Biomedicine

Playing it safe with breakaway bases

"Safe!" yells the umpire after your dust-raising slide into second. "Aargh!" you say, realizing you've just hit the base like an out-of-control snowplow. Between 1983 and 1987, post-game celebrations were marred by crutches, splints and emergency rooms for more than 4,000 players reporting injuries to the American Softball Association. But scientists at the University of Michigan in Ann Arbor say they have a better idea for the 40 million softball players in the United States.

By using breakaway bases, modified to release from their moorings when hit by a sliding player, softball enthusiasts could significantly reduce the number of injuries, say David H. Janda and his co-workers. They had found in an earlier study that sliding causes 71 percent of recreational softball injuries. Aware that outlawing base sliding would "offend the purists," the researchers studied softball games to see if simply changing bases would lower injury rates. In 633 games played on breakaway-base fields and 627 games on stationary-base fields, the researchers found that injuries occurred about 23 times more frequently with stationary bases. Although the cost of breakaway bases is about twice that of stationary bases, they report in the March 25 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION that using the new bases would lead to "a significant reduction in the quantity and the resultant morbidity of softball injuries." They caution, however, that "poor timing, inadequate physical conditioning and alcohol consumption" can still make a player an armchair athlete.

No April fooling these strange ills

From ancient medical conditions to those created by modern society, physicians must be ever alert for the unexpected. Recent reports have added a few more odd-but-true diagnoses:

- Buckle up for safety, but make certain your seat belt fits properly, says Michael Bornemann of the Tripler Army Medical Center in Honolulu. In the April ANNALS OF INTERNAL MEDICINE, he reports a case of thyroiditis apparently caused by a too-tight belt rubbing on a patient's neck. An inflammation of the thyroid gland, the thyroiditis caused neck pain, fever and a flu-like illness in the patient, who had purchased the car two months before the symptoms brought him to Bornemann's office.
- Brush after every meal, but make certain you've satisfied that appetite first. In the March ARCHIVES OF SURGERY, physicians at Duke University Medical Center in Durham, N.C., say they've found toothbrushes inside four adults, who were not suffering from a psychiatric illness that otherwise might explain the unusual discoveries. Because there have been no reports that toothbrushes can pass through the body on their own without doing damage, the physicians removed them with a tube inserted into the throat. In two of the cases, say the authors, alcohol swallowing preceded that of the toothbrushes.
- Add a little honey for sweetness, but beware the maddening aftermath – if that honey is contaminated with compounds called grayanotoxins. Found in some rhododendrons, the toxins cause short-lived, rarely fatal symptoms that may mimic a heart attack, or dramatically affect the central nervous system. Physicians at the Karadeniz University School of Medicine in Trabzon, Turkey, report in the April 1 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION that they have seen 16 cases of "mad honey" poisoning in the last two years. Made by bees pollinating specific plants, the honey has been considered nasty since about 400 B.C., says Kenneth F. Lampe of the American Medical Association in Chicago. In an accompanying editorial, he warns that "[t]oday, cases of mad honey poisoning should be anticipated everywhere [including the United States]. Some may be ascribed to a search for exotic tastes . . . from imported honey . . . [or] the ingestion of unprocessed honey in the quest for 'natural foods.' "

Physics

Dietrick E. Thomsen reports from New Orleans at the meeting of the American Physical Society

Quantum nondemolition experiments

In the physics of the microcosm, a measurement disturbs what it measures. This is one of the consequences of the famous uncertainty principle. A second measurement of the same quality of the same system would not give the same result, because the back action of the previous measurement would have changed it. In the case of measurement of the amplitude of a beam of light, the back action amounts to total demolition: The measuring device destroys the photons or light quanta as they come in, converting their energy to something else.

In recent years scientists have been learning to get around this quantum demolition. Their results are having important repercussions in basic quantum physics and may have applications to communications technology. The first successful experiment was done by Marc D. Levenson, Bob Shelby and Steve Perlmutter of the IBM Research Division in San Jose, Calif., according to a review of the subject by Levenson.

The trick is to use two light beams in a single silica fiber of the sort used in optical communications. One beam measures the other through an interrelation mediated by the substance of the fiber. Passage of a light beam through the fiber changes the fiber's index of refraction slightly. The phase of a wave propagating through this kind of medium will change in relation to changes in the amplitude, and if two beams propagate through the medium simultaneously there is a reciprocal relationship by which changes in the amplitude of one produce changes in the phase of the other.

The experimenters combined light beams of two different colors with a prism, sent them through 100 meters of fiber and separated them at the end. They measured the phase change of one with an interferometer, and inferred a value for the amplitude change of the other from that. The amplitude of the other beam was measured directly in the usual kind of quantum demolition detector. The two results agreed.

A main purpose of such procedures is to measure noise – that is, fluctuations in the amplitude of the light – before the beam is sampled by some detector. One conceptually significant result that these experiments have already shown concerns "shot noise," the noise arising from quantum-mechanical fluctuations. One might think such noise arises from random fluctuations in the source of the light or from similar fluctuations in the detector. Levenson says the experiments prove both opinions wrong. The noise is "vacuum noise" inherent in the light itself, he says.

New voltage standard

The National Bureau of Standards (NBS) is beginning to use a new device for producing standard voltages that should make life easier for electrical laboratories. The modern voltage standard is related to frequency, which can easily be measured, says Richard L. Kautz of NBS in Boulder, Colo. Frequency can be turned into voltage by a Josephson junction, which, when bathed in radio waves of a certain frequency, puts out a certain voltage.

The trouble with the previous devices is that, using one or two Josephson junctions, they put out either half a millivolt or a millivolt. This makes it difficult to calibrate the 1.018-volt Weston cells that the other laboratories use as secondary standards. Furthermore, the primary standard had to be kept at NBS, and so from time to time the laboratories had to send their Weston cells to NBS.

The new standards use microlithography to make series arrays of large numbers of Josephson junctions to produce higher voltages – 2,000 for 1 volt, 19,000 for 10 volts. They can also be kept in other laboratories, lessening the need for travel, and technicians can operate them. They "don't need a PhD physicist to twiddle the dials," says Kautz.