Food Science

Season gingerly to retard rancidity

Fat spoilage (or lipid oxidation) of meats, especially cooked meats, contributes not only to their deterioration but also to rapid development of a rancid, "warmed-over flavor." Potentially more important, some researchers are coming to suspect, is that consumption of oxidized lipids — including cholesterol and fats — may increase the risk of developing heart disease (SN: 5/4/85, p. 278). But ginger aficionados, take heart. New research indicates cooks might retard lipid oxidation by seasoning their culinary fare with this spice.

Drawing on Japanese research suggesting that the rootlike ginger rhizome has antioxidant properties, a trio of researchers at the University of California at Davis added the extract from freshly ground ginger to salted pork patties in concentrations ranging from 0.05 percent to 0.5 percent by weight. Whether the pork was refrigerated or frozen after treatment, ginger retarded the natural rate of lipid oxidation in cooked and uncooked meat.

Ginger's potency was highest at a neutral pH of 7, and its antioxidant effect was directly proportional to the amount of ginger used, according to a study by Yubang Lee, Yongsoo Kim and C. Robert Ashmore in the January-February JOURNAL OF FOOD SCIENCE. Among refrigerated cooked-pork patties, for example, the oxidation rate in the most seasoned meat was only one-third that in the ungingered meat. In fact, the researchers say, heavy dependence on this flavoring in oriental cuisine may reflect an observation by early cooks that the spice was "effective in the extension of shelf life, especially in the absence of refrigerators." It's unknown whether extensive use of ginger might contribute to Japan's comparatively low incidence of heart disease.

Nitrosamines and margarine

There have been reports in recent years that certain margarines were contaminated with trace levels of n-nitrosomorpholine (NMOR), a volatile nitrosamine that the National Toxicology Program classifies as a potential human carcinogen. But it was unclear whether the chemical was introduced by the testing procedures themselves, or by some commercial production technique. Now a Canadian study not only confirms the presence of NMOR in several margarines but also identifies its source — their paper wrappers.

Many of these wrappers contain between 5 and 73 nanograms of NMOR, the study shows. Though samples from the inner core of a stick of margarine showed no NMOR, the outer 1 centimeter could be contaminated with as much as 1.4 parts per billion NMOR, according to a report in the January-February JOURNAL OF FOOD SCIENCE by Nrisinha Sen and Philamder Baddoo of Health and Welfare Canada's health-protection branch in Ottawa.

Not all paper-wrapped margarines were contaminated. In fact, they point out, margarines in the most highly contaminated wrappers were never contaminated, because, coincidentally, a shiny plastic coating had been sprayed onto the inner surface of the waxed paper used in these cases, preventing the contaminant from reaching the margarine.

Aflatoxin strikes thirsty peanuts

Aflatoxin contamination of peanuts cost farmers, peanut processors and manufacturers $18.7 million in 1984. But new data from the U.S. Department of Agriculture's Peanut Research Lab in Dawson, Ga., shows that prolonged thirst is a primary factor in a crop's susceptibility to the mold producing this toxin. While stressing plants with insufficient water for 20 days before harvest did not produce contamination, 30 days of such stress did. Knowing this could help farmers schedule blight-limiting irrigation.

Physics

Dietrick E. Thomsen reports from New York City at the symposium on New Techniques and Ideas in Quantum Measurement Theory

Changing your mind in a hurry

In the microcosmic world governed by quantum mechanics, the observer doing experiments has an important, but not yet precisely defined, effect on the reality of the object being observed. As Carroll O. Alley of the University of Maryland at College Park puts it, "We have a role in creating." Specifically, if an experimenter sets up to look for the wave nature of light, that side of light's dual nature will show itself, but not the presumably equally existent particle nature. Conversely, an experimenter looking for photons — the particulate aspect of light's being — will see them but not waves. One question that arises is whether it makes any difference *when* the experimenter chooses what to look for: long before the apparatus is built, or while the light is on the way through it.

At least three "delayed choice" experiments, which test what happens if the experimenter does not choose until the light is moving through the apparatus, have been done. Alley reported on one conducted with his student Oleg G. Jakubowicz. A group from the University of Munich and the Max Planck Institute for Quantum Optics in Garching, West Germany — T. Hellmuth, Arthur G. Zajonc and Herbert Walther — did the other two.

The Maryland experiment and one of the Garching experiments involve Mach-Zehnder interferometers, devices that take an incoming light pulse from a laser, split it in two with a half-silvered mirror, send the two halves over different paths and recombine them. This is a standard test of the wave nature of light: A wave splits in two, and when it is recombined it interferes — that is, its brightness reinforces or cancels depending on whether the two half-beams are still in phase or not. To test the particle nature of light the experimenter leaves out a mirror that recombines the beams and puts particle detectors at the ends of the two paths. These record light as photons, and also tell over which path a given photon came through the apparatus. The delayed-choice part is to switch this second mirror in and out while a single laser pulse is traversing the apparatus. The switch flips in 1 nanosecond.

One way of interpreting the wave-interference situation is to say that a single photon took both paths at once (a very mysterious thing, as a particle shouldn't be able to do that). In the words of John A. Wheeler of the University of Texas at Austin, who inspired these experiments, the switching of the mirror then "decides whether the photon 'shall have come by one route or by both routes' after it has 'already done its travel.' "

The second Garching experiment is what the experimenters call a "quantum beat experiment." Laser pulses of 553 nanometers wavelength and 1.5 picoseconds duration excite a barium atom. They send it into a superposition of states in which it exists in two excited energy states at once. These states are linked together in a way analogous to the way wave and particle natures are linked.

The excited atom immediately reemits some light, and because of the superposition or linkage, the wavelengths that each of the two states might emit separately are combined in an interference or beat signal like two sound waves beating together. With a polarizer, an experimenter can analyze this signal so as to separate the two wavelengths, but then the result is all one or all the other.

The whole process amounts to a photon leaving the laser and being absorbed and reemitted by the atom through either one of the linked excited states (no beat signal) or both of them at the same time (the beat signal). Switching the polarizer in and out *after the reemission* determines which mode appears.

So far, all three of these experiments support the conventional quantum wisdom that whether you make the choice before or after the event occurs, the effect of the choice is the same.