# Nutrition

*From the annual meeting in Las Vegas of the Federation of American Societies for Experimental Biology*

## Low-cholesterol eggs? This smells fishy

Eggs are a leading source of dietary cholesterol. But adding fish oil to a hen's diet lowers the eggs' cholesterol content—and reduces two risk factors for heart disease among those who dine on them, according to a preliminary study by University of Utah nutritional biochemist Suk Y. Oh in Salt Lake City.

Oh supplemented the diet of hens with enough fish oil to get about 1 gram of it in each egg. Because the oil replaced about 15 percent of the fatty acids normally present in eggs, there was also a 15 to 20 percent reduction in the eggs' cholesterol levels. Oh fed these and regular eggs to 11 healthy volunteers for eight weeks. Six started with four medium-sized fish-oil-modified eggs a day; the rest ate four regular ones. In the fifth week each group switched over to the other type of egg.

Those starting with modified eggs experienced no blood-cholesterol increase until they switched to regular eggs. Then cholesterol jumped from an average of 208 milligrams per deciliter of blood to 223 mg/dl. A similar cholesterol increase occurred right away in those who started on regular eggs, but reversed when this group switched to fish-oil eggs.

Oh also saw little or no cholesterol elevation in people who ate eggs from hens fed other polyunsaturated fatty acids. But only fish oil, he says, appears capable of also modifying blood pressure. In this study it prevented the blood pressure increase that developed when subjects switched to eating regular eggs daily. He concludes that fish-oil eggs may be safe – even for those worried about their cholesterol. At present, however, their fishy taste and smell would deter most diners. That's why Oh's been working to safely deodorize the oil – and the modified egg. He expects to have deodorized eggs by July.

## Warm up with iron

Most women consume less iron than the recommended daily allowance of 18 milligrams. And that may help explain why many women shiver in environments where men are comfortable, according to two new studies.

John L. Beard at Pennsylvania State University in University Park measured responses in normal and anemic women to being submerged to the neck for 100 minutes in a 82°F pool. He tested each woman up to six times during the first phase of her menstrual cycle. Compared with the 10 who had normal levels of iron, the eight anemic women experienced almost twice as large a drop in body temperature (1.3°F), generated 13 percent less heat and had a lower metabolic rate. Moreover, blood glucose measurements indicate the anemic women warmed themselves less efficiently – relying more on glucose than on fats for their energy. After 12 weeks on iron supplements, the formerly anemic women responded normally.

But you don't have to be anemic to respond in this way. In a similar experiment, physiologist Henry C. Lukaski at the Agriculture Department's Human Nutrition Research Center in Grand Forks, N.D., measured the responses of 12 healthy bathing-suit-clad women to a 64°F draft. Prior to the first test, each had dieted on specially prepared low-iron repasts for 80 days. Until the next test, 100 days later, each consumed a revised diet offering them 16 mg of iron daily—more than three times the previous level. While the low-iron diet seriously depleted body reserves of iron (measured as ferritin), Lukaski says the women never actually became anemic.

Tested after the low-iron diet, the women began shivering—the body's attempt to warm itself—after 84 minutes. Measurements showed their body temperatures had dropped almost 1.1°F. After the iron-repleting diet, the women went 8 minutes longer before shivering, experienced only half the drop in core body temperature observed in the first test, and produced only one-half to one-third as much norepinephrine—a hormone that signals the body to generate more heat.

# Technology

## Sing a song of chaos

There seems to be more to the sound of a singing voice than meets the human ear. A new, computer-based technology for automatically converting a singer's tune into musical notation on a computer screen reveals puzzling shifts in sound patterns when a musical note is analyzed segment by segment. The results suggest that the patterns in a sound signal don't always recur in a regular fashion, says Paul E. Dworak of the music school at North Texas State University in Denton. "Rather, a single sound event can be broken down into several modes, with abrupt changes of mode sometimes occurring between two adjacent periods." That type of irregular behavior is characteristic of chaotic dynamical systems—the same kind of behavior that may underlie turbulence in flowing water.

Dworak's intent was to develop a computer system that could evaluate a music student's performance. The computer would first present a melody's musical notes, then display the musical notation for what the student actually sings, allowing the student to identify any wrong notes. Dworak designed and built an electronic circuit that segments the sound wave as it comes in from a microphone. A computer program uses that information to determine a note's pitch.

Instead of looking at the overall shape of waveforms, Dworak's system uses the location of peaks and troughs in the signal to define segments, each one lasting less than a millisecond. "I'm actually looking at the time structure of the sound," he says. "Instead of comparing the shape from cycle to cycle, I'm comparing the time structure from cycle to cycle, which turns out to be more uniform than the shape."

By doing such a cycle-by-cycle analysis, Dworak found that even when the pitch doesn't change in any obvious way, the sound pattern sometimes abruptly shifts into a new configuration after a number of cycles, then suddenly changes again, and so on. Notes played on a guitar and other musical instruments show a similar effect. Whether the effect is audible to the human ear is not yet clear. Dworak is now looking into what causes such perturbations in sound patterns and whether that information can be used to improve the reliability of pitch analyzers. "These structures," he says, "cannot be explained by simple models of sound production."

## A nickel sponge for cooling air

W. Edward Wallace of the Mellon Institute in Pittsburgh has spent years studying the unique properties of metal "sponges" that absorb enormous quantities of hydrogen. "Expose them to hydrogen, and they just gobble it up," he says. "And if you warm them or depressurize them a little bit, the hydrogen comes gushing out." At the same time, the introduction of hydrogen into these metals generates heat, whereas its removal cools the material. Now, Wallace is using that knowledge to develop a hydrogen-based air conditioner that harnesses a car engine's waste heat. Although the idea isn't new, Wallace is counting on an improved design and better materials to succeed where preceding efforts had failed.

Wallace's system consists of two linked cylinders containing specially formulated nickel-based alloys. One alloy is tailored so that, when heated, it releases hydrogen more readily than the other. Exhaust heat would be routed to boil hydrogen out of one alloy, transferring the hydrogen to the other alloy, where it is absorbed. A fan cools the first alloy, which then starts to take back the hydrogen, causing the second alloy, as it releases hydrogen, to cool down significantly.

Such a system, says Wallace, not only saves fuel because it requires no gasoline for power but also avoids the use of chlorofluorocarbon refrigerants, which have been implicated in the depletion of the earth's ozone layer. Wallace expects to have a prototype assembled within the next few months.