



Cancer and Cuisine

By SARAH STEINBERG

It's dinner time and you're hungry. You sit down to a meal of barbecued chicken (slightly burned), a salad of spinach, mushrooms and alfalfa sprouts, a baked potato with sour cream, and a cup of coffee. According to recent research, every food item on the table in front of you contains at least one known mutagen or carcinogen.

Is this reason to claim that everything causes cancer, abandon all hope, and reach for the red dye #2? Certainly not, say scientists. Rather, they stress, recent findings emphasize the wisdom of balanced meals and the need for more research into dietary basis of carcinogenesis so that people may eventually "fine-tune their diets" to avoid cancer, which places second to coronary artery disease as the leading cause of death in the United States.

Although researchers name cigarettes as the single leading cause of cancer identified so far, "there's no question that diet is a major, if not *the* major, factor in human cancers," says Bruce N. Ames, chairman of the biochemistry department at the University of California at Berkeley and inventor of the widely-used Ames test for mutagenicity. In comparing data from different countries, epidemiologists have found wide differences in the rates of many types of cancer. Residents of Japan, for instance, have the highest incidence of stomach cancer in the world. Yet when Japanese natives move to the United States, their risk of getting stomach cancer decreases, and they develop the spectrum of cancers unique to the United States, a situation many epidemiologists ascribe to changes in diet. But because diet is just one of the many environmental factors that could contribute to such a difference, some researchers hesitate to pinpoint nutrition as the prime villain. Most agree that somewhere between 10 and 70 percent of all cancers are due to diet, and therefore could be prevented, if only people knew what to eat.

According to Ames, science ought to look less toward synthetic chemicals as sources of cancer, and more toward substances either inherent in foods or produced in the cooking

process. "Nature is not benign," he says. "Plants produce toxic chemicals to protect themselves against predators." In a review article in the Sept. 23 *SCIENCE*, Ames lists a number of edible plant products, from black pepper to rhubarb, that contain mutagens (chemicals that alter DNA) or carcinogens (chemicals that, in chronic doses, cause cancer in laboratory animals). In addition to plants, Ames mentions fats, such as those found in meat and dairy products, alcohol, molds and browned or burned foods as major dietary sources of potentially harmful chemicals.

But foods aren't completely bad, says Ames. Many contain natural anticarcinogens—chemicals such as Vitamins C and E, selenium and beta-carotene—that neutralize the detrimental effects of the carcinogens. Since the anticarcinogens prevent oxidation of metabolized foods, Ames theorizes that some carcinogens act by oxidizing, forming high-energy free radicals that damage body tissues. Ames predicts that by studying this cancer-defense system, researchers could shed light on the underlying cause of cancer and other age-related diseases.

"I don't want to get into what people should and shouldn't eat," says Ames, who makes no dietary recommendations in his review. "I was mainly discussing the theoretical aspects and speculating on mechanisms of carcinogenesis."

Even so, Ames says that while scientists have studied extensively the adverse effects of synthetic food additives, comparatively little time or money has gone toward the natural plant toxins in our diet, "despite the large doses we are exposed to." By taking "a few percent [by weight] of all the food we eat," and comparing that to the amount of chemicals we ingest in the form of pesticide residues or drinking-water contaminants, Ames estimates that the human dietary intake of what he calls "nature's pesticides" is "probably at least 10,000 times higher than the dietary intake of man-made pesticides."

Does this mean that such substances cause 10,000 times more cancer? "Nobody knows," says Ames.

Frederick J. Stare of the Harvard School of Public Health in Boston, adds, "We don't consume these substances as pure chemicals. We consume them in foods, and foods are complex mixtures of hundreds of chemicals."

In order to link a food to cancer in humans, according to Steve D. Stellman of the American Cancer Society, researchers must demonstrate three things: that a food contains a known carcinogen, that the levels of that carcinogen are high enough to pose a cancer risk, and that human exposure to the food is significant. "Ames has done a beautiful job on the first and pointed out the need for very careful analysis of the second and third," says Stellman, who stresses that laboratory experiments implicating substances as carcinogenic are insufficient to link those substances to human cancers.

Ames agrees that more research is needed to determine the risk natural toxins present to humans. And while it would be nice to have our plants and eat them too, Ames suggests that by breeding for pest resistance, scientists have raised plants' carcinogen concentrations. "That is a possibility," says Walter Mertz of the U.S. Department of Agriculture's Human Nutrition Research Center in Beltsville, Md., adding that "since carcinogens are present in almost everything, it is absolutely wrong to be frightened whenever a new one is discovered." Instead, "we should put emphasis on finding out more about those substances that reduce cancer risk."

So what are we to eat? The National Cancer Institute (NCI) recommends following dietary guidelines published by the National Academy of Sciences' National Research Council last year (SN: 6/26/82, p. 422). In particular, one NCI official, who describes Ames' review as a "provocative" paper designed to stimulate research rather than denounce specific foods, suggests reducing dietary intake of fat, avoiding burned foods, and eating a wide variety of fruits, vegetables and grains. "That way," he says, "you could neutralize the carcinogens in some foods with the anticarcinogens in others." □