

Digital division for fast computing

For a person working with only pencil and paper, dividing one large number into another can be a tedious struggle. The situation isn't much better for digital computers. Faced with 150-digit or larger numbers often encountered in applications such as message encryption, computers can also get bogged down. But a newly discovered mathematical technique may bring computer division up to speed.

Computer multiplication is already fast. Even while two numbers to be multiplied are being fed into the computer, standard methods allow the machine to start generating the answer immediately. In contrast, conventional techniques for division require a computer to "know" both numbers in full before beginning to divide one number into the other. For some large, fast computers, this bottleneck is severe enough that to save time, the divisor is first divided into one, and then this result is multiplied by the dividend to give the answer.

The trick to speeding up computer division, says computer scientist Ernest F. Brickell of Bell Communications Research in Morristown, N.J., is to shift into

a different number system at the right moment. In this arrangement, while all numbers are initially expressed in the ones and zeros (bits) of the binary number system, the results of a division are temporarily registered in a larger number system that also includes twos. After all the computations are finished, the final answers can easily be converted back into binary numbers.

This allows the computer to begin finding an answer even while the numbers to be divided are being read in. Only the first few bits of the divisor and the dividend are needed to start the process. A computer, after a very brief delay at the start, finishes such a computation in the same time it takes to read in the numbers.

The idea of temporarily shifting to a different number system isn't new, says Brickell. What is new is its use for speeding up division.

Brickell and his colleagues are now designing a computer chip that implements this division method. Details of Brickell's algorithm have yet to be published, and Bell Communications Research is applying for a patent on the process. Although this scheme may initially be most useful in cryptography, where high-precision division involving very large numbers is often needed, other applications are also likely to be developed. — I. Peterson

Another hazard in undercooked pork

For decades mothers have admonished their young to beware of pink pork. Their concern has been that if the meat was undercooked and infected with the trichina worm, the diner might develop trichinosis. As a result of such caution, this disease is relatively rare in the United States today. Moreover, U.S. pork producers — through more stringent inspection and improved animal breeding — are working toward meat certified as trichina-free, notes veterinarian Jitender P. Dubey at the Agriculture Department's Animal Parasitology Institute in Beltsville, Md.

These trends worry him because they may lead to complacency. And this is especially dangerous, he suggests, because a study he and his colleagues recently completed indicates that undercooked pork can harbor a far more serious potential health hazard than trichinosis.

The researchers recently reported the first finding of the protozoa *Toxoplasma gondii* in commercial cuts of pork. Like the parasitic trichina worm, *T. gondii* can be killed by cooking meat or edible organs (like the brain and heart) to an internal temperature of 158°F. However, with trichinosis scares on the wane, Dubey worries that consumers may be tempted to serve rarer pork — a practice that has been advocated in some areas of the world, including France.

Humans ingesting the live *T. gondii* parasite may contract toxoplasmosis. In a developing fetus or an immunocompromised individual — including those with AIDS or undergoing cancer therapy — this disease can eventually lead to blindness, mental retardation, even death. Of the estimated 3,300 U.S. infants born each year with this infection (contracted through the mother), about 6 percent soon die, according to National Institutes of Health-sponsored research. How many of the rest develop related problems later in life is not known.

Implications of the new pork finding are described in a related report by Dubey in the July 15 JOURNAL OF THE AMERICAN VETERINARY MEDICAL ASSOCIATION. (In the May 1 issue of the journal, Dubey's group reported the initial discovery of *T. gondii* in pork.) According to Dubey, an estimated one in three pigs may be infected with the parasite. Though cat feces have long been considered the leading source of human infection, Dubey notes in the new report that "fresh pork may be the main meat source of *T. gondii* infection in the United States." However, he says, because an estimated 6 percent of all hamburger may also be contaminated with pork during grinding, many people who eat rare or raw ground beef may also risk picking up the *T. gondii* infection.

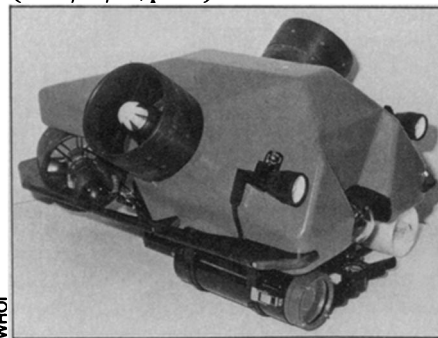
— J. Raloff

New look at *Titanic* with a robot's 'eye'

Scientists at the Woods Hole (Mass.) Oceanographic Institution are delving deeper into the recently uncovered remains of the *Titanic*. This week they landed a small manned submarine, the *Alvin*, on the upper deck of the sunken luxury liner and sent a picture-taking robot down the grand staircase. The robot descended four levels and sent back views of the grand promenade deck and a nearby room containing a large chandelier still intact 74 years after the *Titanic* sank.

Expedition leader Robert D. Ballard radioed the news back to Woods Hole and said the successful mission "was like landing on the moon."

The 50 researchers participating in the expedition departed aboard the research vessel *Atlantis II* on July 9. Ballard also headed the team that found the *Titanic* in the North Atlantic last year (SN:9/21/85, p.182).



The camera-bearing robot Jason Jr.

The lawnmower-size robot, named Jason Jr., carries high-resolution color video and still cameras and is attached to the *Alvin* by a 250-foot electrical tether. Its propulsion system is guided by an operator in the three-person submarine. At a July 8 press conference in Woods Hole, Ballard said Jason Jr. will act as a "swimming eyeball" inside the *Titanic*.

Visibility at the 12,500-foot depth of the wreck is limited, cautioned Ballard, and submersible vehicles must be operated with care to avoid entanglement in parts of the remains.

According to Ballard, one-third to one-half of the *Titanic's* stern was not located in last year's expedition and only a small portion of a field of debris behind the ship was explored. The current expedition is expected to shed light on where missing pieces of the 883-foot vessel are located and what is in the debris.

The researchers hope to get in 12 days of diving before returning by the end of the month. Four hours of exploration are planned daily, sandwiched between the five hours it takes for *Alvin* to dive to the *Titanic's* remains and resurface.

— B. Bower