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.

Summerlin

A skin graft or patch of white paint?