Diet Changes May Buy Cancer Patients Time

Increasingly, cancer researchers are testing nutritional weapons in their war on cancer and its spread. Several programs report promising results in animals merely by altering the amino acid composition of the diet. If successful in humans, these nontoxic strategies could buy patients time for other postsurgical therapies to work.

Gary G. Meadows of Washington State University in Pullman and his co-workers have at least doubled the survival time of mice injected with malignant melanoma by restricting their consumption of phenylalanine and tyrosine. They cut dietary intake of these amino acids to just 13 percent of normal – levels that Meadows describes as "just slightly below the minimum requirement."

Compared to animals fed regular chow, mice on the amino-acid-deficient diet ate normally but grew somewhat slowly. More important, mice fed the deficient chow developed far fewer metastases – secondary cancers spawned by the initial tumor. While black melanoma growths heavily peppered the lungs of mice eating a normal diet, the lungs of those on the deficient diet remained virtually spotless.

"Quite frankly, I never expected this," Meadows says. "You can't get this effect on metastasis with a drug." He described the findings at a recent American Institute for Cancer Research conference on diet in McLean, Va.

Even if this strategy were to work as well in humans as it has in his dozens of animal experiments, it still would not constitute a cure, Meadows notes.

"The diet isn't preventing a tumor from growing," he told SCIENCE NEWS. "It's changing tumor cells, rendering them uniformly suppressed in their ability to colonize [new tissue]."

Still, this is a major achievement, he notes, since most patients don't die from their initial cancer – which surgeons can usually remove – but from its metastases.

The deficient diet seems to alter tumor cells or selectively foster the production of less metastatic ones. As evidence, Meadows points to a study in which his group transplanted tumors. Even in animals eating ordinary chow, tumors derived from mice fed a deficient diet didn't establish new metastatic growths nearly as readily as transplants from animals fed normal food.

Though Meadows' team has yet to isolate the mechanism by which lowered concentrations of phenylalanine and tyrosine thwart metastasis, it's not for lack of trying. They have sought differences in how these cells might attach to new tissue, express important genes, or move in relation to the presence of certain chemical agents.

To date, the most promising lead appears in data on fibroblast growth factor – a secretion important in angiogenesis, the proliferation of new blood vessels needed to feed a tumor. Tumor cells from animals on a deficient diet "apparently produce the growth factor but don't secrete it," Meadows says.

This dietary manipulation of metastasis "looks interesting, but I don't know how it would be implemented in humans" – unless foods were engineered with deficiencies of these key amino acids, says metastasis researcher Hynda Kleinman at the National Institute of Dental Research in Bethesda, Md. But it is important to remember, she says, that in most patients "this would not be the only therapy."

Indeed, Meadows envisions physicians one day prescribing such a diet, or perhaps a drug designed to effect the same changes, "as an adjuvant" – a therapy to augment chemotherapy or immunotherapy.

At the same meeting, David M. Ota of the University of Texas' M.D. Anderson Cancer Center in Houston described another amino acid therapy to "rescue" patients from the serious side effects of chemotherapeutic agents. Working with animals, Ota and his colleagues altered the ornithine content of a diet delivered parenterally – into the veins – as many cancer patients must be fed.

Difluoromethylornithine, a drug to stop the growth of metastases, severely reduces platelet counts in the blood of cancer patients. By boosting the ornithine content of a parenteral diet, Ota and his co-workers blocked the platelet drop without affecting the drug's inhibition of tumor growth. *– J. Raloff*

Debate may resume over volcano-climate link

As huge volcanic eruptions darkened the skies over the northern Pacific Ocean 2.6 million years ago, temperatures dropped precipitously and the northern hemisphere drifted ever deeper into an ice age. Are these events directly related or merely coincidental?

Scientists who study the natural history of oceans set aside their debate on this question in the 1970s for lack of conclusive evidence. Now, extensive core samples gathered on leg 145 of the Ocean Drilling Program may prompt oceanographers to reexamine the connection between Pacific volcanism and the northern hemisphere's deep freeze, says David K. Rea, a marine geologist at the University of Michigan in Ann Arbor and co-chief scientist on the two-month cruise.

These new cores provide "a very exact definition of all the great changes that occurred 2.6 million years ago, which is the time when northern hemisphere glaciation really kicked in," Rea says.

Ship and crew returned in late September with core samples of soft, porous sediment pulled from the floor of the northern Pacific Ocean. Rea describes these sediments as having the consistency of soft cookie dough.

Since ordinary rotary core drills would have turned these soft sediments into soup, the crew used a technique called hydraulic piston coring, which collects fragile sediments virtually intact. This produced relatively continuous core samples that show important details in the sedimentary strata.

These high-quality cores offer a more detailed record of how the northern Pacific responded to climatic change and allow scientists to more accurately date individual events, Rea explains.

This geological record shows increasing glaciation at the time of the climate change, according to Rea's preliminary, unpublished report on the mission. A large number of volcanic eruptions coincided with this cooling trend.

The samples show for the first time that eruptions in the northern Pacific 2.6 million years ago were at least 10 times larger and more frequent than previous volcanic events recorded elsewhere in the sediments, Rea emphasizes. Could these eruptions have spewed enough ash into the stratosphere to reduce sunlight for long periods, kicking a preexisting cooling trend into a full-scale ice age?

"It's a hard thing to prove," replies James P. Kennett, a marine geologist at the University of California, Santa Barbara, and a participant in the previous debate. He notes, however, that the close connection between increased volcanism and climate change indicated in the new cores is significant. "The quality, detailed linkage is quite remarkable," he says.

Rea also stresses the difficulty of proving a cause-and-effect relationship. However, he points out, the 2.5-meter-thick layers of ash found in some of the new core samples seem like "pretty impressive evidence" of a connection between large-scale volcanic activity and the onset of northern glaciation.

"I and the others have to think about whether we want to reopen this whole discussion," Rea says. *– D. Pendick*