Animal Genes Transplanted to Bacteria

Genes (DNA) from related bacteria can be joined together in one molecule and then put in a bacterium to express themselves there, Stanley N. Cohen and Annie C. Y. Chang of Stanford University School of Medicine and Herbert W. Boyer and Robert B. Helling of the University of California at San Francisco reported last November in the PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES. Then in April Cohen and Chang reported in the PROCEEDINGS that genes from unrelated bacteria can be combined in one molecule and put in a bacterium to express themselves.

Now in the May PROCEEDINGS six scientists, including the four previously mentioned, report that genes from animals can be combined with genes from bacteria and be put in a bacterium so that the animal genes can replicate in the bacterium. John F. Murrow of Johns Hopkins Medical School is the lead author of the group, which also includes Howard M. Goodman of the University of California at San Francisco.

These accomplishments should further biological research at the most basic level by giving better insight into gene action and expression and what turns genes on and off. The accomplishments also have practical medical and agricultural potential.

A technique largely worked out by Cohen and Boyer made these accomplishments possible. The technique consists of constructing DNA "chimeras" —molecules that consist of genes from different sources. (Chimeras, according to Greek mythology, are monsters composed of incongruous parts.) Either foreign bacteria genes are united with genes from a particular bacterium (so-called "plasmid" genes); or animal genes are united with the plasmid genes. A chimera is then introduced into the bacterium by a process called "transformation." The chimera replicates in the bacterium independently of the DNA already in the bacterium. This means that all the genes in the chimera replicate themselves—both those that are native to the bacterium and those that are foreign to it, whether they be bacteria or animal genes. The chimera genes are also passed on to the bacterium's offspring; this way carbon copies of the chimera genes can be made.

Joshua Lederberg, Stanford's Nobel laureate geneticist, calls the technique "a major tool of genetic analysis. It does at the molecular level," he says, "what cell fusion does at the cellular level, and what cross-breeding does at the level of the entire organism."

As far as the technique's practical potential, it may help the pharmaceutical industry make biological substances such as antibiotics more efficiently and hence more economically. Cohen and his associates are working on transplanting the genes responsible for making the antibiotic streptomycin from the streptomycete soil bacteria that now produces it. Cohen notes that bacteria transformed with chimeras are much easier to cultivate than streptomycetes.

Major food grains lack nitrogen-fixing bacteria and thus consume large amounts of nitrogen fertilizer. But fertilizer is made from petroleum, which is skyrocketing in price and hence aggravating already inflated food prices. The chimera transplantation technique may help counter this problem by reducing the need for nitrogen fertilizer. Cohen anticipates that it may be possible to take genes from nitrogen-fixing microbes that allow microbes to fix nitrogen. These genes could then be transferred to those bacteria that live next to the roots of corn and wheat. The bacteria would then, presumably, be able to fix nitrogen, and the corn and wheat would not require nitrogen fertilizer.

Some day the technique may be used to correct genetic defects. "But before that achievement is possible," Cohen stresses, "biologists must develop better methods to isolate desired genes from mammalian cells and to solve other major technical problems as well as to resolve important ethical considerations." □

False research: The Summerlin scandal

One July afternoon last year, an unassuming, pleasant young scientist addressed the staff of Georgetown University Medical School about his efforts to get grafted skin and transplanted organs to be accepted by recipients. Physicians in the audience listened attentively, (SN: 7/7/73, p. 4). It looked as if the scientist might have the key—first culture skin or organ tissue so that it will not be rejected by a recipient. If the technique turned out to be successful, it would have profound implications not only for grafts and transplants but also for cancer control, which is being recognized more and more as an immune problem.

The scientist was William T. Summerlin, chief of transplant immunology at the Memorial Sloan-Kettering Cancer Center in New York City—one of the most respected and best-funded cancer centers in the world. A scientific investigating committee at Sloan-Kettering has now charged Summerlin with deliberately falsifying and misrepresenting his research results and has recommended that his affiliation with Sloan-Kettering be terminated.

The Summerlin scandal—some scientists are calling it a medical Watergate —is undoubtedly one of the largest in 20th-century medical science. The scandal calls into question not only Summerlin's integrity but the reasons why he did what he did. Are scientists under so much pressure to produce in these days of tight research funds and keen competition that they feel they have to resort to trickery? Summerlin claims that this was the case. Summerlin's boss and long-time backer is Robert Good, president of Sloan-Kettering and an internationally known immunologist. Good is also known to be ambitious, publicity-minded and a whip cracker.

A skin graft or patch of white paint?

The scandal broke on March 27. James Martin, an assistant in Summerlin's lab, discovered that some of the black patches on white mice looked as if they had been painted on instead of being bona fide skin grafts from black mice. The grafted skin, of course, was supposed to have been cultured beforehand according to Summerlin's technique and hence to have taken in the white mice with no rejection problem. The assistant found that the patches would wash off with alcohol and reported his finding to other scientists in the lab. They told Good, who relieved Summerlin temporarily of his duties and had a committee at Sloan-Kettering look into the charge.

The Committee now reports that Summerlin falsified not only those results, but some others as well—that he successfully transplanted corneas from one species to another after culturing them. Summerlin admits that he did color the skin of two mice with a pen to convince Good it was possible to transplant tissue to genetically unrelated animals without rejection. But he says that he did the coloring in a state of accute depression resulting from an overwhelming work load, the belief that Good had lost faith in his research and the impersonal, cloistered atmosphere of Sloan-Kettering. However, he denies that he misrepresented the cornea results. He says he honestly believed that the transplants had been successful.

In its May 24 report, the committee also chastises Good, who brought Summerlin with him to Sloan-Kettering 18 months ago from the University of Minnesota. Good is also coauthor on a number of Summerlin's scientific reports. The committee feels "that Dr. Good shares some of the responsibility for what many see as undue publicity surrounding Dr. Summerlin's claims, unsupported as they were by adequate authenticating data. Dr. Good was slow to respond to a suggestion of dishonesty against Dr. Summerlin at a time when several investigators were experiencing great difficulties in repeating Dr. Summerlin's experiments."

To which Good replies, "I trusted him. He came as a respected scientist."

Although the committee recommended that Summerlin be fired because some of his actions "over a considerable period of time were not those of a responsible scientist," Summerlin has been placed on medical leave from Sloan-Kettering for treatment of "an emotional disturbance." His $40,000 salary will continue. Summerlin said this week he feels much better now that he is under the care of a psychiatrist and hopes to return to medicine and science. He said he still has faith that first culturing tissue or organs may be the answer to graft and transplant rejections. □

Quest to the birthplace of earth's crust

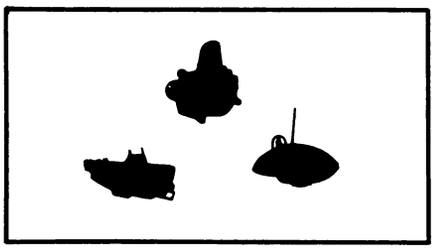
Only the conning tower shows as Alvin approaches its mother ship after a dive.

Of all the trailblazers who have hewn new paths to the remote reaches of the globe, few if any have been to so isolated a spot as that visited by the members of Project FAMOUS, who last summer became the first human beings to descend to the Mid-Atlantic Ridge, one of the sites of the world's continual rebirth. This summer they are going back.

Two miles below the surface of the Atlantic lies a great fracture, a huge rift running north and south almost from pole to pole and bounded on either side by towering undersea mountains. It is there, along the rift, and others like it, that the earth constantly reasserts its life force, pushing apart the vast plates of the ocean floor to make room for new material being thrust upward from beneath the crust. In a continuing cycle of birth and death, aged crustal material is continually sliding away to submerge beneath the outer edges of the plates, driven by the youthful onslaught welling up along fissures like the Mid-Atlantic Rift.

Last summer, after two years of preparation and mapping, the French bathyscaphe Archimède carried French and American scientists on the first seven dives to the rift (SN: 9/22/73, p. 181), only one more than the number of man's visits to the moon. From a location about 220 miles southwest of the Azores, Archimède dove down some 9,000 feet, taking photos, gathering samples and learning the ropes for the heavy assault to come.

This is the year of the assault. Besides Archimède, an unwieldy but deep-diving craft, two more submersibles will join the foray. Jacques Cousteau's SP 3000, now known as Cyana, will use its greater maneuverability to explore and sample one of many transverse faults that run crossways to the rift valley. The hot rod of the trio is Alvin, from the Woods Hole Oceanographic Institution. Alvin has been fitted with a new titanium hull that doubled its working depth to 12,000 feet. The heavily instrumented research submarine will explore both areas as well as the steep walls bordering the main rift valley. Rock, mineral and water samples will be collected using a variety of hammers, drills, claws and



Alvin (top), Archimède (left), Cyana.

Photos: NOAA

First dives to the rift saw "pillow lava."