SCIENCE & TECHNOLOGY

Why Sex Makes Sense

"What's Love Got To Do With It?" by Richard E. Michod, in *The Sciences* (May–June 1989), 2 E. 63rd St. New York, N.Y. 10131-0191.

To scientists, it has never been very obvious why so many species, from yeasts to humans, engage in sexual reproduction.

After all, it consumes a great deal of time and energy. It isn't any fun for most species (such as the yeasts). And it is downright dangerous for the males in certain species. Sporting flashy coloration may melt female hearts, but it also attracts predators.

The textbook answer to the riddle, writes Michod, a biologist at the University of Arizona, is that sexual union creates genetic variation, which enhances a species' ability to adapt to its environment. But the problem is that sex washes out variations as easily as it creates them. Chances are that, say, a bird born with feathers that provide better camouflage than is typical of its species will produce offspring with standard-issue coloring. Anyway, asexual species (including bacteria, sponges, and some lizards) seem to be just as adaptable in the short term as sexual ones.

Only recently, says Michod, has it become clear that sexual reproduction offers unique advantages in the "repair and maintenance" of genes.

All living cells contain pairs of chromosomes, one from each of the organism's parents. Each chromosome in turn contains many genes, which govern individual traits. And the genes are constantly undergoing damage and repair.

Organisms that reproduce sexually have a special advantage in this process. The cells that create eggs or sperm undergo a process called meiosis. Each cell's chromosomes line up and exchange genes, then divide. The result: two egg (or sperm) cells, each with only one set of chromosomes. When egg and sperm are united, a full complement of chromosomes is again created.

Until 1983, scientists believed that the exchange during meiosis occurred to ensure that each egg or sperm cell contained a unique mixture of genes—a prescription for genetic variation. But in 1983, it was discovered that meiosis allows for repairs to damaged genes—an advantage not enjoyed by organisms that reproduce asexually. Moreover, mating ensures a fresh sup-

The War Against AIDS

Even a medical miracle would not eliminate Acquired Immune Deficiency Syndrome (AIDS), warns MIT's Kenneth Keniston. In the second of two special issues of *Daedalus* (Summer 1989) devoted to AIDS, he observes that our rhetoric about the disease hinders efforts to cope with it:

The metaphor most used to understand AIDS is that of war. We speak of our battle with AIDS and vow to fight it. A war, as author Susan Sontag notes, involves an enemy, soldiers on both sides, weapons, a struggle to win. As she does not note, it also suggests an outcome: the idea that the war will end in victory or defeat. Thus, the war metaphor, with its unstated hope that there will be a victory for our side, also prepares us poorly for the long-term consequences of AIDS. Wars eventually end. They do not get steadily worse or continue indefinitely. They are followed by a time of peace. We do not view them as something we must live with forever. But as I have suggested, this is unlikely to be the case with AIDS.

If in most of us, optimists, the war metaphor promotes fantasies of complete victory, in pessimists it encourages the equally problematic image of unconditional defeat. . . . This dark view, too, fails the test of plausibility: it assumes that no intervention or combination of interventions—medical, behavioral, social—will make a difference . . . . By predicting total and inevitable defeat, it disarms us for the efforts necessary in the long run.

ply of chromosomes in each new organism, so that mutant genes that survive in one parent are often suppressed by dominant genes from the other. Asexual organisms, by contrast, perform a kind of incest.

That is why sex and all that goes with it makes sense to scientists, if not to others.

Chaos

"Chaos Theory: How Big an Advance?" by Robert Pool, in *Science* (July 7, 1989), 1333 H St. N.W., Washington, D.C. 20005.

Chaos has crept into science. A century after "chaos theory" was first hinted at by the French mathematician Henri Poincaré (1854–1912), scientists are debating whether it heralds a revolution even more fundamental than quantum mechanics and Einstein's theory of relativity, or whether it is merely a small step forward for science.

Chaos theory is hard to explain, notes Pool, a *Science* staff writer. It suggests that systems described by mathematical equations—the motion of heavenly bodies, for example—sometimes "act in such a complicated way you cannot predict exactly what they will do in the future. The best you can do is make probabilistic statements about them."

Like quantum mechanics, chaos theory has no single author. Many scientists have developed and applied it in different fields. MIT astronomer Jack Wisdom, for example, has shown that Pluto's orbit around the sun is chaotic. The research of Ary Goldberger, a Harvard cardiologist, suggests that healthy human hearts have chaotic fluctuations in their pattern of beating; ailing hearts have more regular beats.

Nearly 30 years ago, MIT's Edward Lorenz sparked the "chaos revolt" among scientists when he demonstrated the existence of chaotic behavior in atmospheric air flows. As a result, meteorologists accept the idea that weather forecasts more than a couple of weeks into the future are now impossible. But some insist that chaos theory will eventually help them overcome that limit.

Such arguments are the nub of the debate over chaos theory. Is it chiefly a new tool that will help penetrate the mysteries of the universe? Or does it show that some questions never will be answered, that we will have to drop our 200-year-old vision of a clock-like Newtonian universe? An answer may be decades away.

The Green Hour

"Absinthe" by Wilfred Niels Arnold, in *Scientific American* (June 1989), 415 Madison Ave., New York, N.Y. 10017.

Artists and writers in every age seem to discover a new chemical shortcut to the Muse—marijuana, LSD, cocaine, and, perennially, alcohol. In 19th-century France, the drug of choice was absinthe.

Absinthe owed its popularity to French soldiers who fought in the Algerian wars of the 1840s. While in North Africa, they began to add extracts of the wormwood herb (*Artemisia absinthium*) to their wine, believing that it warded off fevers. It didn't, although according to Arnold, a biochemist at the University of Kansas Medical Center, wormwood did have a few medical uses, such as the treatment of roundworms, detailed by the ancient Egyptians, Greeks, and others.

In France, the veterans' newly acquired taste for the bitter herb (one ounce diluted in 524 gallons of water can still be tasted) was satisfied by absinthe. The pale green liqueur "was said to evoke new views, different experiences and unique feelings." One of wormwood's ingredients is thujone, a chemical that can cause intoxication and hallucinations—as well as convulsions and permanent damage to the nervous system. (Thujone was later used in research into convulsive therapy for schizophrenics.) By the 1850s, the French