

Daily rhythms running like clockwork

Bright light alone, according to one case study, can rapidly reset the human circadian rhythm — the biological clock that keeps myriad daily cycles such as sleepiness and body temperature in harmony with the environment. Though this finding is consistent with animal studies, researchers had previously thought human daily cycles were also governed by the sleep-wake cycle and by social cues.

Charles Czeisler of Brigham and Women's Hospital in Boston conducted the experiment, reported in the Aug. 8 *SCIENCE*. In it, a 66-year-old woman with a naturally fast-running biological clock and a regular sleep pattern sat before bright lights for four hours each night before going to bed — the time at which her unusually short cycle made her most sensitive to light. Because most people are most sensitive to light during sleep, previous studies involved waking them up — which made researchers unsure whether subsequent circadian changes resulted from light or from premature awakening.

While her sleep patterns remained the same, other aspects of the woman's circadian rhythm — such as body temperature and hormonal secretions — shifted after only one exposure. The magnitude and rapidity of the shift — six hours after two exposures, Czeisler reports — suggest that the human circadian rhythm may be easier to reset than was previously believed. Therapeutic applications of bright lights may ease the frequent and sudden shift changes experienced by the estimated one-third of U.S. workers on rotating shifts.

Another experiment exploring circadian rhythms was discussed last week at meetings held at the Marine Biological Laboratory at Woods Hole, Mass. Robert Barlow placed horseshoe crab hatchlings in environments of complete light, complete dark and normal light/dark. The crabs raised in total darkness did not develop eyes, nor did they display evidence of circadian rhythms. But the all-light crabs, when placed in darkness and then exposed to a single flash of light, began to show normal rhythms. Both the all-light crabs and the light/dark crabs had individual cycle periods of about 24 hours. This suggests, says Barlow, that the period of the biological clock is genetically set but environmental stimuli must trigger it, in a process analogous to winding up a new watch that will then run forever.

Sound diagnosis of arthritis

Doctors may soon use the sound of arthritis to detect the disease in joints before obvious — and more severe — symptoms appear, thanks to a device invented by Manuel Casanova of Johns Hopkins Medical Institutions in Baltimore. In tests conducted on 19 patients, the device detected abnormalities in the knee joints of all eight patients who had been previously diagnosed as arthritic.

Called a rectifying-demodulating phonopneumograph (RDP), the shoebox-sized device can produce either the sound or a graphic display of the vibrations a joint makes when it moves. The inexpensive device — it costs less than \$200 to build — works “like a watch battery and crystal in reverse,” says the inventor. Movement in the joint, picked up by the microphone, moves the RDP's crystal to create electric impulses, which translate into sound or graphs. Nonarthritic joints sound squishy and produce a graph with both sharp peaks and smooth curves. Arthritic joints crackle like crumpled plastic and produce a graph with only sharp, multipointed peaks.

Casanova says fixed structures such as ligaments produce the multiple peaks in the sound waves of arthritic joints and may indicate the inflammation of arthritis, which, if detected early, can be brought under control with drugs. A noninvasive diagnosis additionally spares patients the usual diagnostic probes and injections.

The oldest oil . . .

While the Soviet Union, Oman and China have commercially extracted oil and gas from rocks of the Proterozoic eon (which ended 600 million years ago), fields this old are not usually expected to be sources of petroleum. However, a group of Australian researchers, having recently discovered signs of the oldest oil ever found, suggest in the Aug. 21 *NATURE* that those searching for petroleum take Proterozoic rocks more seriously.

M. J. Jackson and co-workers at the Bureau of Mineral Resources, Geology and Geophysics in Canberra found Proterozoic hydrocarbons at various stages of maturation in 14-billion- to 1.7-billion-year-old sediments in the McArthur basin of northern Australia. In one formation, “live” oil (crude oil containing gas) bubbled up from 14-billion-year-old rocks. This is more than 400 million years older than previous finds.

Laboratory analysis of the oil and other organic matter indicates that they were deposited in marine and lake environments, and that they were produced from ancient bacteria (SN:12/15/84, p.372) and algae — primarily prokaryotes, single-celled animals having no distinct nuclei. The hydrocarbon biomarkers, or chemical-fossil traces of these animals, are the oldest ever identified, according to the researchers. Because there are so few biomarkers for eukaryotes, nuclei-containing animals that were more advanced than prokaryotes, the McArthur sediments support the notion that eukaryotes began thriving later in the Proterozoic, the researchers say. They also note that the age of the sediments and their low degree of thermal alteration makes the rocks “a valuable resource for the study of primitive biota.”

. . . and the oldest piece of earth

Scientists at the Western Australian Institute of Technology in Perth have discovered the oldest fragments of the earth's crust, according to the August issue of Australia's *SCIENCE AND ENERGY NEWSLETTER*. Bob Pidgeon and Simon Wilde found the 4.3-billion-year-old zircon crystals in the Jack Hills area, about 700 kilometers northeast of Perth. The crystals are about 200 million years older than other zircon crystals found previously in Australia and are thought to be 250 million years younger than earth and the solar system.

Earthquake news

• The National Science Foundation (NSF) has announced that it plans to award the State University of New York at Buffalo \$25 million over the next five years to establish the nation's first federally funded Earthquake Engineering Research Center. According to NSF, the center will focus on key problems in earthquake engineering and science that are not being addressed adequately by the agency's unsolicited-proposal system. For example, earthquake engineers will concentrate on older buildings that were built with little regard for earthquakes and on integrating earthquake requirements with those of other hazards, such as winds.

• Two researchers at the Tokyo Institute of Technology have concluded that there is a high probability of an earthquake with a magnitude of 6.5 or greater occurring off northeast Japan in the next few years. Keiko Kuge and Yoshimori Honkura used a statistical technique to show that such quakes have typically been preceded in this region by a seven- to 10-year period of increased seismic activity or by a three- to six-year period of decreased seismicity. Since the region is currently experiencing very little seismicity, the researchers conclude that the probability of a 6.5 or greater earthquake occurring by 1998 is greater than 90 percent. They write in the August *GEOPHYSICAL RESEARCH LETTERS* that “no severe hazard would be expected from such an earthquake.”