworth, chairman of UAB's nutrition sciences department. In them, he says, "you [could] see the premalignant cells that are known to be correlated with early cancer."

Roughly half the participants were then randomly selected to receive large daily B-vitamin supplements — roughly 100 times the recommended daily allowance of B_{12} and 20 times that of folic acid. After four months, there was a noticeable improvement in both the number and degree of abnormal and precancerous cells in the sputum of those taking the supplements. However, "there was a worsening or no change in those who got the placebo," Butterworth says.

He says this research may ultimately "provide a medical treatment for an early lesion in the form of a vitamin capsule." However, he adds, such pills "would be a poor substitute to stopping smoking." For now, the real benefit of these findings, he says, is the insight they offer into the way cells are genetically altered into early, noninvasive cancers. For example, he says, the folic acid found in yeast, liver and green leafy vegetables may limit the lung's ability to repair damaged DNA.