SCENT AND HUMAN BEHAVIOR: OLFACTION OR FICTION?

Evidence is mounting for chemical communication between people

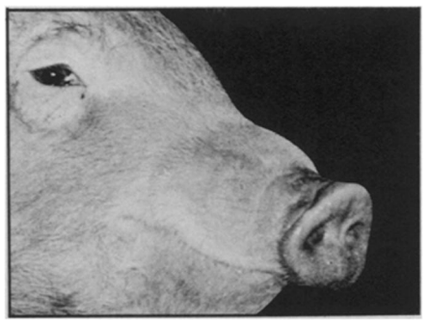
BY JANET L. HOPSON

It is logical to believe, on several levels, that human pheromones should some day be found. These chemical agents of silent communication have turned up regularly among other members of the animal kingdom: moth mating lures, ant alarm substances, mouse maternal signals, antelope dominance cues, wolf territorial markers, dog attractants. Humans share many genetic and morphological characteristics with other mammals. Why not chemical scent signals, too?

Aside from a few skeptics who raise essentially moralistic arguments ("Smells are bad. Why would the exalted *Homo sapiens* use them?"), most scientists are open to the possibility of human pheromones. But where does one begin to look for them, and in what form? Despite our physical similarities to the Class Mammalia, humans remain uniquely cognitive and verbal creatures. Is it more logical, therefore, to assume a case of matter over mind, and look for specific chemical cues, or to search for largely psychological effects — mind over matter? Both approaches have been investigated, but even after a decade of research, these questions remain unanswered. There are amongst the findings, however, tantalizing hints of future solutions.

The search for a specific, single human odor substance (or a related group of substances) analogous to an insect attractant evolved from research on rhesus monkeys. Psychiatrist Richard P. Michael and co-workers at the Georgia Mental Health Institute in Atlanta published a series of articles, beginning in 1970, on what they called "copulins" from rhesus females. Michael's group found small, straight-carbon-chain vaginal acids, such as acetic acid (vinegar) and close chemical relatives, that appeared to stimulate male sexual interest when daubed on the genitalia of spayed and otherwise sexually undesirable female monkeys. Michael then looked for — and found — the same "copulins" in some women's vaginal secretions.

Michael's group did not claim that the volatile chemicals act as human sexual excitants, but their work, domino-fashion, started a chain of other studies on behavioral effects of "copulins." Researchers looked for the acids during women's mid-cycle fertility. Others looked for them during sexual arousal and abstinence. Still others had married women rub the chemicals on their chests before bed, then record rates of sexual activity. And researchers for perfume companies even added the weak acids to their perfume formulations.



The result of every test, in the end, was ambiguous, and the excitement over "copulins" faded. This was particularly true after primatologist David Goldfoot and colleagues at the Wisconsin Regional Primate Research Center at Madison proved that "copulins" did not, in fact, act as attractants for the rhesus males in their colony. The behavior seen among Michael's primates, says Goldfoot, could be interpreted simply as "disinhibition response," i.e., that a sexually bored male monkey will respond to almost any novelty — but only for a short time. After that, it will return to being bored by the spayed female, with or without vaginal acids.

This entire chain of events leaves the subject of specific human sexual attractants up in the air, so to speak. But it does not by any means negate the possibility of finding behaviorally active odor signals in *Homo sapiens*. The most substantial discoveries thus far have simply involved activities other than sexual allurement.

Just one year after Michael's work on rhesus monkeys appeared in NATURE, that British journal published a Harvard University student's first scientific article. Martha McClintock, then an undergraduate psychology major, had studied the anecdotal phenomenon of synchronized menstrual cycles among women friends and roommates. She studied 135 residents of a women's dormitory in Boston, and found that the synchrony phenomenon was more than anecdotal. In October, the cycles of roommates and close pairs of friends started an average of 8.5 days apart. By March, their cycles started only five days apart — a statistically significant change. Randomly matched pairs of women showed no such change. McClintock also showed that the consumption of similar foods in the dining hall and similar light cycles (sun, moon and study lamps) had no effect. The only variable that seemed to affect the women was time spent together. But what passed between them?

An answer came several years later when, in 1977, Michael Russell of the Brain Behavior Research Institute at Sonoma State Hospital in Eldrige, Calif., reported a study he conducted at San Francisco State University (SN: 7/2/77, p. 5).

A colleague of his named Genevieve had noticed the menstrual synchrony effect in several personal situations — in each case, her own cycle "driving" or dominating others. For the experiment, Genevieve wore sterile cotton underarm pads to collect perspiration. Russell then recruited 16 women volunteers, each of whom came to the laboratory three times a week for four months to have a liquid substance applied to her upper lip. Half received applications of alcohol; the others, alcohol plus Genevieve's underarm secretions.

The cycles of the first group did not change. But those who received "essence of Genevieve" showed a startling change. After four months of the experiment, their cycle-starting dates had changed from an average of 9.3 days apart to only 3.4 days apart. In McClintock's study, the synchrony effect was due to time spent together. But Russell showed that the women need not even know each other. Olfactory stimulation from one woman's underarm secretions was contact enough.

The next step will be to isolate the specific substance or substances from perspiration that can affect behavior — and to determine the evolutionary significance of synchronized menstrual cycles. (Even before that work is completed, Russell's experiments have had the beneficial effect of steering the focus of research from the vagina to the axilla — a more likely source of scent signals in a vertical social organism.) A good starting place for that specific substance might be estrogen, the same feminizing hormone that works in mice to suppress and synchronize estrous cycles.

An interesting parallel study would be the effect of airborne *male* hormones on women's menstrual cycles. The male hormone odor from mouse urine can induce early sexual maturity in "teenage" females and can re-start an adult female's suppressed cycle. In her study, McClintock

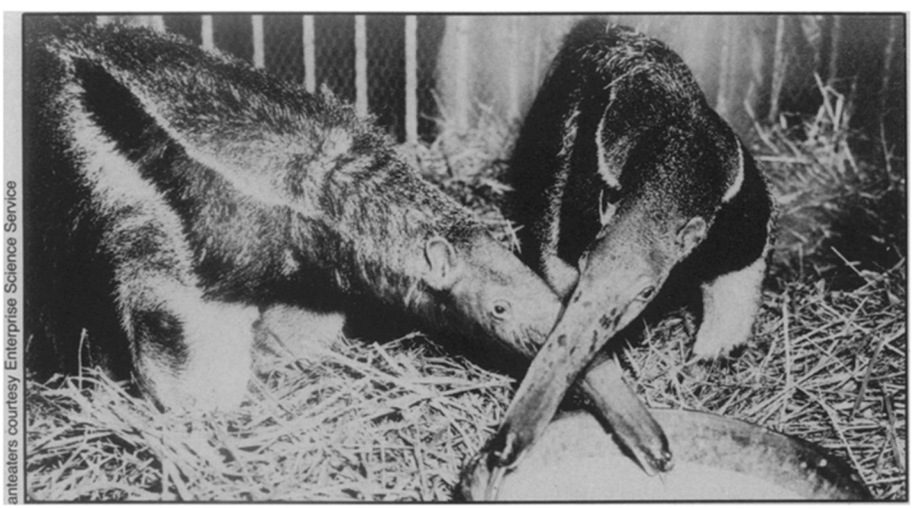
found that women who seldom dated men had significantly longer cycles than the others. Several of the women mentioned that they became more regular and had shorter cycles when they dated more often. And most provocative of all, several women chemists (who insist on anonymity) found that daily olfactory contact with natural and synthetic musk compounds during a series of experiments caused their cycles to shorten dramatically. Coincidentally, the volatile components of men's perspiration and urine are often characterized as "musky."

Among mice, the odor of one male's urine can also bring out aggression in other males. Researchers at Brooklyn College decided to analyze mouse urine for the specific pheromones that bring out that fighting spirit. But collecting male mouse urine is a tedious and unrewarding task. So they decided to use a readily available substitute — men's urine. Amazingly, when smeared on a male mouse, men's urine promoted aggression in other mice. An extract of men's urine containing only the volatile, odorous components worked as well as the odorous fraction of mouse urine. Women's, girls' and boys' urine, however, had no such effect. This lead remains merely suggestive, since no further studies have been completed on human male aggression and urinary hormones. But the possibilities for speculation are endless and the results of a carefully designed study are eagerly awaited.

A third category of human behavior hints at the possibility of chemical scent signals: mother-baby communication. Michael Russell in California and researchers at Oxford University in Great Britain tested the ability of human infants to recognize their mothers by odor alone. At six weeks of age, sleeping babies will orient their heads and make sucking motions toward their own mother's breast pad, but will ignore or cry at those of strange mothers, or pads moistened with cow's milk. At six *days* of age, awake and alert babies can make a similar discrimination, preferring their own mother's scent to that of a strange woman.

A recent experiment conducted with squirrel monkeys has yet to be attempted with human infants, but could have dramatic implications for the use of lotions, colognes and deodorants by new mothers. Psychologists William Redican and Joel N. Kaplan at the Stanford Research Institute at Menlo Park, Calif., found that the infants of mothers smeared with synthetic perfumes (rose- and clove-scented) grew up preferring those odors to natural monkey scent. That response in itself is not new, and has been seen among dogs, rats and deer. What *is* unusual is that those same infants had weaker social attachments to their mothers and, as adults, to other monkeys than did infants reared with natural squirrel monkey odors.

Obviously, considerable research remains before the field of candidates can be narrowed to a few specific human chemical signals. But there is, in the meantime, a separate but equally valid approach to the subject of silent communication — mind over matter. Since we are cognitive creatures, governed and motivated by learning, language, reasoning and social mores, why should we assume that all human scent communication will be directly physiological? Why expect the stereotyped mating reflexes of a housefly or a hamster? Why not, instead, look first for changes of attitude toward future behavior rather than the direct behavior itself?



anteaters courtesy Enterprise Science Service

Several interesting studies have focused on the interactions between olfaction and emotion. British psychology students at Hatfield Polytechnic in Hertfordshire were asked to assess the leadership traits of three men and three women candidates for student body secretary. J. J. Cowley and co-workers distributed paper surgical masks to the students, ostensibly to hide their facial expressions. In reality, the masks had been soaked with tiny quantities of vaginal acids or with "boar taint" — a hormone-like secretion from male pigs and from men's perspiration. The male students seemed unaffected by either of the subliminal odors. But the women wearing the female scent tended to approve more highly of candidates with shy, retiring personalities — and to dislike the assertive candidates — than did the control-group women. The women wearing the male-scented masks did the reverse! Somehow, the odors affected their feelings and judgments, but through a process that was entirely subliminal.

A second study proved the unique link between odor, emotion and memory. Trygg Engen at Brown University and Bruce Ross of Catholic University proved that the memory for odors is far different from the memory for sights and sounds. When asked to remember the visual details of pictures, most people could do so with nearly 100 percent accuracy over short periods of time. After three months, however, their ability dropped to about 50 percent — no better than guessing. Subjects asked to remember smells, on the other hand, displayed only about 80 percent accuracy over short periods. But, strangely enough, this accuracy level did not drop, even after a year's time.

Another peculiarity: While these remembrances are long lived, they are distinctly nonverbal. A perfume or even a food aroma may smell familiar, but naming it is a different matter. Those subjects who can correctly pick out an odor that was shown to them months before will frequently fail to remember its *name*. There seems, says one researcher, to be an "inexplicable mental gap" separating an odor from its correct name — a gap not found to such a high degree with vision or hearing. This implies that the odor recognition takes place at a preverbal level — a primitive, noncognitive level that is more automatic, perhaps more closely tied to visceral mechanisms than the "cerebral" senses of vision and hearing.

The notion of primitive, pre-verbal brain processing reminds one that the modern limbic system, step-child of the ancient rhinencephalon or "smell brain," is largely responsible for generating fear, rage, aggression, pleasure and for regulating sex drives and reproductive cycles, both in humans and other animals. Nerves that travel to the brain's gray matter from the olfactory receptors high in the nose detour first through the limbic system, stimulating it — and its centers of emotion and sexuality — each time a smell is received.

No one, yet, has traced the ties between emotions, memory and odor to specific pinpoint areas of the human brain. But work in mice suggests that some day those tie-lines will be found.

And it takes no great stretch of the imagination to foresee a time when this odor-emotion research will intersect with the search for specific human scent signals. And when those two lines of inquiry cross, we will understand precisely how organic scent signals affect human behavior and emotions — mind over matter, matter over mind, or both at once. □