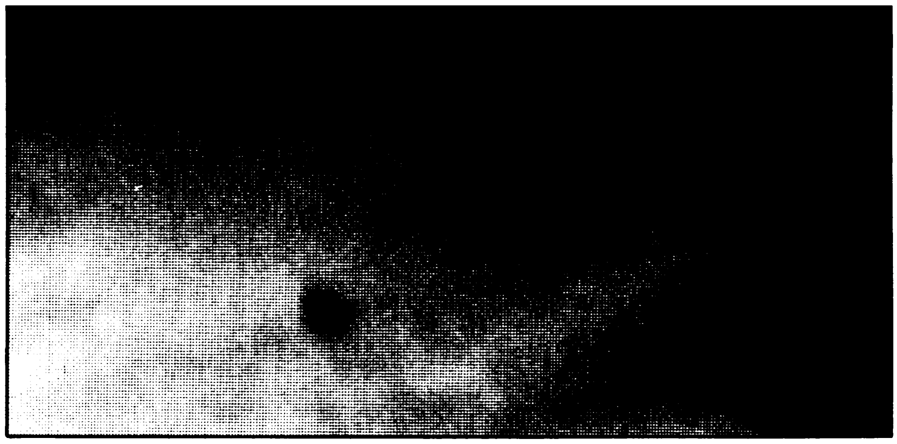
there is "some indirect evidence" that the higher mortality rate can be accounted for by the presence of subclinical disease, yet are at a loss to explain it. They point out that since the two studies involved different time periods unknown factors may have been involved. Nonetheless, they believe that their results "raise some questions as to the health benefits from weight reduction in persons of average or near-average weight." □

Another moon: Jupiter's 15th



JPL

Newfound satellite and its shadow, seen crossing Jupiter by Voyager 1. Dark streak extending from shadow is cloud feature coincidentally aligned with shadow's position.

Last year a 14th satellite of Jupiter was discovered in one of the Voyager 2 spacecraft's photos by scientists who had originally thought the point of light to be a star (SN: 10/20/79, p. 263). Now a researcher who was looking for the same object in photos from Voyager 1 has discovered yet another satellite, Jupiter's 15th.

Attempting to measure the 14th moon's orbit more precisely, Stephen P. Synnott of Jet Propulsion Laboratory (the Voyager control center) had been looking at Voyager 2 photos taken when the object should have been one or two orbits behind or ahead of its position in the photo that led to its discovery. Failing to find it at the time, he turned to pictures from Voyager 1, and in one of them, he says, "I saw what looked like a shadow against Jupiter's disk." The next frame showed the same shadow in a different position, and Synnott assumed it to be number 14 (designated 1979 J1) until an orbit calculated from the two images showed it to be on a clearly different path. After a search of "weeks and weeks," Synnott finally located a single photo that showed both the shadow and its source — a previously unknown satellite, now designated 1979 J2.

It orbits the planet at a mean distance of slightly more than 151,000 kilometers from the cloud tops, Synnott calculates from the several frames in which the object has by now been identified. This puts it between the orbits of Amalthea (about 107,000 km out) and Io (nearly 350,000), circling Jupiter once every 16 hours 16 minutes. It also becomes easy to see how as few as two photos could enable Synnott to tell that the object's orbit was not that of the 14th moon, whose mean distance from the clouds had been calculated as slightly over 57,000 km, just about along the edge of Jupiter's ring system (also discovered from Voyager pictures). Synnott has now revised his calculations, in fact, and determined that the true distance is only about 56,400 km — actually *in* the ring.

The newly found satellite appears tiny in the photos, and Synnott estimates it to be only about 80 km across — "at least in the direction we can observe." It has only been spotted in photos showing it against the disk of Jupiter, and since it is almost certainly gravitationally "locked" with its longest axis pointing at the planet, it is possible that the Voyagers were only able to see it, in effect, "end on." Amalthea, for example, measures 155 km in one dimension, but 270 km in the direction radial to Jupiter. To measure the new satellite's long axis, Synnott hopes to be able to pick out the object against the dark sky in photos taken off the edge of the planet, when the spacecraft would have been facing it broadside.

Its composition, too, is uncertain from the limited data, although Synnott says that it is "about as dark as Amalthea," whose surface has been found to approximate laboratory spectra of carbonaceous chondrite material augmented with sulfur possibly transported inward from Io. The yet-unnamed number 15, in fact, could turn out to be more sulfur-rich still, since its orbit is about 44,000 km closer to Io's than is that of Amalthea.

Jupiter may actually have not merely 15 satellites, but 16. In 1975, Hale Observatories astronomer Charles Kowal spotted a possible candidate in an earth-based photograph (SN: 10/11/75, p. 229), but subsequent observations failed to confirm its presence around the planet. It was seen far from Jupiter, so at least it cannot be confused with the two "Voyager moons," but if it is someday confirmed, it will probably be assigned a place as the 14th satellite, bumping the newcomers to 15th and 16th. And no one is ruling out the possibility that still more may be discovered. □

Waking up to a biological alarm

The human body, keeping time to a variety of biological clocks, somehow knows there is a time to every purpose. But where and what are the body's timepieces? According to recent work by Harvard Medical School researchers, one behavioral timer may have been found — the clock that dictates the time to be asleep and the time to be awake. If validated, the find will be the first identification of a biological timekeeper in humans.

The clock, described by Martin Moore-Ede, Ralph Lydic and co-workers at a recent meeting on sleep in Mexico City, is a small cluster of neurons in the hypothalamus of the human brain. A similar area was identified eight years ago in the brains of rodents and called the suprachiasmatic nuclei (SCN). When the region was destroyed, the rodents lost their circadian (approximately 24-hour) rhythm in feeding and other behaviors.

With these findings in mind and interested in the physiological basis for "jet lag" and sleep disorders, Moore-Ede and co-workers began to search for a structure that might be responsible for such behavior. They found that the brains of squirrel monkeys contain structures similar to the rodent SCN — actually two clusters of neurons in the hypothalamus located on either side of the tip of the brain's third ventricle (a fluid-filled cavity). When the neuronal clusters were destroyed, the rest-activity cycle of the monkeys was disrupted, while other rhythms — such as body temperature — were unaffected. "Obviously this is not the only biological clock, but it is certainly a major one," says Moore-Ede.

Moving systematically up the primate tree the researchers then studied the brains of eight New World (Western Hemisphere) and Old World (Eastern Hemisphere) primates and sections of 16 human brains, ranging in age from 28 weeks gestation to 50 years. In each, says Moore-Ede, the same cluster of small, rounded neurons — identified microscopically — was present. As the scientists moved up the evolutionary tree, however, the position of the 300-micron-wide clusters shifted, so that in humans the cells are more diffusely distributed and placed on the sides rather than at the tip of the ventricle. This more diffused distribution may be related to the observation that the sleep-wake cycle in humans is not as rigorous as in other species, says Moore-Ede.

While the exact mechanism is not understood, Moore-Ede says the cells are apparently an "endogenous, self-contained pacemaker" sending out precise signals to the rest of the brain. Because the appropriate human experiments cannot be done, proof that the cell clusters

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... Biological clock

are the human sleep-wake timekeeper is as yet indirect, based on the experiments in monkeys and observations that some humans with drastic changes in the sleep-wake cycle have damage to that region of the brain, says Moore-Ede. "These findings suggest we're on the right track," he says. "Now we must rely on experiments of nature to continue to validate the findings." □

Baby woolly mammoth blood

Intact red and white blood cells of a woolly mammoth have been found in tissue taken from the mammoth discovered frozen in Siberia in 1977 (SN: 3/18/78, p. 167). The cells are the oldest body cells to be examined in so natural a state — the animal lived approximately 44,000 years ago.

The blood cells were discovered in a gram of tissue given by Soviet scientists to Wayne State University School of Medicine in Detroit. When Marion Barnhart analyzed the dried material by scanning electron microscope, she saw the red and white blood cells in blood vessels and capillaries of the tissue. The cell membranes appear to be intact, and the white cell surfaces still have their characteristic fingerlike projections.

The blood cells resemble those of modern elephants, Barnhart says. For instance, the red blood cells are 5.3 microns in diameter, while frozen elephant cells are 5.1 microns. The mammoth white blood cells are as large as 11.5 microns across.

Barnhart also looked at remnants of skeletal muscle in the abdominal sample. She used scanning electron microscopy to locate an appropriate muscle region and then made thin slices of that tissue to examine under high magnification. The membranes and contractile fibrils are missing, she told Science News. But there is dense material that corresponds to the characteristic A and I bands of muscle, and the Z bands, which define skeletal muscle segments, are intact. "The length of the sarcomeres [segments] is realistic compared to those of modern elephants," Barnhart says.

Others at Wayne State examining the biochemistry of the baby woolly mammoth tissue have identified collagen, the fibrous protein found in connective tissue. The scientists are analyzing abdominal muscle because they believe tissue deep in the mammoth is the best preserved. A slower rate of freezing 44,000 years ago and a slower rate of thaw more recently helped to keep the cells intact. The mammoth is the best preserved specimen that has been found in Siberia; in most cases scavengers and bacteria destroy body cells and repeated thawing and refreezing disrupt the cells. □

BOOKS

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