"We have not abandoned it at all," Wallace replied. To grant patent rights on living organisms, he said, "would be an unprecedented extension of the patent law."

People using bacteria have indeed enjoyed patent protection, but the patents have been awarded not for the bacteria themselves but for the process in which they are used, the government claims. As for the few instances in which patents have been granted on bacteria themselves, these were just the "isolated actions of lower level employees," states the government's brief: "The policy of the Patent Office, however, is that living things themselves are not patentable."

In its written reply brief, the government has tried to impress upon the court just how unprecedented patenting of life would be. Theologians may enjoy debating questions about angels dancing on pinheads; here is the kind of speculation that lawyers get high on:

> [The] familiar terms and concepts of the patent law are not easily adapted to the patenting of living microorganisms that reproduce themselves. The microorganisms themselves presumably would not infringe the patent by reproducing (and thereby manufacturing themselves) without a license. And a human being who himself becomes infected, or whose plant or animal (or whose food, liquid, etc.) becomes infected, presumably also would not become an infringer merely by providing the medium in which the microorganisms propagate (at least if he does so unintentionally and takes reasonable measures to curb the growth of the infection—and does not use the microorganisms in any way). But the very fact that living organisms may reproduce in ways and places uncontrolled by the patentee or his licensees, and perhaps in profusion, suggests that patent grants on the organisms themselves would be unprecedented in scope.

While the government has warned against extending the scope of the patent law without express approval from Congress, General Electric has presented the argument's exact mirror image, that the scope of the law should not be restricted without a special act of Congress: "If the Government wishes to reverse its policy, it should address its desires to the Congress, which can legislate an exclusion, if that is found to be required by the public interest."

Several amicus briefs have been filed in the case. The Peoples Business Commission, supporting the government, contends that the granting of plant patents has harmed the genetic diversity of crop plants, and that the patenting of bacteria will lead to the patenting of higher forms of life. General Electric is supported by amicus briefs from the University of California, which stands to be granted a share of the fundamental patent on the recombinant DNA technique, and from Genentech, the leading gene splicing company. The Supreme Court is expected to hand down a decision some time before 16 June, when its current term ends.—NICHOLAS WADE

The Osage Oil Cover-up

Where the Osage Indians have 9970 oil wells pumping away, bureaucrats would have parks, reservoirs, and water-skiers

Pawhuska, Oklahoma. The policy of the Administration is to increase domestic oil production, but here in Osage County, the Corps of Engineers is trying to swamp 83,000 acres of oil-rich country with dams and reservoirs. The National Park Service wants to expropriate another 97,000 acres for a park. That these two bureaucratic giants have so far been slowed or stopped short of their goals is due to the spunk of the Osage Indians, who own the mineral rights in Osage County. After years of being exploited by white men seeking to do them good or otherwise, the Osage Indians have learned a basic rule of survival in white man's country: sue on sight.

The result is that the bureaucratic armies of the Great White Father have not been very successful in their attempts to cover the oil. In fact, the Osage are running circles around them.

"We've got 9970 pumping oil wells in the county right now," says Sylvester J. Tinker, 78, chief of the Osage. "Hell, we can't get enough rigs in here to drill the new ones. And still those sorry sons of bitches in Washington are telling us to cover it up."

The chief regularly flies to Washington to lobby on behalf of the tribe, and he gets results. A bill now before Congress to create a Tallgrass Prairie National Park has been amended so that the Osage will be able to continue producing oil and gas. Still not satisfied, the chief is out to kill the legislation. The chief and the tribal council also played a role in winning complete exemption for all Indian oil from the windfall profits tax—a feat the oil companies have failed to pull off. And with the help of the courts, the Osage have stopped or slowed work on two dams that have already run up construction bills of $49 million.

Just who the bad guys are in this tale out of the Wild West is not always clear. The Corps, for instance, claims the dams are needed not only for recreation but for controlling floods in nearby Tulsa, and that little Osage oil would be covered up. The Osage, of course, disagree. What is clear in all this is that the Osage have proved to be adept politicians, defending themselves in the face of a sprawling bureaucracy. It is also clear that the situation is filled with ironic twists from start to finish, and in that sense it perfectly mirrors the complex politics surrounding oil in the 1980's.

The dams in question, for instance, were authorized by Congress in 1962, when filling stations were pumping gas for 30 cents a gallon. And the Prairie Park, rather than being caught up by the tricks of time, is a classic case of ongoing bureaucratic schizophrenia. Two agencies within the Interior Department are fighting each other, the Bureau of Indian Affairs (BIA) to save the Osage lands and the National Park Service to take them away.

Not the least ironic are the Osage themselves. Unlike their brethren of the TV stereotype who battle only poverty and squalor, the Osage are the richest Indians in the world. In 1970, the income from leases to the mineral rights in Osage County amounted to $6.5 million. Today the high price of oil is turning once-marginal fields into money-makers. In 1979, the Osage took in $31 million.

And the Osage are fighting their way into the space age. Petroleum companies that lease the 160-acre tracts and that once sent royalty payments by mail must now do so through electronic-funds transfer. "We don't want to miss a day's interest," says David L. Baldwin, an Osage Indian and superintendent of

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the BIA office in Pawhuska. In an old red-brick building atop a hill in the center of town, Baldwin and his 20-person staff in the minerals division keep watch over the tribe's 4185 oil and gas leases. To help with the job, he recently installed a general-purpose business computer—an IBM System 34 with five terminals.

One reason the Osage refuse to let their oil wealth be covered up or compromised is their strong memories of past exploitation. The Osage suffered a long history of abuse at the hands of those out to get the Osage oil money by any means available, even murder. Their past treatment offers an important clue to their present attitudes.

Back in the booming oil days of the 1920's, the Osage spent lavishly, foolishly, becoming the envy of every other Indian tribe and the target of every hustling white. They were the rich, the richest Indians in the world. An average Osage family of five had an income of $65,000 a year. Money meant cars. When an Indian's auto ran into a tree or ran out of gas or got stuck in the mud, he would sometimes just leave it. In one case, an Indian went through ten cars in 1 year. Money also meant houses. Two full-bloods built a magnificent one in the 1920's, but they did not live in it. The house was reserved for cows, horses, chickens, and hay, while the couple slept out on the lawn in a hut.

The Osage had more money than they knew what to do with. At least for a while. An army of salesmen soon took up residence in the towns of Osage County. Like the cars and fancy houses, much of what they sold was alien to Osage culture. Priceless china and silverware sat on shelves while the Indians ate with their fingers. Expensive vases were used to keep vegetables. Grand pianos often stood out on lawns, rain or shine.

Marriage was another way to part the Indian from his money. Don Dickenson was a full-blood who lived in the town of Fairfax. He met a white woman, went with her for about a week, and then married her. Three days later she left him with $100,000 in alimony in her purse.

Soon the feds stepped in. They decided that since so many Indians were indifferent to money, the Osage required guardians, persons who would wisely manage their affairs. A good plan on paper, it seldom worked in the real world. Typical was the attitude of one guardian who bought a car for $200, and then sold it to his ward for $1250. Even as the feds were looking to the guardians as a way to control the fleecing, con artists were hatching a new plot that called for the murder of whole Indian families. This period of Osage history is commonly referred to as the reign of terror.

Photo by W. J. Broad

Chief Sylvester J. Tinker (foreground) and senior field supervisor Bruce Hendricks look on as an independent oil hauler takes on a load of Osage oil.

The idea was to snatch an Indian's "headright"—the unit by which oil revenues were divided among the tribe. In 1906, as Oklahoma was preparing for statehood, the reservation was broken up into individual allotments. At the time there were 2229 Osage Indians. Each Indian got 658 acres and could do with it as he pleased, even sell it. But what lay beneath the ground, the mineral rights, could not be touched. They belonged to the tribe as a whole, and any income derived from those mineral rights would be spread equally among all 2229 Indians. The equal share was a headright.

From that day in 1906, the number of headrights never changed. The only way to lose one was to die, at which time the headright, or part of it, was passed on to the immediate heirs.

This fact led to the slaughter of dozens of Indians during the reign of terror. The brains behind one of the worst schemes was William K. Hale, a wealthy white man who was related to an Osage family by marriage. One of the best-liked men in Osage County, Hale in the 1920's started killing off his nephew's Indian family, all the while posing as a concerned citizen. He was a pallbearer at one of the funerals. Hale figured he would inherit an estate valued at $2.5 million and an annual headright income of $250,000. All that was required was the deaths of ten people. For the deaths of one household, he simply arranged to have the whole house blown up.

For a time, there were more federal agents in Osage County than were stationed in New York. They worked for 3 years before cracking the case. By then, Hale had killed all but two of his victims.

With the solving of the Hale case, the reign of terror came to an end. It is the memory of the Hale case, and the many incidents like it, that still haunt the Osage. This fear of being exploited, even murdered for their oil money, helps explain their violent opposition to recent "threats" such as a flood control dam or a Tallgrass Prairie Park.

Another reason for Osage obstinance is that they have twice seen oil revenues shrink, and they now see the current booming situation as a new lease on a life of affluence. By the late 1930's, the oil fields that could easily be tapped for primary production had been played out, and the oil income dropped. Boom and bust occurred again in the 1960's, when secondary production methods—those where water or other solvents are first pumped into an oil field—for a while increased oil income. Things went slowly downhill until the Arab oil embargo started the current oil price spiral, making even hard-to-get oil profitable to pump. The upshot is clear. The income from a single headright currently amounts to $26,680 a year, the largest payments to the Osage in the history of the tribe. "We've been doing pretty good since them Arabs started causing problems," says chief Tinker. "I bless 'em every morning."

To keep their oil profits flowing, the Osage are now engaged in a legal and legislative battle with the Army Corps of Engineers. During the past 30 years, four Corps dams and their reservoirs have covered 45,000 acres in Osage County with water, and now the tribe is out to stop the covering of an additional 38,000 acres. In the past this was no easy matter. Through rights of eminent domain, the Corps would come in, buy surface rights, and have the Osage mineral rights subordinated to the surface rights by court order. The tribe still owned the oil under the reservoirs, but they had no control over access to it. That changed after a 1976 ruling by a federal court of

appeals. The court ruled that the United States was without authority to condemn, without a clear expression of congressional intent, Indian lands acquired by treaty and held in trust by the United States.

This ruling brought to a halt the Corp's Candy Lake project last August and now threatens the future of the Skiatook Lake project, in which the dam is already completed but the lake cannot be impounded until the mineral rights are subordinated to the surface rights. Two other proposed dams are also in jeopardy. The Corps is now awaiting passage of special legislation in Congress that would allow them to continue work.

The Corp contends that the loss of oil revenues would be minimal, and that the federal investment in the dams under construction is already so large that to stop now would be foolish. The Corps estimates, for instance, that the oil production in the Skiatook Lake area amounts to only 1 percent of the total Osage daily production. This, they say, pales in comparison to the $6.9 million in annual benefits expected from flood control, water supply, and recreation. Moreover, $44 million has already been spent on the Skiatook project.

"You eventually come out with the logic that says you will complete the project," says Col. Robert G. Bening, the chief engineer at the Corps Tulsa District office. "I don't know if we're talking 12 months or 12 years. That's hard to say. The situation is similar to the snail darter and the Tellico dam. It boils down to there already being a huge federal investment, and no politician is about to ignore that." The bottom line, says Bening, is that the Corps, as it has in the past, will pay the tribe for projected loss of oil and gas income.

The Osage are not impressed. They note that eastern Oklahoma already has the world's greatest concentration of man-made reservoirs. They claim the so-called benefits of the proposed dams are the daydreams of idle bureaucrats. In the past, moreover, the payments for lost oil and gas revenue have not nearly matched the projected losses. And it is happening again, they insist. With Skiatook, 436 oil and gas wells would be affected, and the tribe would lose more than $1 million a year in royalty payments. These payments would now be even greater, they say, but companies hoping to lease mineral rights have been scared off by the prospect of the dam and its reservoir. Their reluctance to explore the field will result in an underestimation of the field's capacity.

Shrewd politicians that they are, the Osage are not particularly worried by all this. When pressed, they even admit that the two dams already under construction will probably be finished, given the hefty federal investment. Their legislative and legal maneuvering is basically a stalling tactic so that they can pump as much oil as possible before flooding of the area, and so they can up the ante on the proven reserves of the covered oil fields. One way to do this is to let out oil leases near the dam sites to producers for free. The tribe still takes about one-sixth of the money made off any oil discovered by a driller as a royalty payment, and will eventually get a better idea of the proven reserves under the flooded area. This information is then used in court during settlement for mineral rights.

One Osage official, who asked not to be named, took this logic a step further. "We'll actually get paid for the oil

Carter Creates a Sinewy NRC

One year after the accident at Three Mile Island, President Carter is sending Congress his plan for streamlining authority at the Nuclear Regulatory Commission (NRC). The changes are meant to help the NRC identify and deal more rapidly with problems which are thought to present a danger to public safety.

According to White House aides who drafted the plan, this reorganization strengthens the NRC's muscle in several ways. (i) It establishes the NRC chairman as primus inter pares in making policy. This distinction, it is hoped, will eliminate the confusion inherent in the present law, which declares that "each member of the commission . . . shall have equal responsibility and authority in all decisions and actions of the commission." (ii) It makes the chairman the final authority for day-to-day operational decisions. The chief executive officer of the NRC will serve as the chairman's deputy, and he will have the unambiguous responsibility for directing the operational staff. Among offices which will continue to report to the full commission are the licensing board panel, the licensing appeals panel, the advisory committee on reactor safeguards, the office of inspection, and the general counsel. (iii) The reorganization plan gives the chairman power to screen all candidates for staff appointments and to hire and fire personnel for most staff jobs. Candidates for key positions, including nominees for the licensing and advisory committees, will require full commission approval. (iv) In the event of a nuclear accident, the chairman will be vested with emergency powers to act for the entire commission.

Officials in the White House said the reorganization plan will be sent to the government operations committees in the House and Senate; they will have 45 days to mull over the particulars. If no objections are raised, and if Congress does not block it, the plan should be in effect by June.

In a separate action, the President signed an executive order on 18 March, creating a five-member Nuclear Safety Oversight Committee. Its task will be to report to the President on the performance of the overhauled NRC. The members have not yet been chosen.

The President decided not to follow the advice he was given on nuclear export decisions. The Kemeny report on the accident at Three Mile Island recommended that the NRC be relieved of duties involving foreign trade, for these were thought to distract the NRC from its domestic chores. Plans were drawn up to move the export approval function to the State Department or to a special office under the President. But these ideas were dropped, a White House official said, because it seemed unwise to broach this controversial subject in the spring of 1980. The official said the President wanted to avoid a debate on nonproliferation policy in Congress. He suggested that the President may take the issue up again next year, if he is reelected.

Although President Carter has said that he intends to name a new NRC chairman in June, White House officials left open the possibility that the acting chairman—John Ahearne—will be named to the post. There is one great advantage in taking this course, it seems. As an installed member of the NRC, Ahearne would not have to face confirmation hearings in Congress. That may be important in an election year.—ELIOT MARSHALL

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twice," he said. "Once in court and once when the technology of oil extraction has evolved to the point where drillers will be able to suck oil from under the reservoirs." This type of extraction is normally done by slant drilling, but since the oil fields of Osage County are close to the surface, this method is not practical. For the moment at least.

And so it goes. The chief flies out to Washington to battle the Prairie Park, the dams, the bureaucrats. The litigation continues even at home in Oklahoma. On the basis of the appellate court decision, the tribe last year sued six cities in Osage County because their municipal lakes are said to impinge upon the Osage mineral rights. Such local activity is nothing new. Back in the 1960's, when the Osage were not quite so flush, a white resident of Osage County gave some 1500 tons of boulders to the city of Tulsa for use in a park. The Osage, however, claimed they owned the mineral rights to the stone. After some haggling, the donor ended up paying the Osage 10 cents per cubic yard for the boulders.

Is it worth the effort? To most Osage, the answer is a clear yes, a yes on basic economic grounds. For some, the exploitation of the past makes enlightened self-interest even more to the point. It was because of increasing white settlement that the Osage in 1872 were compelled to leave their lands in southeastern Kansas, going south to settle in what some whites laughingly called those barren hills, not fit for man or plow. And though the arrival of unexpected wealth brought its compensations, it also brought con artists and mass murderers. The Osage do not forget. Chief Tinker, for instance, takes along a small-caliber gun when he travels the back roads of Osage County. "The Osage got money," he says with a grin. "All them other Indians got is their ass and a hat."—WILLIAM J. BROAD

Is Science and Engineering Training Adequate?

President Carter, "increasingly concerned," directs NSF and the Department of Education to report on this question by 1 July

The National Science Foundation and the Department of Education are now engaged, at President Carter's direction, in a high-priority effort to assess the health of science and engineering education.

The study has been ordered partly because American industry is faced with a shortage of engineers, especially engineers trained in computer-augmented design and manufacturing techniques. Also, with most new engineering graduates finding attractive jobs in industry upon receiving their bachelor's degree, the engineering schools are discovering that to recruit enough graduate students and junior faculty they must look increasingly to foreign-born nationals.

President Carter gave Secretary of Education Shirley M. Hufstedler and NSF director Richard C. Atkinson their marching orders in a memorandum, dated 8 February, that said: "I am increasingly concerned whether our science and engineering education is adequate, both in quality and in numbers of graduates, for our long-term needs. Accordingly, I would like you to carry out a review of our science and engineering education policies at the secondary and university levels to ensure that we are taking measures which will preserve our national strength. Please submit a report to me, with your recommendations, by July 1, 1980."

Carter's directive to Hufstedler and Atkinson was sent on the advice of Frank Press, the White House science adviser, who in a memo to the President in early February had suggested that the study of science and engineering education be undertaken. Press, in turn, had acted partly on information received over a period of several months from engineering school deans and people in industry. He figured that, if the nation was already faced with a shortage of engineers, the additional demands generated by major new federal spending for synfuels R&D and defense research and engineering might make that shortage still worse. Also, in his memo to the President, Press is understood to have cited a report by two U.S. Census Bureau analysts, Louvan E. Nolting and Murray Feshback (*Science*, 1 February) that the number of scientists and engineers taking part in R&D in the Soviet Union may substantially exceed the number so engaged in the United States.

Press says he is not at this point asserting that there is a major problem in science and engineering education. Except for a few fields such as computer science and toxicology, there is no shortage of scientists today and many new Ph.D.'s in the sciences have been hard put to find jobs in the fields in which they have been trained. But Press says more information is needed as to whether a shortage of physical scientists may develop in the years ahead. (As one NSF staffer points out, the number of students receiving bachelor of science degrees in physics in 1978 was down by more than a third from the number who received such degrees in the peak year, 1970.)

At NSF, a task force headed by the agency's deputy director, George C. Pimentel, and two assistant directors, is in charge of the education study. A parallel effort is in progress at the Department of Education under the direction of Michael O'Keefe, deputy assistant secretary for planning. The major R&D funding agencies such as the departments of energy and defense and the National Institutes of Health are also being drawn into the study, as are private organizations such as the National Academy of Engineering, the AAAS, the American Chemical Society, and various education groups.

The present shortage of engineers in industry may have resulted from widespread reports in the early 1970's of massive layoffs in the aerospace industry and of some engineers being reduced to pumping gas or driving taxis. Misled into thinking that engineering in general faced hard times and bleak prospects, many students entering college in those years made their career choices accordingly. More recently, engineering enrollment has grown dramatically, but the supply of graduates still lags behind demand.

But catching up with the demand for bachelor's degree graduates is not the only problem facing engineering education. Engineering schools are having trouble recruiting enough American-born graduate students and junior faculty and in giving up-to-date training. The sit-

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