Sweetener Problem Crystallizes

A sweet tooth may cause ulcers from indecision among fans of laboratory safety tests as researchers, armed again with new results, continue to joust over the more direct health hazards of sugar and artificial sweeteners. Although the benefits of reducing sugar intake are clear, at least for diabetics, people particularly susceptible to dental caries, those on long-term low-calorie diets and the obese, a recent report by the Office of Technology Assessment finds no evidence that adequately correlates the use of artificial sweeteners with successful sugar avoidance.

While studies on the necessity of artificial sweeteners are few, reports of their effects multiply. The serious question is whether the chemicals will cause cancer. Addressing this question, a report in the Dec. 2 SCIENCE signals thumbs down for saccharin and its contaminants and thumbs up for xylitol and an experimental sweetener, NHDC (neohesperidin dihydrochalcone) (SN: 7/16/77, p. 40). The experiments by Robert P. Batzinger, Suh-Yun L. Ou and Ernest Bueding at Johns Hopkins Medical Institutions did not test for tumors in animals, but rather for genetic changes in bacteria developed especially to spot chemicals likely to cause cancer. The results differ from those of bacterial tests on saccharin done two years ago and from animal tests on xylitol announced last month.

Batzinger and colleagues performed a matrix of tests to examine saccharin of different purities directly and as it is processed in the body. Samples of sweetener obtained from pharmaceutical manufacturers and from packages of Sweet 'N Low caused more genetic changes in the bacteria than did a purified sample, similar to that used in the studies of Canadian rats (SN: 3/19/77, p. 182; 7/2/77, p. 12). Only a highly purified sample did not affect the bacteria. Previous experiments by Berkeley researchers Edith Yamasaki, Joyce McCann and Bruce Ames (cited in the OTA report) had indicated that impure saccharin does not induce genetic changes in the bacteria. Bueding says his current method is more sensitive for many chemicals.

The experiments done at Johns Hopkins went on to investigate the effects of saccharin and its impurities as the chemicals are metabolized during passage through an animal's body. If the bacteria are incubated in the abdomen of a mouse that has been given saccharin through a gastric tube, the results are similar to those from the original chemical. Pure saccharin is inactive, and the higher the level of impurities, the greater the genetic change produced. However, when the bacteria were exposed to urine excreted from mice that had been fed saccharin, even the purest sweetener induced genetic changes. Whether this suspicious activity is eventually traced entirely to small remaining levels of impurities or whether some genetic change will be attributed to a metabolite of saccharin itself is probably an academic question. Pharmaceutical companies say that beyond a certain level, purifying saccharin would make it too expensive for general use.

"If you look at all the carcinogenicity data on saccharin, it is fairly convincing," Bueding says. "You can't rely on a single test. The predictive value [of the bacterial test] is quite high. To me it's a red flag."

Xylitol, a sweetener derived from birch trees, fared far better than did saccharin in the bacterial tests. It did not cause genetic changes under any of the test conditions, even at concentrations 30 times greater than that examined with impure saccharin. Last month, however, suspicion was cast on xylitol, which is already in commercial use in Wrigley's Orbit chewing gum. A British laboratory linked the sweetener to tumors when mice were fed a diet of 10 to 20 percent xylitol. That report led the National Institute of Dental Research to interrupt a study a few days old at the University of New York at Stony Brook. Only nine sticks of xylitol gum had been chewed in the experiment, which was attempting to measure the effects of xylitol on children's dental health. The institute is now awaiting evaluation of the animal experiments by the Food and Drug Administration, but Bueding believes the mouse study will not meet FDA standards. Because the high level of xylitol caused urinary tract and kidney stones, the tumors probably were a secondary effect due originally to the stones, he says.

For the experimental sweetener NHDC, the bacterial and animal tests agree: no health problem is indicated so far. However there has been a matter of taste. "Neohesperidon dihydrochalcone is characterized by a sweet sensation that is slow in onset, long in duration and accompanied by an aftertaste similar to licorice or menthol," the OTA report says. But Samuel Klein, a consultant to Research Organic Corporation, said in a telephone interview that they have the problem licked. Adding another chemical, which is a trade secret but is on the FDA's GRAS (Generally Recognized as Safe) list, "gives a quick impact of sweet taste," he says. The resulting combination is 1,000 times sweeter than sugar and can sweeten a beverage with 12 percent the number of calories. The hopeful producers of the new sweetener are now waiting for FDA approval. □

Orbit established for Object Kowal

Object Kowal, the asteroid-sized body recently discovered between Saturn and Uranus (SN: 11/12/77, p. 311), is still an enigma, either a minor planet outside the solar system's known asteroid population or a comet that is not currently displaying a typical cometary appearance. Several weeks of study, however, have at least yielded the object's precise orbital characteristics, in the process enabling it to be located on previously made photographic plates dating back more than 80 years.

The first few weeks of observations suggested a possible orbit to Brian G. Marsden of the Harvard-Smithsonian Center for Astrophysics, who made the requisite calculations and passed the result along to the object's discoverer, Hale Observatories astronomer Charles Kowal. Though not quite on the button, this early estimate enabled Kowal to locate the object on two plates made in 1969, thus providing observations over a long enough arc of the object's motion for Marsden and colleagues to work out the orbit in detail.

The object gets as close to the sun as 1.27 million kilometers (8.51 astronomical units), bringing it inside the orbit of Saturn, where its next perihelion will occur in February 1996. The rather elongated path (eccentricity 0.38) also extends out just about to the orbit of Uranus, reaching an aphelion of 18.9 AU or about 2.8 million km from the sun, a distance it last reached in November 1970. Inclined 6.9° from the plane of the ecliptic, the orbit carries the object around the sun once every 50.7 years — at present. Perturbations by Saturn (and to a lesser extent by Jupiter and Uranus) actually produce a fluctuating period that varies between about 47 and 51 years.

Aided by these parameters, Kowal has been able to locate the object in a Palomar Sky Survey plate from 1952, while William Liller and Lola Chaisson of the Center for Astrophysics have found it in plates made in 1895, 1936, 1941, 1943 and 1976. The object was at perihelion in March 1895 and August 1945, Marsden points out; unfortunately, he adds, it appears only as a faint streak in the '95, '41 and '43 plates, making it difficult to tell whether there is any of the diffuse appearance that would answer the question — raised by its distance from other asteroids—of whether it is a defunct