SCIENCE NEWS of the week

Mating Signal Mediates Strong Bonds in Microbes

People have schemed for centuries about ways to attract and hold onto members of the opposite sex. But a gut bacterium, *Streptococcus faecalis,* makes use of a system for snaring sex partners that outperforms anything human beings have ever devised. *S. faecalis* excretes a variety of sex pheromones — chemical signals — that induce other members of this species to launch into an energetic "mating response" in which the bacteria literally glue themselves to each other.

Since Don B. Clewell of the University of Michigan in Ann Arbor and colleagues first reported finding pheromones in *S. faecalis* in 1978, they have identified five different types of pheromones, all small proteins, or peptides. Clewell suspects these bacteria may make as many as a dozen. They have also just found that some disease-causing strains of staphylococcus bacteria secrete one of the pheromones, but for reasons apparently unrelated to sex. This peptide may play a role in the staph bacteria's virulence, Clewell believes.

Although bacterial conjugation, or mating, has been studied for decades, *S. faecalis* offers "the only substantive case where pheromones have been shown to be related to conjugation and plasmid (DNA) transfer," says Clewell. Reports that another gut bacterium, *Escherichia coli,* makes a sex attractant are "unconfirmed," he says. He presented his findings at a symposium this week at the Marine Biological Laboratory in Woods Hole, Mass.

When bacteria conjugate, the "male" cell or donor produces an appendage called the "sex pilus," which appears to connect with the "female's" membrane and is thought to act either as a grappling hook or a conduit through which plasmids, small DNA rings, transfer genes.

When *S. faecalis* bacteria, harboring certain plasmids, sense these chemicals, they respond by synthesizing a sticky protein coating. When these sticky primed bacteria collide at random with those making the pheromone (called, not surprisingly, the clumping-inducing-agent) they adhere to and mate with each other and the sticky "induced" bacteria pass copies of their plasmids to those making the pheromone mating signal. (Clewell showed a slide of *S. faecalis* "engaged in a massive orgy" incited by the pheromones.) The recipient becomes a donor now able to respond to other pheromones and also donate copies of its plasmids.

Each of the five known pheromones induced the mating response only in bacteria harboring the plasmid that corresponds to that particular signal. Thus pheromone A causes the response in bacteria carrying plasmid a; pheromone B induces those carrying b; and so on. *S. faecalis* will keep secreting appropriate pheromones until it has collected all corresponding plasmids.

Clewell's group has recently found that one of the pheromones *S. faecalis* makes is also excreted by 23 strains of *Staphylococcus aureus,* which causes disease in people. Curiously, the staph strains that do not cause sickness generally don't secrete the pheromone (the pheromone doesn't cause *S. faecalis* to transfer plasmids into *S. aureus,* however). This discovery suggests that these peptides might "contribute to pathogenicity in *S. aureus*," Clewell speculates.

To study the relationship to more complex bacterial genes, Clewell and his colleagues are trying to isolate and sequence the genes coding these pheromones.

—G. Morse

Depression: Genetic clue is skin deep

Scientists have uncovered preliminary evidence that a genetically transmitted sensitivity to acetylcholine, a chemical messenger in the brain, may predispose some people to manic-depression or other serious mood disorders. The finding suggests that offspring of parents with a history of depression may one day be tested for a susceptibility to the disorder, but some investigators caution that the abnormality cannot yet be considered a genetic "marker." Its immediate importance is as a vehicle for further research.

In a small sample of psychiatric patients and their relatives who suffer from severe depression, the researchers identified an elevated density of acetylcholine-binding sites. These sites may contribute to a biological vulnerability, report psychiatrists N. Suzan Nadi, John I. Nurnberger Jr. and Elliot S. Gershon in the July 26 NEW ENGLAND JOURNAL OF MEDICINE.

About 4 million people in the United States suffer from manic-depression, in which depressions are interspersed with periods of elevated or irritable mood. Severe depression, alternating with normal or near-normal periods, occurs among approximately 8 million people.

Nadi and colleagues, all of the National Institute of Mental Health (NIMH), studied 17 patients with manic-depression, one patient with severe depression and 18 of their relatives with various mental disorders. The scientists then took skin samples from each and grew several generations of skin cells in laboratory cultures to eliminate the effects of drugs or hormones on receptor density. Levels of the acetylcholine receptors were significantly elevated compared with those of five symptom-free relatives and 18 normal volunteers.

But not every manic-depressive followed this pattern. One manic-depressive mother in the study had a low receptor sensitivity, as did her manic-depressive son. This indicates that the acetylcholine system affects only a portion of families with these disorders, says Gershon.

It has been known for some time that acetylcholine has a role in depression and mania, says psychiatrist Solomon H. Snyder of Johns Hopkins University in Baltimore. In an editorial in the same journal, he points out, for example, that several antidepressant drugs block acetylcholine receptors.

But this is the first "direct biochemical demonstration" of abnormalities in receptor density among depressed patients and their relatives, says Snyder. This does not mean, he adds, "that the cause of mania and depression has been uncovered." The number of subjects in the study is not large enough. He also notes that the genetic factors that regulate acetylcholine receptors in the skin may not regulate the brain receptors.

The NIMH researchers should know within "a very few years" if the skin test predicts who will develop manic-depression, says Gershon. They are now following 25 offspring of manic-depressives and 25 of normal parents to see which ones develop psychiatric illness after exhibiting receptor sensitivity.

The new results are encouraging, says psychiatrist Herbert Y. Meltzer of the University of Chicago, "but a lot of work still needs to be done" to determine the percentage of manic-depressive and normal subjects who respond positively to the skin test. He adds that the test should be given to people with other psychiatric illnesses since "biological abnormalities tend to overlap among several psychiatric disorders." Snyder and depression researcher David J. Kupfer of the University of Pittsburgh, agree.

"It's conceivable that the test's diagnostic specificity will blur with more research," Gershon told SCIENCE NEWS. He is more concerned, however, that further studies show a shared acetylcholine receptor sensitivity between manic-depressive parents and their children who develop the disorder. *—B. Bower*