Earthquakes may be influenced by the moon

In 1971, as an earthquake shook his apartment, Steve Kilston stood in the doorway and gazed outside at the full moon setting over the western horizon. "It was then that I first thought that maybe the moon has some influence over earthquakes," says Kilston, now an engineer at Hughes Aircraft Co., in El Segundo, Calif.

Kilston, of course, was not the first to wonder how the moon affects the earth's inhabitants and processes. Over the centuries the lunar orb has been blamed for many things from bizarre behavior in humans to the transformation of man into werewolf. While astrologers sometimes predict earthquakes based on planetary positions, it is widely believed that only the moon and the sun exert enough gravitational pull to affect the earth. In fact, the solid earth has its own tides in response to the sun and moon, and moves up and down as much as six inches each day. Only now, though, after many false starts, is firm scientific evidence beginning to indicate that in areas such as Southern California, with specific geological and geophysical qualities, the moon indeed can influence whether and when earthquakes occur.

With Leon Knopoff of the University of California at Los Angeles, Kilston examined records of earthquakes that struck within a narrow band of Southern California in the last 50 years. They report in the July 7 NATURE that large earthquakes, Richter magnitude 6.0 or greater, can be correlated with moonrise and moonset, full and new moons, and with the 18.6 year precession period of the lunar orbit, which tilts and wobbles in a predictable cycle. Every 18.6 years the moon reaches its northernmost position, which scientists call the maximum lunar declination. Kilston and Knopoff found that while not every major quake in the area occurs at this time in the lunar orbit, major quakes did strike in 1933, 1953 and 1971 (and 1857, when historical data show that a major quake occurred) — all times when the moon was at or near its maximum declination.

The reason this effect is seen primarily in Southern California, they say, is that the San Andreas fault and other major faults in the region run in a roughly northwest/southeast direction. During the full moon, moonrise and sunset approximately coincide; at the new moon, moonrise and sunrise are at roughly the same time. In each case, the gravitational pull is in the same direction. In the first and last quarters of each lunar month, the forces cancel each other out. Since the pull is unevenly distributed, with either the east or west side of the fault being closer to the moon at a given time as it passes over, the fault is pulled apart slightly, making it easier for the two sides to stretch, twist and slip past each other. The 18.6 year precession cycle is important in Southern California because the western side of the fault, which is part of the Pacific plate, is moving toward the northwest. The moon pulling from that direction simply helps it on its way, Kilston says.

In most parts of the world and for most earthquakes, the correlation does not hold. "Most earthquakes just occur at their own time, and the tides don't exert a very strong influence," says Fred Klein of the United States Geological Survey in Menlo Park, Calif., who also has looked for lunar effects on earthquakes. "But in some special cases, where there are local areas with a certain kind of tectonics and a certain geologic setting, the effects are stronger and can actually be seen to trigger earthquakes." A firm link has not been established before, Kilston says, because the effects of lunar tides have been figured globally and tend to cancel out. Different locations may be affected by different parts of the lunar cycle.

The work of astrologers has "gotten mixed up with people who do true science, so that there's always been a bad framework for doing this kind of work," Klein says. He calls the topic "exciting," but says that because of its dubious image, "maybe it hasn't received as much attention as it should have."

The next time the moon will approach the most northerly latitude in its orbit is in November 1987. Kilston explains that the probability for a major quake in Southern California then, or for several years on either side of 1987, is perhaps twice that of any other time. "It doesn't do us too much good in preparing except to realize that the next earthquake may be a little sooner than we would otherwise wish to believe." He adds, however, that "we don't have nearly enough data," and hopes that another 100 years or so of observations will improve understanding of the correlation between the moon's motions and earthquakes. —*C. Simon*

AIDS: New victims but maybe a treatment

The AIDS (acquired immune deficiency syndrome) epidemic is becoming increasingly unnerving. The Centers for Disease Control in Atlanta published in its July 15 MORBIDITY AND MORTALITY WEEKLY REPORT that of the 1,831 AIDS victims documented so far, four were apparently not members of those groups known to be at high risk for AIDS — male homosexuals, intravenous drug users, Haitian-born residents in the United States or hemophiliacs. Yet all four were health care workers, raising the possibility that they may have acquired AIDS through contact with AIDS patients or via blood products contaminated with an infectious agent that causes AIDS.

However, CDC scientists are reluctant to conclude that health care workers can acquire AIDS from such sources. One reason is that only one out of the four workers seems to have had contact with an AIDS patient or with blood products. Another reason is that the scientists were unable to totally rule out that the four workers did not acquire AIDS from sexual activity or intravenous drug use.

The worker who appears to have had exposure to an AIDS patient or blood products is a 32-year-old Baltimore man who came down with AIDS in January of this year and who died from it on June 2. Since 1981 he had worked in a hospital ambulatory-surgery area, where his duties included removal of surgical equipment that was often contaminated with blood. Furthermore, 11 months before he came down with AIDS, he stuck himself on a disposable syringe, and seven months before, he was in the ambulatory-surgery area when a patient with AIDS-like symptoms underwent a tissue biopsy there.

Meanwhile scientists seem to have come a step closer toward unraveling the immunological aberrations underlying AIDS and to possibly identifying an effective treatment for this incurable, often fatal disease.

Alain H. Rook, a Food and Drug Administration scientist working on the National Institutes of Health campus in Bethesda, Md. and colleagues first found that AIDS patients have a pronounced deficiency in the activity of two kinds of white blood cells that help compose the body's immune system. One is the natural killer cell, known to kill virus-infected cells and tumor cells. The other is the virus-specific killer cell, which kills cells that contain a particular virus. They then exposed natural killer cells and virus-specific killer cells from six AIDS patients to two different substances known to bolster normal immune system activity — the protein interferon and the protein interleukin-2. Interferon enhanced the natural killer cell activity of only one AIDS patient and failed to produce increases in activity in virus-specific killer cells from any of the AIDS patients. But exposure to interleukin-2 significantly bolstered the activity of both the natural killer cells and virus-specific killer cells from all six AIDS patients.

These results, reported at a recent American Society for Virology symposium at Michigan State University and also in the July JOURNAL OF CLINICAL INVESTIGATION, suggest that interleukin-2 might be able to help restore normal immune function to AIDS patients and counter their disease. Hook and his co-workers are now testing this hypothesis: Four AIDS patients are receiving interleukin-2, at a cost of $125,000 a patient. —*J.A. Treichel*