researchers' rights in the cells and other materials which at present are exchanged under the protection only of mutual trust and gentleman's agreements, forces apparently too fragile to withstand the stresses of commercialization. There is the issue of whether Roche, in taking only genetic information from the KG-1 cells, was infringing upon even theoretically patentable material. Computer programs cannot be patented, nor can scientific theories: Is genetic information some different category? Another conceivable issue, also apparently novel, is that of a patient's rights in his own genes.

That the KG-1 case has surfaced at all is a tribute to the ingenuity of researchers and entrepreneurs in putting the new biotechnology so rapidly into practice. Yet the powerful forces of the profit motive clearly have the capacity to strain and rupture the informal traditions of scientific exchange.—NICHOLAS WADE

UCSD Gene Splicing Incident Ends Unresolved

After an episode commingling the trivial and the tragic, researcher quits post

The gene splicing incident at the University of California, San Diego, which began as a matter of a trivial infraction of the NIH rules, has ended in what researcher Ian Kennedy calls "irreconcilable differences" between himself and the university's biosafety committee. Kennedy, in whose laboratory the infraction occurred, resigned from the university on 12 September.

His decision followed the submission on 28 August of a report to the NIH from the chairman of the university's biosafety committee, Gordon Gill. The report makes plain that Kennedy and the committee could not agree on the sequence of events that led up to the infraction, a virus cloning experiment which, though now permitted, was barred by the then prevailing NIH rules.

By both Kennedy's version and the committee's, the infraction was of a somewhat trivial nature and, since the experiment is now permitted, clearly raised no issue of public health. It is overshadowed by the situation surrounding the differences between Kennedy and the committee, a situation which caused anguish to his colleagues and has now led to the resignation of an able researcher.

The episode began earlier this year when students in Kennedy's laboratory told the chairman of the biology department of their concern that Kennedy had cloned part of the genetic material of the then prohibited Semliki forest virus instead of the Sindbis virus that was planned for the experiment. A sample of the presumed Sindbis virus was sent for testing to the California State Department of Health, which reported that it contained *Semliki* forest virus.

Kennedy attributed the result to an accident that occurred when shipping the viruses to San Diego from the University of Warwick, England, where he used to work: Semliki forest virus must have contaminated a vial of Sindbis virus and overgrown it in culture, he suggested. The biosafety committee concluded that, for whatever reason, the wrong virus had been cloned. Kennedy's permission to clone was rescinded, and the committee so informed the NIH in a preliminary report of 31 July.

A four-person subcommittee appointed to make a further study has now examined Kennedy's laboratory records and talked with his technicians and former students. Some troubling differences have emerged between Kennedy's account of what was done and when, and the version arrived at by the subcommittee.

In brief, Kennedy's position, as described in the committee's latest report, is that he cloned what he assumed to be Sindbis virus during a period from December 1979 to January 1980. DNA prepared from these clones was used in January to perform an important experiment, the infection of mouse cells to produce entities that protect the cell from further attack. Kennedy described the experiment at a seminar but has not yet published it. From January onward, Kennedy states, he worked on developing cloning methods for Semliki forest virus—in anticipation of the experiment becoming legal—up to but not beyond the point of cloning it. Cloning experiments by his technician in March and April were undertaken with the presumed Sindbis material to instruct her in cloning techniques.

The biosafety committee's version, in essence, is that from June 1979, Kennedy began a logical, clear-cut sequence of experiments directed toward the cloning of Semliki forest virus, and that the cloning of that virus occurred in March and April of this year. The committee does not believe that there is conclusive evidence of any earlier cloning of either virus.

A comparison of the two accounts would suggest that the infraction of the NIH rules was only one among several questions confronting the biosafety committee. For one thing, the committee's own reconstruction of events was in severe conflict with Kennedy's account. For another, the January mouse cell experiment depended on the existence of cloned material.

Kennedy, having read the committee's report, still stands on his version of events. In an hour-long conversation, he offered a firm, articulate, and plausible defense of his position. He believes that through procedural defects the four conducting the inquiry misinterpreted the evidence in his notebooks and failed to allow him sufficient time to explain his position, in part because of pressure from the NIH to submit a report quickly. The inquiry was opened with very little notice, he says, and he got off on the wrong foot by a dispute as to the date at which the P3 lab was supposed to start keeping records. From that point on, in Kennedy's view, it was hard for him to recover ground in explaining the complicated chronology and sometimes personal shorthand of his notebooks. Not being allowed to be present when his technician and others were questioned, he was unable to correct several simple misunderstandings created in the committee's minds.

Members of the subcommittee decline in general to comment on the situation, though one member states that Kennedy was given ample time to present his case and that there was no pressure from the NIH.

The task of deciding between Ken-

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nedy's version of events and the committee's may be unnecessary now that Kennedy has resigned, although a departmental committee charged with looking into the other matters raised by the episode plans to complete its report. In the absence of conclusive proof, the benefit of the doubt should presumably go to Kennedy; the biosafety committee seems to signal such a resolution, while standing on its own version of the facts, by saying in the conclusion of its report that Kennedy may have cloned Semliki forest virus either with knowledge or "due to poor record keeping or lapse of memory . . . by mistake without prior identification." But the committee goes on to note that Kennedy should not be allowed to resume cloning experiments because of the "absence of . . . mutual trust," a verdict that did not allow him much room for maneuver.

Having resigned earlier from the biosafety committee, of which he was a member, Kennedy has now resigned from the university. "My reason for resigning was in no way prompted by any feelings of guilt, and I have maintained from the outset of this matter that I am innocent of any wrong doing," Kennedy declares. But since there is no prospect, he maintains, of the university's biosafety committee allowing him in the near future to resume cloning, a procedure essential to his work, it seemed better to continue his work elsewhere. According to committee chairman Gill, however, the committee made plain that it would consider future cloning requests.

Kennedy is now preparing a report of his own at the request of the NIH. He is confident that the NIH's study will vindicate his position. His colleagues, even if they in his view misunderstood his actions, in any event paid tribute to his skills as an experimentalist. He plans to go to Europe for a scientific conference and then to look for another job.

If the incident at UCSD had been a simple matter of Kennedy having anticipated the change in the NIH rules by a few months, whether through accident or an excess of enthusiasm, he could have been rapped on the knuckles and everyone would have heaved a sigh of relief and gotten back to work. Unfortunately, the case was evidently much more complicated because Kennedy turned out to be a man with a special problem, the problem being that of a situation in which, for whatever reasons, he came in this matter to lose the trust of his colleagues.

Did such a situation merit special allowances? Within the constraints of its responsibilities to the NIH, did the biosafety committee go as far as possible in recognizing the particular nature of the situation it had to deal with? The biosafety committee may have felt it had little option but to render a cold rendition of the facts, and to let all other matters be addressed by the departmental committee. But after its declaration of a lack of mutual trust, Kennedy's resignation was presumably not a matter of surprise. Only the committee knows how hard it may have tried to find more gradual solutions to the issue it perceived, and maybe there were none.

—NICHOLAS WADE

Navy Considers Scuttling Old Nuclear Subs

Reactors on decommissioned vessels must be disposed of as radioactive waste; burial at sea is one alternative

The U.S. Navy is considering disposing of the dangerously radioactive power plants of decommissioned nuclear submarines by scuttling the submarines at sea over deep ocean bottom areas that would be chosen off the Atlantic and Pacific coasts. No radioactive waste has been dumped off U.S. coasts since 1970, and for the past 8 years the Environmental Protection Agency (EPA) has issued no permits for such dumping.

The Navy has only two practical options for ultimate disposal of defueled reactors of decommissioned submarines, either scuttle the subs or remove and bury the reactors on a government reservation. Both options are under review.

The ocean disposal option will of course be open to the Navy only if the EPA can be persuaded that the deep seabed is a suitable place for reactors that are thousands of times more radioactive than the kind of low level waste commonly dumped off the Atlantic, Pacific, and Gulf coasts between 1946 and 1970, when sea disposal of such radioactive material was allowed.

During that period 87,000 containers (mostly steel drums) and other items of waste were dumped under license from the old Atomic Energy Commission; altogether, the radioactivity thus disposed of came to 94,000 curies. But one submarine reactor could contain 50,000 curies, or better than half as much as all of the radioactivity disposed of offshore during more than two decades of active dumping.

Whether the dumping of such a reactor would be environmentally acceptable, neither the Navy nor EPA is prepared to say. The effects of past ocean dumping of radioactive waste have in general been poorly monitored. From existing information EPA cannot say either that such dumping is harmful or that it is innocuous.

The land disposal alternative that the Navy has under review would involve removing the entire reactor compartment from the submarine, putting this large structure (weighing several hundred tons) on a barge, and towing it to a government installation for shallow burial. The government has only two installations in mind: the Hanford reservation on the Columbia River in Washington, and the Savannah River Plant reservation in South Carolina.

Sea disposal of entire submarines might be much the easier and cheaper of the two options. But if this is the alternative proposed, the Navy may well provoke controversy in the United States and perhaps other nations, such as some of those around the Pacific basin where radioactive waste disposal has become an issue of extreme political sensitivity.

"My gut reaction is that it is not a smart idea," Thomas Cochran, staff physicist with the Natural Resources Defense Council, commented to this reporter.

Cochran observed that there are al-

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