Recurrent dreams: Clues to conflict

Do dreams bear any relation to how a person feels while awake? Sigmund Freud and his psychoanalytic offspring held that the imagery of dreams has psychological significance for the dreamer. Biologist Francis Crick, the co-discoverer of the DNA structure, more recently proposed that dreams have no meaning; in his opinion, they randomly purge the brain of unneeded and overabundant associations stored in networks of brain cells (SN: 6/13/81, p. 378).

Recurrent dreams, however, do not fit into Crick's picture of disorganized, random dream production, say psychologists Ronald J. Brown and Donald C. Donderi of McGill University in Montreal. In fact, they report in the March JOURNAL OF PERSONALITY AND SOCIAL PSYCHOLOGY, people experiencing a recurrent dream tend to report more psychological distress than people who either no longer have or never had recurrent dreams. The researchers conclude that decades-old clinical observations, most notably those of psychoanalyst Carl G. Jung, are correct in suggesting a relationship between recurrent dreams and psychological conflict.

"Most people outside of the psychoanalytic schools have treated dreams as a kind of accident," says Donderi. "But the state of recurrent dreaming appears to be related to reports of decreased psychological well-being, regardless of the validity of psychoanalytic theory."

The investigators used newspaper and radio ads to recruit 30 people who were currently experiencing a recurrent dream that had appeared for at least six months, 18 individuals who had had a recurrent dream in adulthood that appeared for at least six months but had not recurred for a year or more, and 19 people who reported never having experienced a recurrent dream in adulthood. Volunteers first completed a dreaming questionnaire; if a remembered series of dreams contained the same theme, characters and emotions, it was considered to be recurrent. Six standard measures of psychological functioning were also administered. Subjects then wrote down remembered dreams for 14 consecutive days. They slept at home, not in a sleep laboratory, and each subject recalled about one dream per night. The dreaming questionnaire and psychological tests were then repeated.

Recurrent dreamers, when compared with the other two groups, reported marked elevations in anxiety, depression, stressful life events and minor physical complaints. Their 14-day dream reports yielded larger proportions of aggressive, anxious and upsetting dream content than reports of the comparison groups. All subjects scored within or near the normal range on psychological tests, add the researchers, but "the data indicate a systematic and statistically significant deficit [for recurrent dreamers] across the entire range of well-being measures." Subjects who no longer experienced a recurrent dream had the highest well-being scores and most tranquil dream content, says Brown, supporting Jung's contention that a recurrent dream ceases once some type of psychological conflict is resolved.

Another Jungian aspect of dreams, archetypality, was also found to be most common among former recurrent dreamers. Archetypal dreams contain bizarre, emotionally charged, often metaphorical elements and, according to Jung, reflect fundamental aspects of psychological functioning. Former recurrent dreamers, notes Brown, may have developed a greater awareness of their own unconscious processes through resolving a conflict and thus remember more dreams with archetypal content.

— B. Bower

The magnetic attraction of periodicities

Scientific interest in the cyclic patterns of nature has passed through cycles of its own. The most recent upswing in the hunt for periodicities in the earth's history was sparked by the suggestions that mass extinctions have occurred regularly every 26 million years or so (SN: 10/1/83, p. 212) and that at least one mass extinction was caused either by meteorites that bombard the earth about every 30 million years (SN: 6/2/79, p. 356) or by episodes of volcanic eruptions.

While scientists go back and forth over the statistical validity of studies showing similar periods for events in a number of geologic records, they are becoming increasingly intrigued by the possibility that all these periodic processes are somehow linked. Two new papers, taking very different tacks, focus on the possible connection between extinctions and the rate at which the earth's magnetic field reverses its direction.

In the March 13 NATURE, Poorna C. Pal of the University of Ilorin in Nigeria and Kenneth M. Creer at the University of Edinburgh in Scotland resurrect a 30-million-year (Myr) pattern in the record of magnetic field reversals after the pattern had recently been questioned on statistical grounds (SN: 10/19/85, p. 245). Instead of analyzing the entire 165-Myr geomagnetic history, as other researchers have done, Pal and Creer focused on the last 83 Myr, in which the reversals have been relatively frequent. Pal and Creer reason that if impacts do disturb the geomagnetic field, their effect would be most evident during such periods of frequent reversals, when the field is the most unstable.

The researchers found that the reversal frequency increased sharply during three periods, each separated by 30-Myr intervals: at 8 to 12 Myr ago, 35 to 45 Myr ago and 65 to 75 Myr ago. They point out that the spurts coincide with global-scale catastrophic episodes signaled by mass extinctions, impact craters, geochemical anomalies and the production of small glass grains called tektites, which are thought to be created by impacts. Pal and Creer suggest that "the approximately periodic recurrences of catastrophic episodes caused reversal spurts during [times of frequent reversals]."

The researchers argue that during periods of frequent reversals, comets or asteroids bombarding the planet enhance the turbulence in the earth's fluid outer core. Many scientists believe that, somewhat like a giant dynamo, the motion of these electrically conductive core fluids produces the geomagnetic field (SN: 10/5/85, p. 218). Reversals may be triggered by changes in the fluid motion, such as increased core turbulence.

However, according to Richard Muller at the University of California at Berkeley, "the model that they [Pal and Creer] describe fails miserably when you try to work it out in detail." Last December, Muller announced at the American Geophysical Union meeting in San Francisco that he and Donald Morris, also at UC Berkeley, have taken a more detailed look at how impacts might trigger field reversals. In their model, the dust thrown up into the atmosphere by impacts cools the planet, enhancing the growth of ice sheets at northerly latitudes, which changes the planet's moment of inertia by effectively bringing water closer to the earth's axis. This in turn speeds up the earth's rotation, disrupting the flow patterns of the liquid core and changing the geomagnetic reversal rate. Muller says he can't discuss the details of this model because the work has not yet been published.

David E. Loper and his co-workers at Florida State University in Tallahassee have also explored the relation between extinctions and the magnetic field. But unlike Pal, Creer and Muller, Loper does not think impacts play an important role in triggering either reversals or extinctions. Loper's group believes that the natural activity within the earth causes episodes of frequent reversals and bouts of vigorous volcanic eruptions, which, some researchers have argued, are responsible for mass extinctions (SN: 3/16/85, p. 172). Loper presented his ideas March 14 at a symposium on the environmental effects of volcanism, held at the University of Rhode Island in Kingston.

Loper's group suggests that a layer of hot mantle material close to the core periodically becomes unstable, releasing mobile plumes of hot mantle material that rise to the surface and feed volcanoes. The researchers argue that the release of the plumes also leads to field reversals. The loss of material, they say, thins the layer, allowing more energy to escape from the core. This enables the heat engine in the core to drive the geodynamo harder, and as the flux of energy to the geodynamo increases, the reversal rate increases as well. In a rough, preliminary calculation, Loper estimates that the layer becomes unstable about every 22 Myr.

Loper's group is conducting laboratory experiments to learn more about the behavior of the lower mantle layer, which seismologists have dubbed the D″ layer. The researchers place a layer of dyed water, representing the mobile D″ layer, under viscous corn syrup representing the colder overlying mantle. "We get what looks like episodic behavior" in the rising plumes of water, notes Loper.

Neither Loper nor Pal and Creer are the first to suggest and model links between these different periodic processes. But what *is* relatively new, say several observers, is that the findings of periodicity in a number of records are enjoying a resurgence of respectability. When all these hunts for periodicity resumed several years ago, says one scientist, "I thought it would be just a flash in the pan. But the idea has grown and periodicity is spreading waves throughout geologic thought." — *S. Weisburd*

Pacific's CO_2 levels: Cause for concern?

One of the greatest concerns associated with the world's burning of some 5 billion tons of fossil fuels annually is the large amount of carbon dioxide (CO_2) it generates. Right now, only about half of that combustion-generated CO_2 stays in the atmosphere. Much of the rest, it is generally believed, is taken up by the oceans. But new research indicates that the ocean might not remain as robust a sink for CO_2 as it has been. That would leave even more of the gas to accumulate in the atmosphere, potentially triggering a more rapid and devastating global warming from the so-called "greenhouse effect."

Researchers from the University of South Florida in St. Petersburg have been studying the calcium carbonate shells of pteropods (planktonic mollusks) in the north Pacific (SN: 12/15/84, p. 376). Not only have their shells incorporated some of the carbon that entered the water as CO_2, but the creatures are also a mechanism by which a portion of that carbon is eventually removed from upper ocean waters; as the creatures die, their shells fall toward the ocean bottom, carrying the carbon along. If a shell falls a long way before dissolving, it carries the carbon far from the surface, potentially making it easier for more CO_2 to enter, helping to reduce atmospheric CO_2 levels. This is usually the case, since high acid levels, which help dissolve the pteropod shells, are normally present only at great depths.

But Robert Byrne and his colleagues have identified regions in the north Pacific where the pteropod shells begin to dissolve at depths of only 170 meters — well within the top 10 percent of the ocean depth — and in far shallower water than generally expected. Since CO_2 is one source of water acidity, Byrne notes, the regions of shallow acidity they've identified may be an indication of higher CO_2 levels beginning to accumulate in the surface waters.

If true, this suggests a couple of causes for concern, he says. First, the more acidic water is, the less CO_2 it will absorb. So a trend toward more acidic surface waters could spell a long-term decline in the amount of CO_2 the ocean will accept from the atmosphere. Moreover, if shell dissolving begins too high in the water column, there is a risk that the shells will be less effective at removing carbon from surface waters. That could exacerbate the acidity problem and the potential inability of the ocean surface to accept as much atmospheric CO_2. — *J. Raloff*

EPA suspends permit

Because a tree does not a greenhouse make, Advanced Genetic Sciences, Inc. (AGS) has at least temporarily lost its permit to conduct field tests of its genetically engineered bacteria. The Environmental Protection Agency (EPA) this week charged AGS with violating regulations when it injected "Frostban" bacteria into about 50 trees on its Oakland, Calif., rooftop (SN: 3/8/86, p. 148). The agency also charged that the company "knowingly falsified" data by describing its tests as greenhouse experiments and failing to inform EPA of cankers that developed on the bark of several trees after the injections. The EPA adds, however, that it has concluded that the bacteria are not pathogenic. The agency is levying a $20,000 fine.

AGS has said that it believed the bacteria were always contained during the rooftop tests, first within syringes and then within the trees. According to EPA, the company plans to repeat the tests in its greenhouse in the next two months; after review, the EPA will decide whether to reinstate the permit. □

Antibody cocktail to fight bacteria

A mixture of seven human antibodies, produced by a new laboratory procedure, is proposed as an effective protectant against a deadly bacterium. The bacterium, called *Pseudomonas aeruginosa,* is the most lethal of the microorganisms that patients commonly acquire while hospitalized. Mark E. Lostrom and his colleagues at Genetic Systems Corp. in Seattle focused on this bacterium in devising a new strategy to develop prophylactic "cocktails" made of human antibodies.

The bacterium *P. aeruginosa* comes in at least 17 varieties, each having a characteristic surface molecule. The Genetic Systems scientists decided to work only with the seven varieties that are responsible for 90 percent of hospital infections, Lostrom said last week in Washington, D.C., at the American Society for Microbiology Conference on Biotechnology.

Invading bacteria expose many surface components to a host's immune system. Some of these components are shared by all bacteria of a species, whereas others provide the means of distinguishing the varieties, called serotypes. Using standard methods for producing large amounts of specific mouse antibodies (monoclonal antibodies), Lostrom and his colleagues employed a laboratory model of an immune system attack directed at each of the different surface components of *P. aeruginosa.* The serotype-specific antibodies, only one of which attacks a given bacterium, were the most efficient at triggering destruction of the bacteria. The antibodies against components found on all the serotypes were not effective.

The serotype-specific antibodies were also effective at protecting live mice against a bacterial attack. The mice given antibody prophylactically, before a large dose of the bacterium of the same serotype, all survived and showed few symptoms. Mice not given the antibody were killed in 1 to 3 days by the same dose of bacteria.

Antibodies against one shared bacterial product did confer some protection. *P. aeruginosa* makes a potent toxin; a monoclonal antibody that binds this toxin protected mice against a toxin dose that kills unprotected mice within a day. Lostrom says the toxin's role in human disease is unclear.

Lostrom proposes that a preparation of seven or eight monoclonal antibodies — one for each of the seven important serotypes and perhaps one for the toxin — should protect patients against most hospital infections.

Because administration of mouse antibodies to patients may create an undesirable immune response, the next