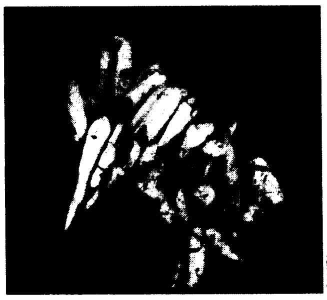
Ethnobiology

Kathy A. Fackelmann reports from Boston at the 16th Annual Conference of the Society of Ethnobiology

Unearthing the roots of tribal tradition

Nancy J. Turner remembers romping through the Montana woods as a child and marveling at the profusion of yellow avalanche lilies *(Erythronium grandiflorum)*. Decades later, as an ethnobiologist at the University of Victoria in British Columbia, Turner has turned up surprising evidence that the bulb of this showy perennial once served as an important food source for Indians living in what is now western Canada and the U.S. Northwest.



Turner

The avalanche lily, commonly called the yellow dogtooth violet, often grows in alpine meadows and valleys. Interviews with tribal elders indicate that Indians in the Northwest once harvested bulbs of this plant in large quantities – about 100 kilograms or more per family per year.

"It's a beautiful flower," Turner says, "but it also has tremendous significance as a food." Her research suggests that tribal cultures of British Columbia, Washington, Idaho, and Montana relied on the lily's deeply buried bulb as a winter staple. The bulb was eaten alone or combined with other ingredients to make stews, soups, or puddings, she says.

Turner explains that from June until the first snowfall, native women would use a sharp digging tool to unearth "root" vegetables, including avalanche lily bulbs. They strung together the whitish bulbs, each about the size of a little finger, and placed them in a roasting pit. After dousing red-hot rocks with water, the women would cover the pit, allowing steam to roast the roots for about 36 hours. Finally, they dried the bulbs to preserve them during the long, cold months ahead.

Archaeologists have found roasting pits suggesting that a root-digging culture flourished in central British Columbia about 3,000 years ago, Turner says.

Some Native Americans living in British Columbia still collect and prepare the lily bulbs according to the ancient recipes, says Turner, who describes the taste of the bulbs as mild and sweet.

Ancient tribes weren't the only ones with a yen for the lily bulb. Turner says grizzly bears, marmots, squirrels, and small rodents go after the tasty bulbs, often hiding them in caches in the ground.

Aztec cure for official fatigue

Bill Clinton and Al Gore might want to take note of an ancient cure for a fatigue that afflicted Aztec public officials in the 16th century.

Healers concocted an elaborate remedy for Aztec rulers who complained of tiredness, according to Robert Bye of the Botanical Garden in Mexico City. They would boil some herbs in water, add some animal blood, and top off the potion with digestive "stones" found in bird gizzards. To restore energy levels, haggard rulers bathed with the resulting liquid.

Did the potion work? No one knows for sure. However, Bye says the blood-and-gizzard brew was a popular remedy. His study of the De La Cruz-Badianus Manuscript of 1552, the earliest known New World document on herbal medicine, suggests that the focus on reviving run-down rulers was unique to Aztec culture.

The common folks of Aztec society also suffered from fatigue, Bye says, but they got a more pedestrian remedy: Healers simply boiled a few herbs in water and used the liquid to wash the victim's feet.

Physics

Electron antics at magic angles

The notion of a "metal" that contains no metal atoms may sound a little strange. But over the last few decades, researchers have synthesized a number of electrically conducting organic compounds. Curiously, several organic metals also become superconductors at sufficiently low temperatures. Now, scientists are finding that some of these substances have other unusual magnetic and electrical properties.

One of the most striking examples concerns the magnetic and electrical behavior of organic conductors based on a molecule called tetramethyltetraselenafulvalene (TMTSF). Stacked like pancakes, with each layer slightly offset, these negatively charged, planar molecules form an array with regularly spaced niches for small, positively charged ions. In the early 1980s, researchers were startled to discover that these materials themselves become magnetic when subjected to a magnetic field.

"You simply turn on a magnetic field and you've got yourself a magnetic material; turn off the field and it's nonmagnetic," says physicist Michael J. Naughton of the State University of New York at Buffalo. In this case, the organic metal becomes an antiferromagnet, in which the spins of neighboring ions line up parallel to each other but in opposite directions.

In 1989, A.G. Lebed of the L.D. Landau Institute of Theoretical Physics in Moscow and Per Bak of the Brookhaven National Laboratory in Upton, N.Y., predicted that applying a strong magnetic field to a crystal of one of these materials would also cause dramatic decreases in its electrical conductivity at certain angles. Lebed dubbed these particular values "magic" angles. In essence, the theorists reasoned that electrons in the material – restricted by its crystal structure to motion in one dimension – would meet increased resistance when forced by the magnetic field to travel in certain directions.

Subsequent experiments by Naughton and his colleagues and by groups at Princeton University and in Japan found large changes in electrical conductivity at just the angles that Lebed and Bak had identified. But the researchers discovered that the electrical conductivity actually increases rather than decreases at those particular angles.

Theorists have weighed in with a number of explanations, but none of the theories appears completely satisfactory. "There has yet to be a consistent theory," Naughton says. "The issue isn't settled yet."

One promising approach, proposed by Princeton's Paul M. Chaikin, suggests that electrons traveling in the directions defined by Lebed's magic angles avoid what Chaikin calls "hot spots" – in some sense, places where electrons tend to be strongly deflected. In the presence of a magnetic field, electrons are typically swept into these hot spots. At magic angles, the coordinated motion of electrons in harmony with the organic metal's crystal lattice allows a fraction of the electrons to avoid the hot spots.

The Landau Institute's Victor M. Yakovenko argues that interactions between electrons, which allow them to coordinate their behavior, may play a crucial role. He suspects the same mechanism underlies the superconducting, antiferromagnetic, and electrical behavior of these organic metals.

But new experiments have added more puzzles. Researchers had already found that increasing the external magnetic field would magnify the conductivity peaks at the magic angles. Naughton's group went to magnetic fields higher than those previously used. "The effect does get stronger up to a certain field range, but by 30 teslas it is almost completely gone," Naughton says. "This is something new for the theorists to chew on." Naughton described his group's most recent findings at an American Physical Society meeting held this week in Seattle.