Gene-splice license: Buy early and save

License to "cleave, splice, insert, grow and express" DNA is now being offered by Stanford University. While use of recombinant DNA techniques in noncommercial basic research does not require a license, the approximately 200 U. S. firms employing the methods with commercial intent have been invited to apply for licenses for the gene-splice processes patented by Stanley N. Cohen of Stanford and Herbert W. Boyer of the University of California at San Francisco (SN: 12/13/80, p. 372). Stanford will charge a firm $10,000 to sign up for the nonexclusive license plus an annual fee of $10,000. Stanford will also collect royalties of 0.5 to 1 percent of net sales of products resulting from the technique. With a strategy on par with airline bonus coupons, Stanford is offering an incentive to companies to become licensed this year, rather than waiting until they have a salable product. Those that sign up before Dec. 15, 1981, may deduct from future royalties five times the basic fees paid. (For example, a company taking three years to develop a product could apply $200,000 against its first $400,000 in royalties.) Companies receiving the license must express intent to follow the recombinant DNA safety guidelines devised by the National Institutes of Health. The licensing money collected by Stanford, conservatively predicted at an annual figure of several hundred thousand dollars in the first few years and $1 million by 1986, will cover the costs of administering the license and then will be divided between Stanford and UCal.

"What we're offering people is essentially the basic tool needed in genetic engineering," says Niels Reimers of Stanford's Office of Technology Licensing. "Because the license is nonexclusive, we're not giving anyone a competitive advantage." Stanford president Donald Kennedy says the licensing terms were designed to "assist the process of technology transfer by making sure lots of players get into the game." He says, "Funds generated through this licensing program will help replenish the basic research enterprise." In the announcement of the license terms, the universities "gratefully acknowledge" public financial support to the fundamental research programs that gave rise to the Cohen and Boyer techniques. That support came from the National Science Foundation, NIH and the American Cancer Society. □

Studies lower reactor-rupture estimates

New experimental results "show the probability of a steam explosion breaching a [nuclear] powerplant's containment may be 10 to 100 times less than estimated in earlier reactor-safety studies," says Marshall Berman, supervisor of Sandia National Laboratories' Reactor Safety Studies division. More important, if true these data would lower substantially the probability of radioactive materials entering the atmosphere as a result of a nuclear-plant steam explosion.

Steam explosions present the greatest rupture threat to a nuclear-reactor's protective containment vessel. Although such accidents are considered unlikely, they could occur when water violently and rapidly vaporizes, such as during episodes that involve a loss of core-cooling water. In such situations, the temperature of a reactor's fuel could climb from 550°F, the normal operating temperature, to roughly 5,000°F. At such high temperatures, the fuel would lose strength, melt and begin dripping molten debris into any remaining cooling water. An explosive vaporization of that water could ensue, creating pressures that might conceivably rupture the reactor's reinforced containment vessel. The nightmarish result could be a wholesale venting of radioactive-gas clouds directly into the environment.

In Sandia tests, metals and metal oxides — to simulate reactor-core materials — were melted and then dropped into instrumented water chambers. High-speed motion-picture cameras, together with pressure and temperature sensors, recorded the details.

In one test involving an 11-lb. melt and a vessel pressurized to 150 lbs. per square inch, the drop failed to initiate an explosion. With help from the detonation of a small explosive, the experiment was completed. That test suggests, Sandia researchers now say, that high pressures inside a reactor vessel may suppress explosions from the contact of molten debris with water. An explosion can still be triggered, however, by external stimuli — such as shock waves caused by the impact of falling debris. Smaller-scale tests, involving only a few grams of "fuel" or less, recorded explosions of single droplets. They indicate that the type of melted material and magnitude of external "triggers" determine both the likelihood and yield of explosions.

These tests have been used to extrapolate what type of pressures can be expected in actual reactor accidents and the threat missiles — such as reactor control-drive assemblies — might pose. Experimentation will now turn toward use of materials more closely simulating melts expected in real reactor cores. While directly applicable to accident predictions for water-cooled reactors, these tests would also be applicable toward conditions present in steel mills and other molten-metal operations — though not in liquid-metal breeder reactors. □

Undergrads devise gene-hormone theory

The PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES for the first time is about to publish a paper written solely by college undergraduates. It is the first written report of two Harvard students' model of how hormones (and also carcinogens) turn on a cell's genes.

Richard Ebright and James Wong both graduated from Harvard College last June and plan to continue research at Harvard Medical School. As roommates, they devised their hormone action model in an all-night session their junior year and have since been doing experiments that add support.

The model offers an explanation of how hormones in animals (and the messenger molecule cyclic AMP in bacteria) interact with DNA. Ebright and Wong propose that the cell's receptor molecules hold the messenger in such a position that the exposed segment resembles adenine, one of the components of DNA. The receptor carries the hormone or cyclic AMP to the appropriate place in the genetic material. There, the adenine group displaces a DNA adenine and thus disrupts the tight bonding of the two strands of DNA. The resulting exposure of unpaired components initiates expression of the gene.

In the case of a carcinogen, Ebright and Wong hypothesize that a hormone receptor binds the insidious chemical instead of the hormone. The receptor carries the carcinogen to the specific point in DNA where it can affect cell growth and replication. Unlike hormones, which stay bound to DNA for a limited period, the carcinogen forms an irreversible bond and so permanently alters the gene.

As support for their model, Ebright and Wong offer data collected in the Harvard laboratory of Lan Bo Chen. They report that cyclic AMP and its analogs bind to bacterial receptors with only one end. The other end, the adenine, inserts into the DNA. In further experiments, Ebright and Wong showed that steroid hormones can bind to the same bacterial receptors and have the same action as cyclic AMP. Experiments with carcinogens indicate that a derivative of the potent benzpyrene binds well to receptors for estrogen. The idea of a receptor carrying a carcinogen is an appealing explanation of how cancer-causing chemicals manage to locate and affect the few genes in a cell that control growth.

Ebright and Wong have been praised for their originality by Carroll M. Williams, the Harvard professor who first advised them, and Salvador Luria of the Massachusetts Institute of Technology. They have been criticized, however, for their approach by James D. Watson, some say ironically, for beginning with an idea and following with the experiments. □