plications of DNA Science's products or processes; Johnson and Johnson was granted similar rights to the company's pharmaceutical work. Hutton's lawyers immediately questioned the legality of such an arrangement, however, for it would have meant that the corporate investors stood to gain more from their stake in the company than other investors.

Such problems were not deemed insurmountable, but shortly before the 28 July closing date, another complication arose. Johnson and Johnson sought to negotiate more favorable proprietary rights from its investment, and the closing date was deferred for a week to see if an accommodation could be reached. About that time, however, Hutton's board of directors had second thoughts about the whole structure of DNA Science.

One concern was that the agreements with Weizmann, Battelle, and Baxter would have accounted for virtually all the initial $40-million investment. The Weizmann deal alone would have soaked up $25 million. This would have made the company very inflexible and unable to respond to any new investment opportunity that might arise. More important, Hutton's tax specialists argued that the tax bills which were then under final consideration in Congress could make R & D an attractive area for tax shelter investments, but DNA Science, as it was then structured, could not take advantage of these new opportunities.

Thus, for a variety of reasons, DNA Science's board of directors, which is dominated by Hutton executives, failed to agree on the financial arrangements by the new closing date. The deal collapsed, and the money was returned to the investors.

These developments have left Christian Anfinsen in a difficult position. He accepted an offer to become chief scientist at Taglit shortly after the agreement between Hutton and the Weizmann Institute was struck. The job was attractive, he says, because he wanted to live in Israel for a while and he thought the venture had some exciting prospects. He arrived in Rehovot on 1 July. Asked in a telephone interview why he left before the financial arrangements were signed and sealed, Anfinsen replied that "one tends not to doubt the ability of a company like E. F. Hutton to manage an enterprise like this." Now that the agreement with DNA Science has collapsed, however, Anfinsen says that alternative arrangements are being explored to keep Taglit alive, and "it is conceivable that it may be revitalized." In the meantime, he has a post as visiting professor at the Weizmann Institute.

To some observers, the difficulties encountered by DNA Science in raising noncorporate investment indicate that the financial markets have become much more cautious about biotechnology. "Companies can no longer put gene in their name and raise $5 million overnight," says Scott King of F. Eberstadt and Co. "Hundreds of millions of dollars have been invested [in biotechnology] but total sales are a few tens of millions a year if you are generous," he says. The problems with DNA Science "are a very visible sign of the greater selectivity in capital markets."

Officials of DNA Science do not agree. Harsanyi notes that the company was taking a different tack from other biotechnology ventures, by trying to tap much more conservative sources of finance, and Harsanyi argues that it was "amazing" that the company managed to raise more than $20 million from such sources.

Schneider conceded in an interview that the fund raising had not been as successful as originally anticipated, but he laid part of the blame on unforeseen difficulties in dealing with pension funds and other conservatively managed financial bodies. DNA Science had received enthusiastic commitments from the money managers of several outfits, but the deals failed to win approval from the committees that have the last word on the dispersal of funds and several large sums were withdrawn, Schneider says.

Whatever the problems encountered in raising capital for the original company, Hutton believes that the new tax law should make it easier to raise cash for a different kind of operation. Schneider says in particular that Hutton's tax specialists have found a way to structure the company to take advantage of the 25 percent tax credit for incremental investments in R & D (*Science*, 21 August, p. 843).

Although they are unwilling to discuss specific details because they believe their competitors may not yet have seen the same opportunities, officials of DNA Science say that the revamped company will essentially be financed by a collection of limited partnerships. Each partnership will contribute a separate pool of cash and have a stake in several specific projects; it will be able to take advantage of the tax credits while sharing in any subsequent profits that may come out of the work it finances. In some respects, the arrangement would work like existing schemes for channeling tax shelter

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Satellite Data Indicate Ozone Depletion

Three years ago the federal government banned the use of chlorofluorocarbons (CFC's) in most aerosol spray cans, and public anxiety about damage to the ozone layer quickly dispersed. But that action dealt with only one use of CFC's. They are still widely employed as refrigerants, foaming agents, and cleansers—uses for which there are generally no good substitutes. A fierce battle has been raging over whether such uses should be restricted.

The battle took a new turn in mid-August when reports appeared in several newspapers that satellite data have provided the first direct evidence that ozone is being removed from the upper reaches of the stratosphere. The data, obtained from two meteorological satellites, indicate a very gradual degradation of the ozone layer may be taking place about 40 km from the earth's surface.

According to Donald Heath, a scientist at the Goddard Space Flight Center who analyzed data gathered by Nimbus-4 and Nimbus-7, the rate of depletion at that altitude is about 0.5 percent a year. Heath said that he examined a 7-year series of data from Nimbus-4 and checked it against results obtained from the first 2 years of Nimbus-7. After correcting for seasonal variation, he says he found a slight year-to-year decrease in ozone concentration. "There is no way that can develop fortuitously; something real has happened in the atmosphere," he told *Science*.

The evidence linking this decrease to CFC's is far from absolute, but the ozone layer is most vulnerable to breakdown by CFC's at the 40 kilometer level, according to atmospheric models. A complete explanation of what is going on in the stratosphere must await the results of planned experiments to measure the levels of various intermediate products thought to be involved in the ozone breakdown reactions. Nevertheless, the Nimbus findings are "very significant," says Shelby Tilford, head of the atmospheric processes branch at NASA, for "they provide the first direct evidence of ozone depletion."

An interesting twist to the Nimbus

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findings is that the concentration of ozone in the troposphere seems to have increased in the past few years. The source is believed to be atmospheric pollution, perhaps partly from high-flying aircraft. Although this may help to block some ultraviolet radiation from reaching the earth's surface, a change in the distribution of ozone in the upper atmosphere could alter temperature distribution, with unpredictable effects on climate.

By themselves, these findings will not affect the outcome of the battle over further regulation of CFC's. But if they are confirmed, they undermine one of the chief arguments put forward by industry: that there is no hard evidence that CFC's are affecting ozone concentrations in the stratosphere.

The Environmental Protection Agency has been grappling with the problem of whether to regulate industrial uses of CFC's for several years. Last October, it issued a so-called advanced notice of proposed rulemaking, in which it simply outlined possible courses of action and asked for comments. In particular, it suggested that a cap could be placed on production, to keep use of CFC's at present levels.

The notice brought more comments than any other proposed rule in EPA's history—more than 2300 responses at last count. In part, the warmth of the response is a result of a well-organized and well-heeled lobby established by users and producers of CFC's in August 1980. Called the Alliance for a Responsible CFC Policy, it is seeking to prevent further regulation of CFC's at least until the ozone depletion theory is confirmed or shot down with hard evidence.

The alliance has drafted bills to prevent EPA from taking further action on CFC's until more studies have been completed. They have been introduced into the Senate by Lloyd Bentsen (D–Tex.) and into the House by Thomas Luken (D–Ohio). Heath, who says it is "most unfortunate" that the study results were announced before publication (they were cited during testimony by Mario Molina, a chemist from the University of California at Irvine who was one of the original formulators of the ozone depletion theory), plans to submit a paper to a scientific journal within a month.—***Colin Norman***

Brookhaven Director Quits as Isabelle Teeters

Amid rising costs, schedule delays, and increasing uncertainty over the fate of a one-half billion dollar particle accelerator under construction at Brookhaven National Laboratory on Long Island, the director of the laboratory has resigned.

George H. Vineyard handed in his resignation on 17 August to the trustees of Associated Universities, which runs Brookhaven for the Department of Energy. "I have wanted for some time to go back to research at the laboratory," says Vineyard, "and this appeared to be a good time to make the move."

Vineyard did not link his resignation to the troubles with the half-built accelerator, called Isabelle (*Science*, 21 August, p. 846). The machine is intended to be the most powerful in the history of U.S. high energy physics. Although it has already consumed $130 million, completion has been delayed because of technical problems with the construction of 1100 superconducting magnets—the heart of the project. Concern over the fate of Isabelle has recently heightened due to the completion by European physicists of a rival accelerator that may skim off the easiest discoveries in Isabelle's energy range. Says George A. Keyworth, the President's science adviser: "We have to ask ourselves in great detail what the composition of the best U.S. high energy physics program can be under realistic budget expectations." The Administration's decision on the fate of Isabelle is due this fall.

Vineyard, 61, said he is willing to stay on as director until the end of the year, unless a successor can be found earlier. Previous to his 20 years at Brookhaven as an administrator (six as deputy director and nine as director), Vineyard worked primarily in neutron scattering, a field of research far from the particle accelerators of high energy physics. Said Vineyard in a prepared statement: "The Isabelle project has, I believe, turned the corner by overcoming technical difficulties with the superconducting magnets. I am at an age when if I am to do more in research it is time to go at it. I would particularly like to take a leave for scientific refreshment, and may do so when I step out of this job."

—***William J. Broad***

Gene-Splicing Patent May Net $1 Million a Year

Stanford University has been getting a healthy response from industry to its 3 August announcement that licenses are available for its patented gene-splicing technology.

The patent granted last December is for the basic method of gene splicing and cloning that was developed in 1973 by Stanley N. Cohen of Stanford and Herbert W. Boyer of the University of California at San Francisco.

The patent sets a precedent as the first one to be awarded covering a process in the field of recombinant DNA. A second part of the patent application, still pending, covers the products of the process. Legal ground for this was cleared last year when the Supreme Court upheld granting of a patent to A. M. Chakrabarty of General Electric Co. for developing a strain of bacteria that digests oil spills.

Although there have been rumors that some firms want to contest Stanford's gene-splicing patent, Andrew Barnes of the university's Office of Technology Licensing says he is not aware of any challenge to the patent which "appears to be unassailable."

Stanford, in its press release announcing availability of licenses, carried the implied boast that it is not out to make unseemly profits from its piece of the bioengineering action. The nonexclusive license is available to any commercial user of the process for an initial fee of $10,000 plus an annual fee of $10,000. The royalty rate will be 1 percent on net sales of products up to $5 million, and 0.5 percent on sales above $10 million annually. Annual revenues, which Stanford estimates could reach $1 million in 4 or 5 years, will be divided between Stanford and UCSF.

Stanford expects to get license applications from about 200 firms that are either now employing the technique or gearing up to do so. Barnes is planning trips to Japan and Western Europe in the fall to explain the terms of the agreement to foreign firms.

—***Constance Holden***