

# 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. □

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## Orbit established for Object Kowal

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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

or possibly a quiescent comet.

It is possible, in fact, that if the object is a comet, earthbound observers may never know it. A defunct comet—a “dead” comet nucleus — would already have given off most or all of the volatile material that would otherwise produce the familiar hazy appearance of the coma, to say nothing of a tail. In addition, however, Object Kowal always stays far from the sun by known cometary standards, so that it may never get warm enough to give off even an existing supply of volatiles. “We’ve never seen a comet beyond 11 AU before,” says Marsden, adding that most have been observed at less than 6 or 7. Object Kowal’s perihelion of 8.51 AU could mean that it will get warm enough to reveal a cometary nature when it comes around in the mid-1990s, but it may not. Frustratingly, the lack of visual and spectroscopic evidence will not prove that the object is *not* a comet.

Ironically, the object was actually singled out on the 1941 plate — and even marked with an arrow—in a study done in the early 1950s, about a quarter-century before Kowal’s “discovery.” It had been spotted by Ann B. Hearn (now married to University of Maryland astronomer Thomas Matthews), working with the late Harlow Shapley on a search for distant galaxies. It was Kowal, however, who found that the object was circling the sun, thus earning recognition as its discoverer and the honor of giving it a name. Although the object’s nature is still in question, Kowal has in fact suggested a name: Chiron, one of the centaurs of Greek mythology. If other, atypically distant minor planets are found, he says, perhaps they might be thus categorized as “Centaurian planets.” □

## IWC supports larger Pacific whale takes

Meeting in Tokyo this week in a special session called by the Japanese and Russian delegations, the International Whaling Commission (IWC) approved an increased quota on commercial hunting of North Pacific sperm whales. In June the IWC approved a take of fewer than 800 and a total ban on the take of any bowhead whales. The latter caused severe repercussions amidst coastal Eskimos whose subsistence culture depends on eating bowheads (SN: 9/17/77 p. 185). At an IWC scientific committee meeting in Canberra, Australia, a week prior to this Tokyo meeting, new data used in mathematical models of sperm whale population dynamics supported an increased North Pacific take of 6,000; at the same time, the committee again endorsed a total bowhead ban. But in full committee the IWC decided to rescind the total bowhead ban for political (and cultural) reasons and to support an increased sperm whale take of 6,000. □

## King Philip’s tomb — A golden find



Wide World Photos

About 17 feet below the Greek farming village of Vergina lies what a University of Salonika archaeologist believes, “without reservation,” is the 2,300-year-old tomb of King Philip II of Macedon, father of Alexander the Great. Chemical analyses have dated the tomb at 350 to 320 B.C. But Manolis Andronikos, who found the tomb, says the deciding factor in identification of the tomb was his discovery of five small ivory heads on the tomb’s floor. The heads, he believes, portray Philip, his parents, his first wife, Olympias, and their son Alexander. A solid gold casket contained Philip’s bones, he says.

## Hyperactives as teens: Problems linger

For years, the “they’ll grow out of it” philosophy has been applied to both hyperactive and learning disabled children. But research results now indicate that while many such youngsters do improve in later life, their academic and social progress often appears to be slower than hoped for.

That was among the conclusions of a followup study of sixty-two 14-year-old boys who had been diagnosed as learning disabled (LD) in grade school. The youngsters — classified as either hyperactive, hypoactive or normoactive (normally active) — were compared with a control group of 31 non-learning disabled children who had normal levels of activity. The LD youngsters, although of average or better than average intellectual level, had either failed a grade or were near failure and were about two years behind controls in oral reading achievement.

In the extensive followup, researchers from the University of Arkansas’s Behavioral Laboratory and Child Study Center tested the children on a variety of academic and social adjustment measures. In addition, the youngsters were rated by their teachers, parents and a team psychiatrist.

The results at age 14, reported in the OCTOBER AMERICAN JOURNAL OF ORTHOPSYCHIATRY, include:

- Only two of the 23 hyperactive boys presented no problems for either the home, school or community. Ten remained academically below normal and exhibited

social deviancy as well. Three who were academically adequate continued to have behavioral problems. And eight, although still academically handicapped, had become generally cooperative at home and at school.

- Normoactive LD youngsters presented principally academic problems — 72 percent continued to have basic problems in two or three basic skills.

- Among hypoactives, 71 percent had marked deficiencies in two or more academic areas, and only one in 14 was achieving normally in all areas.

- Sixty-one percent of the control group students remained adequate to superior in all three areas tested by the Wide Range Achievement Test.

The researchers were particularly discouraged by the outcomes of the hyperactive boys, especially since earlier studies in the field (in the late 1960s) indicated that children might outgrow hyperactivity between the ages of 10 and 14. But this proved untrue in the Arkansas study, even though most of the LD youngsters had received the benefit of special learning programs and medication between their original diagnosis and the followup study.

“We hoped these various programs would have made an impact, but that didn’t happen,” team researcher Peggy T. Ackerman told SCIENCE NEWS. “If anything, the children treated more intensively [with tutoring, resource rooms, medication, etc.] turned out worse off than all the rest. ... But of course they were the ones