Eating food additives and having them too

What you don't absorb can't hurt you. This is the strategy that has now produced three food dyes and one preservative that the developers believe will be much safer than present additives. At the American Chemical Society national meeting in New Orleans this week, Ned M. Weinshenker and Nicolo Bellanca described the new compounds, their method of synthesis and the safety tests performed so far.

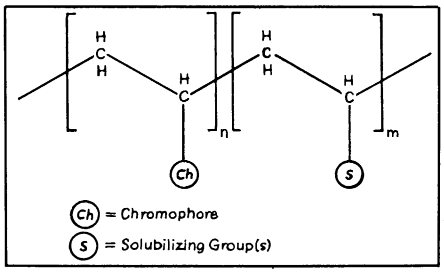
Most food additives, according to Weinshenker, perform their intended function in the food system to which they are added and serve no further function once they are ingested. "If they are not used past the throat, why should they be allowed to get into the rest of the body?" he questions.

The researchers at Dynapol, a small company in Palo Alto, Calif., formed specifically to develop the new type of additive, are working on food colorings, antioxidants and even sweeteners. They synthesize long polymers (molecules with repeating subunits) that are too large to filter across the lining of the intestinal tract into the body. The challenge is in finding molecules that perform the desired function but that will not break into smaller pieces either during cooking, food storage or passage through the body. The polymers must be able to withstand the acidity of soft drinks, the high temperatures of baking and candy making and the attacks of intestinal enzymes and microbes.

The researchers expect to have food colors and a preservative on the market in three to four years, if all goes well in the safety testing. Sweeteners have turned out to be a more difficult problem. Molecules of those additives must interact successfully with receptors on the tongue. Dynapol chemists have produced sweetener polymers large enough to prevent absorption but none that give the full range of sweet tastes. "The subtleties between good sweeteners and poor sweeteners are difficult to engineer," Weinshenker says.

Yellow, red and red-violet are the colors of the dyes Bellanca and colleague W. J. Leonard Jr. have most successfully produced. A blue dye is also being developed and an orange may follow. With blends of four or five colors, the researchers expect to be able to duplicate all the colors currently available to food companies and the shade of recently banned Red Dye No. 2.

The dye molecules have a structural backbone of carbon molecules (see diagram). The chromophore is the part of the molecule that absorbs light and confers color. Solubilizing groups were incorporated because the product, to be practical, had to be soluble in water. The two major portions of the molecule (in brackets) are repeated many times so that the final dye molecules have backbones about 600 carbons long. The polymer *is* the dye, Bellanca says; it isn't that a dye is attached to a polymer.



Molecular structure of the polymeric dye.

The antioxidant that Weinshenker described is actually a composite of three preservatives now on the market. The polymer contains groups resembling BHT, BHA and TBHQ. Tests feeding the additives to rats showed that although BHA, BHT and TBHQ all caused enlargement of the animal's livers, the polymer had no effect.

The scientists are doing very extensive safety tests on the polymers. They have been using the Ames screening test for mutagenicity not only on the final product, but also on raw materials, concentrated impurities and the products of stress with light, heat, acid conditions and components in the urine of animals fed the polymers. "Only if all results are negative, do we proceed with that candidate," Weinshenker says.

If the additives are not absorbed, the only possibility for harm would be local irritation of the digestive tract. So far in their animal studies, there has been no indication of the problems there.

Also there is probably no need to worry about technicolor feces and pursuant psychological trauma. "With normal consumption patterns there should be no problem," Weinshenker explains. If people eat very high levels of a certain food, however, it is possible there will be coloration. "If you abuse beets, you'll have the same effect," Weinshenker points out.

These compounds will not be the first additives that are long polymers, although they will be the first deliberately developed as such. Cellulose and cellulose derivatives, which are used as thickening agents, are considered the safest of food additives. They are also not absorbed by the body.

"Historically, food additives were picked from a myriad of industrial chemicals that had originally been created to solve nonfood problems," Weinshenker says. Now that safety is becoming to consumers the most important property of additives, new approaches are needed. □

Ararat 'ark' wood dated at A.D. 700

Perhaps the last hope that the battered remains of Noah's Ark exist on Mount Ararat near the Turkish-Soviet border has been washed away by a new wave of scientific evidence. Recent tests at the University of California at Los Angeles, La Jolla and Riverside all conclude that a piece of timber found at the Ararat site is only about 1,200 years old—some 2,700 years younger than the first known account of the Ark.

Despite similar findings at England's National Physics Laboratory in the early 1960s and at UCLA in 1970, speculation that the pile of oak timber might indeed be part of the Ark has increased in the last several years. The interest has been fueled by a recent movie that strongly suggests the wood is part of the Ark.

But the new UC experiments confirm that the timber came from a tree that was chopped down around A.D. 700, UCLA archaeologist Rainer Berger reported last week at a symposium on archaeometry and archaeological prospection at the University of Pennsylvania Museum in Philadelphia. Berger believes the wood—discovered more than 20 years ago packed in a snow- and ice-filled crevice 13,500 feet up the mountain—might be the remnants of a shrine that perhaps commemorated the landing of the Ark near that site.

Using carbon-14 dating, Berger recently repeated his 1970 study on a piece of Ararat wood and came up with the same results. In separate tests, R.E. Taylor of Riverside and Hans Seuss of La Jolla obtained similar findings. Taylor extracted the solid cell wall (lignin) portion from part of the wood and dated that sample at 1,210 ± 90 years.

Seuss disproved an argument that because the wood was located so high on the mountain, it was exposed to an unusual amount of cosmic rays that manufactured high levels of C-14 to make the wood appear younger when tested. Seuss obtained the remains of a tree in the Danube River region, near sea level, and a bristlecone pine from the 10,000-foot-high White Mountains of California. Through tree-ring studies in both areas, each of the specimens was known to be about 2,000 years old. Seuss found that the two pieces of wood had the same amount of C-14, and that altitude apparently had no effect.

French industrialist Fernand Navarra first found the Ararat remains in 1955, almost immediately triggering speculation among biblical scholars that the wood might be part of the Ark. Genesis says that the Ark landed in the Ararat vicinity, Berger notes, but he questions whether this is the same Ararat of ancient times.

The first English examination dated the wood at 1,190 ± 90 years. But critics said the British researchers had not deconta-