Dream machine: End of a fantasy?

"A dream is a wish your heart makes," Jiminy Cricket once sang. Ah, if it were only that simple. In its inevitable, myth-exploding fashion, scientific research has now rendered that romantic, musical idea not only out of date but ostensibly incorrect.

Sigmund Freud actually identified dreaming not as a wish, but as a reactive process to protect consciousness and sleep from the disruptive effect of unconscious wishes that are released in sleep. Freud hypothesized a built-in "censor" or "guardian" within each of us that disguised or transformed our devilish wishes into harmless dream imagery. According to a revolutionary new theory of dreaming, however, both Freud and Cricket may now be relegated to the "nice try" division of dream modeling history.

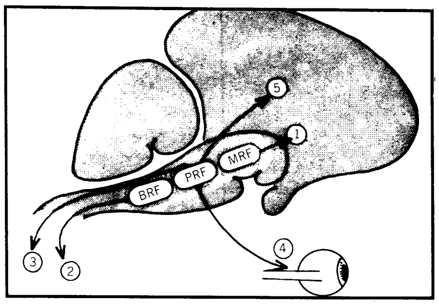
In the lead article in December's American Journal of Psychiatry, psychiatrists J. Alan Hobson and Robert W. McCarley, both of Harvard Medical School, detail their "neurobiological" theory of dreaming. While the model does not discount Freud's psychoanalytic proposals altogether, it ascribes to them only secondary importance to the brain's "preprogrammed" biological functions in dreaming.

Hobson and McCarley's complex hypothesis is based on a number of dream research results, but primarily on their own studies on the brain activity of cats during desynchronized (D) sleep — a phase characterized by erratic electrical impulses during which humans are known to dream. Though there is no assurance that cats dream in D sleep, the psychiatrists acknowledge, the very fact that the animal brains undergo human-like electrical patterns during sleep justifies the cat as "a reasonable subject for our study of the brain as a dream process generator."

In a series of experiments, the researchers recorded the activities of "individual neurons in many parts of the brain as the sleep cycle normally evolved.... The frequency and pattern of ... the signal units of nerve cells are taken as indices of the cells' excitability; the influence of a recorded neuron upon other cells and that neuron's own control mechanisms may also be inferred from the data." Those recordings, in conjunction with chemical and electrode stimulation of various brain areas, has yielded the "activation-synthesis" model of dreaming.

According to the model, the crucial "clock-trigger mechanism" lies in the pontine stem in the back portion of the brain. Generated there are various neuronal impulses, including those of oculomotor (visual) and reticular (sensory activation) nature. The sporadic (but automatic) outbursts of this generator periodically activate the forebrain (through the midbrain), which stores sensorimotor information in the memory. Overall, the mechanism accounts — *biologically* — for not only dreams, but possibly their "scene changes," "subplots," "symbols" and even "bizarreness" as well, the psychiatrists suggest. Finally, the pontine and other brain mechanisms work to block out motor and other input, allowing the dreamer to carry out the sleeping hallucination without interruption.

The model, in effect, discounts Freud's psychoanalytic notion of dreams in several ways. It identifies physiological, rather than psychological, components as the primary motivating force for dreaming; traces the origin of the dream process to sensorimotor systems, "with little or no primary ideational, volitional or emotional content"; identifies dreaming as a "synthetic, constructive" process, rather than a disguising or distorting one; and attributes forgetting of dreams to a neurologically-based "amnesia" state, instead of to repression.



J. A. Hobson and R. W. McCarley/AJP

Dream model: The reticular formations of the pontine (PRF), midbrain (MRF) and bulbar (BRF) brain regions orchestrate: 1. forebrain activation; 2. blockade of outside input and 3. motor input; 4. oculomotor activity; 5. provision of forebrain with neurologically generated information.

The researchers say their findings are "of profound significance ... we can now ... characterize and measure many aspects of the brain when it is in dream state." □

Tooth patterns and the human-ape split

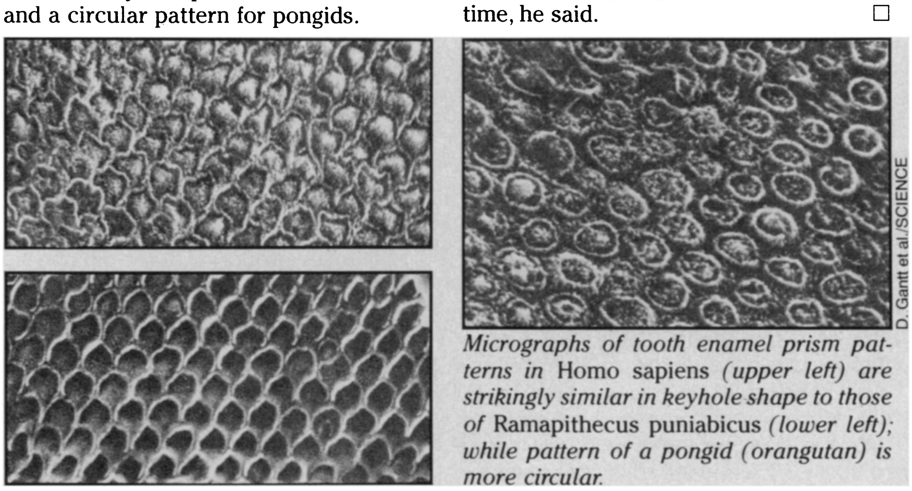
Teeth are frequently as important to archaeologists as they are to dentists. Often, teeth are not only the most abundant but the *only* fossil remains available to researchers. Much of the knowledge of "prehuman" hominoids, such as *Ramapithecus*, is currently based on dental remains.

However, morphological analyses of isolated tooth fossils "may not provide definitive answers regarding either adaptation or phylogeny," write David G. Gantt of Washington University in St. Louis, David Pilbeam of Yale and Gregory P. Steward of Southern Illinois University in the Dec. 16 Science. "Data obtained from these specimens have often led to a variety of conflicting interpretations."

The researchers report that through the use of a scanning electron microscope they have analyzed the enamel prism patterns in the teeth of *Homo sapiens, Ramapithecus* and pongids (apes). Clear differences are evident between the well-documented keyhole pattern in human teeth and a circular pattern for pongids.

But the most exciting finding is the clear similarity between the contemporary human tooth pattern and that of *Ramapithecus punjabicus,* the earliest known hominoid — both are of the distinctive keyhole pattern. Although the scientists warn against drawing premature conclusions about the similarity, Gantt told Science News that the finding represents "the first quantified evidence" that *Ramapithecus* is an ancestor to humans.

Gantt, now at Florida State University's Anthropology Department, said upcoming experiments will focus on identifying patterns in the teeth of *Dryopithecids* (ancestors of great apes) and *Sivapithecids* (another ancestor of *Homo sapiens*). If the *Dryopithecid* prism patterns are circular (and the *Sivapithecid* patterns keyhole-like), then the team's current findings will be corroborated, Gantt said. But if they are of a keyhole shape similar to that of a hominoid, that will be a strong indication that human-ape split occurred later in time, he said. □



D. Gantt et al/SCIENCE

Micrographs of tooth enamel prism patterns in Homo sapiens *(upper left) are strikingly similar in keyhole shape to those of* Ramapithecus puniabicus *(lower left); while pattern of a pongid (orangutan) is more circular.*