hole. The evidence is very convincing."

There is additional evidence. As reported by the Stony Brook group at the meeting, the abundance of chlorine monoxide followed a diurnal cycle. It reached a peak at midday, declined during the evening, and became undetectable during the night. All chemical theories predict just such a cycle in which chlorine monoxide formed by the action of solar ultraviolet radiation returns to a nighttime reservoir such as chlorine dioxide. The latter compound had been found in unusually large amounts at night by the expedition group headed by Susan Solomon of the National Oceanic and Atmospheric Administration Aeronomy Laboratory in Boulder, Colorado. Its presence along with high concentrations of chlorine monoxide bolsters the chemical hypothesis, but chlorine dioxide alone could not be taken as proof because it is not unequivocally linked to ozone destruction the way chlorine monoxide is.

The analysis of Antarctic chlorine monoxide having been given "a good start," as one spectroscopist put it, thoughts naturally turned to the possible implications for the rest of the globe. Malcolm Ko, Jose Rodriguez, and Nien Dak Sze of Atmospheric and Environmental Research, Inc., of Cambridge, Massachusetts, reported results of their modeling that included an assumed nonstandard chemistry. Theirs is only a one-dimension model, they pointed out, and a number of elements in it are not known as well as they need to be. No one knows exactly which reactions are occurring on Antarctic aerosols, or how the rates of those reactions would be affected by the poorly understood differences between Antarctic and lower-latitude aerosols.

Nonetheless, a preliminary model run seemed warranted, and, as expected, the results were not encouraging. When run with standard chemistry, total stratospheric ozone showed no decrease as a variety of trace gases related to human activities increased. But when nonstandard chemistry was included, total ozone decreased a whopping 16% between 1955 and 2060, mostly in the lower stratosphere where aerosols recycled chlorine from inactive reservoirs.

The dynamicists may still prevail against the chemical hypothesis, which would mean that the Antarctic ozone hole is a harmless curiosity. But if the claimed high concentrations of chlorine monoxide are confirmed, dynamics will be relegated to the role of creating a temporary experimental vessel whose conditions so favored aerosol-enhanced reactions that their effects could not escape notice. This fall's 1987 National Ozone Expedition could settle the question. ■ RICHARD A. KERR

Anthropologists Turn Advocates for the Brazilian Indians

An international movement of anthropologists is attempting to help Brazilian Indians, but some question whether advocacy is appropriate for researchers

FOR Waud Kracke, an anthropologist at the University of Illinois in Chicago, the moment of truth came early, when he was still a graduate student at the University of Chicago. In 1969, Kracke went to Brazil to do his fieldwork among the Parintintin Indians, still harboring the traditional notion that his role was to observe and record—not to intervene in the lives of native people. His plan was to conduct a study of leadership in the tribe.

But soon after Kracke arrived, a measles epidemic struck the Indians. Kracke, whose medical knowledge was largely limited to the Merck Manual he carried with him, found himself spending all of his time giving injections and making diagnoses.

"Initially, I felt guilty," says Kracke. "It wasn't what I was supposed to be doing as an anthropologist and it was very different from my expectations." Yet Kracke felt he could not very well refuse to help. It was the start of a new view of himself as an anthropologist.

Now Kracke is working with a growing international network of anthropologists who are serving as advocates for indigenous people. In Brazil, where much of the movement began, the groups are doing what they can to help the Indians gain title to their land and avoid exploitation by colonists. The network includes four major advocacy groups—Cultural Survival, based at Harvard University; Survival International, based in London; International Workshop for Indigenous Affairs in Copenhagen; and Gesellschaft für Bedrohte Völker in Germany.

It is a movement that is attracting increasing attention from academic anthropologists, according to Robert Fernea of the University of Texas at Austin. Fernea, as program chairman of the ethics committee of the American Anthropological Association, recently invited David Maybury-Lewis of Harvard University, who founded Cultural Survival, to address a special seminar on advocacy at the association's annual meeting next November. "I think our interest in advocacy is evident. We are concerned," Fernea says. "It is no longer something we can divide from our intellectual interests."

Yet although the advocacy movement has the loftiest of purposes, it raises troubling questions about the role of anthropology. At what point do researchers step over the thin line between being helpful and being patronizing? Who should make decisions about the fate of indigenous people? At what point should anthropologists stop being observers and start being participants? Should anthropologists be motivated by an imperative that is an inverse of Kipling's white man's burden?

Advocacy, says Fernea, "is no longer something we can divide from our intellectual interests."

Anthropologists' answers to these questions vary, but more and more of those who work in Brazil are coming to agree with Maybury-Lewis, who says, "We shouldn't be worried about being patronizing. It is really quite a minor issue when it comes to what is happening to these people."

If ever there were a place where advocacy is needed, say the anthropologists, it is Brazil. The 200,000 Indians who live in the vast jungle are caught in a continuing struggle as mining companies attempt to gather what is thought to be vast mineral wealth buried beneath the rain forest, lumber companies want certain increasingly rare jungle trees, cattle ranchers want to graze their herds on deforested rain forest land, and local political leaders hope to profit from development projects. "Passions run strong," says Kracke. "Everyone has a vision."

The defenders of the Brazilian Indians are up against "the endless land-hunger of the system," says anthropologist Kenneth Taylor of Survival International's Washington,

D.C., office. "The more you get into large-scale agribusiness, the larger and larger the land holdings become. People get pushed off the land—and this includes small farmers and sharecroppers—and the political solution is to shunt them to some other part of the country." Few are concerned if the resettled Brazilians are pushed onto land that is occupied by "some little Indian tribe in a lost part of the jungle," says Taylor.

For example, in the late 1970s the Brazilian government began to build a highway through the Amazon jungle and to resettle poor people there. The slogan, says Taylor was "land without people for people without land." The proposal was for 100 kilometers on each side of the Transamazon Highway to be state land, which Brazil would give to desperately poor rural workers from the northeastern part of the country.

But, of course, there were already people on this land. There were Indians and rubber tappers, who live almost like Indians and who tap rubber from the jungle rubber trees and sell it. There also were people who live along the river banks and sell jungle produce, such as bananas and cassavas, as well as fish and animals that they hunt.

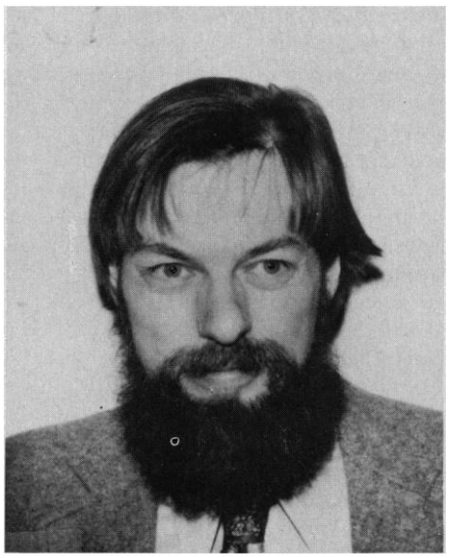
And, as the Brazilian government was told by its own scientists and advisers, the project could never turn out as promised anyway because the jungle soil was too poor to support agricultural crops. "The nutrients in the soil are absolutely minimal," Taylor says.

The highway was built, but the land reform failed. And Indians—some of whom had never been contacted by outsiders—fell victim to disease and saw their lands invaded by now desperate peasants who had nowhere else to go.

A second project was, if anything, even worse for the Indians, according to the anthropologists. The project was to be the biggest land reform ever attempted, according to the Brazilian government. Government workers would pave an already existing highway through the jungle in the state of Rondônia. Called the Polonoroeste Project, it was initiated in 1982 and was financed by the World Bank.

The paving of the road began and the peasants arrived in droves—more than 200,000 in 1985 alone, according to anthropologist Stephan Schwartzman of the Environmental Defense Fund. The idea was that not only would the World Bank's half a billion dollars fund the paving but it would also help pay for health posts, schools, banks, shops, sawmills, and factories so that development would be integrated and rational. In addition, the plans called for Indian lands to be identified and protected. There are at least 75 Indian groups living in the area affected by the highway project.

But the plans were not followed. After a few years, says Taylor, "the road was paved, but virtually nothing else was taken care of." The settlers failed—as many as 80% of the migrants in some settlements have sold their land to speculators after only 4 years, according to Schwartzman, and the rain forest is rapidly being destroyed. Schwartzman says that if the deforestation continues at its current rate, "within a few years, the entire state, the size of West Germany, will be denuded."



Waud Kracke. *An anthropologist at the University of Illinois in Chicago, Kracke has spent his entire academic career as an advocate for the Brazilian Indians.*

Although the poor people could not farm the land, the wealthy made enormous short-term profits. They would seize the land from the peasants, seed it from airplanes, and bring in cattle herds to graze. After 2 or 3 years, the soil would be too depleted to support even pastures, and the cattle would be moved on to the next cleared stretch. "The poor Brazilians were swept like dust in front of a broom," says Maybury-Lewis. And the land that was left after the farming and the cattle grazing was "almost like a desert," says Taylor. "The vegetation of the forest protects the soil from the heavy rainfall and powerful ultraviolet rays of the tropical sun. When the land is cleared, the soil is converted to concrete-like mud. Then the sun bakes it until it is as hard as concrete."

The Polonoroeste Project is "a classic example of development gone wrong," says Taylor. "In our opinion, it was ill-fated and wrongheaded from the word go." The Indians have been badly affected. "Indian lands were invaded, diseases were introduced, and some Indians have been killed by settlers."

World Bank ecologist Robert Goodland agrees that the project had serious problems. In fact, he says, although the bank is now protecting Indians and rain forests in Rondônia, the poor people who the project was supposed to help have suffered greatly. "As long predicted by ecologists, the poor people have now swollen the slums of the local

© Stephan Schwartzman

Harvesting manioc. *The Krenakore Indians living in the Xingu Indigenous Park in Mato Grosso, Brazil, collect manioc from a garden they planted. The garden is only accessible by canoe. The brown roots in the boats are manioc—the source of tapioca starch and a staple food of the Indians. The Indians recognize as many as 18 varieties of this vegetable and prepare it in a variety of ways.*

towns," Goodland says. "If there had been some lasting benefit, one could understand [that the effects on Indians and the jungle ecology] were trade-offs. But the poor people are now full of malaria and hungry."

The Polonoroeste Project followed closely on a project that led to the destruction of Indian lands by another group—miners. The project was known as Radam, for Radar Amazonia, and it used remote sensing to discover mineral deposits in the Amazon Basin. Photographers in planes flew over the jungle, scanning through the clouds with radar to get images of the vegetation. From these pictures of the plants growing in various areas, scientists deduced what minerals might be there. Although the project got some admiring publicity (*Science*, 29 April 1977, p. 513), anthropologists were dismayed. Before the project began in the 1970s, says Taylor, "Amazonia was very remote and transportation was almost impossible. Radam opened up the Amazon once and for all."

When it looked as though a valuable mineral might be in some inaccessible part of the jungle, prospectors would fly overhead in a helicopter. A few men would rappel down to the ground and would start clearing the area. Then the helicopter would return with more men who would continue to clear the vegetation. Before long, the men would have cleared an area large enough for an airstrip and serious mining would begin.

The effects frequently were dramatic. For example, in February of 1985, Radam announced that thorium was present on land occupied by the Yanomamo Indians. By late April, six men had gone into the area, using an airstrip that had been built by missionaries. By the end of July, 500 miners were there, and the Indians had been exposed to measles, tuberculosis, and venereal disease. Many Indians died. Fifty percent of one group of Yanomamo were killed by measles in 1985, according to Taylor.

In September of 1986, after fighting broke out between the Indians and the miners, Brazil's minister of the interior signed an evacuation order that was supposed to force the miners to leave. But thorium was not the only prize in the area. It turned out that gold was there too and so, says Taylor, "there was no keeping them out."

At least one group of Indians was able to take advantage of the miners, however. Terry Turner of the University of Chicago, who studies the Kayapó Indians in central Brazil, reports that when gold was discovered on Kayapó territory in 1980, miners poured in. The Brazilian government had never recognized the Indians' claim to the land and so the Kayapó had no legal rights to it.

Wide World

Yanomamo girl. *Reflecting the traditional culture of this Indian group, a girl decorates her face with vegetable dye and puts sharpened twigs in her pierced lips, nose, and ears.*

"In 1983, the Indians decided they might as well be hung for sheep as lambs," says Turner, and so they staged an armed takeover of the mine on their territory. For 2 weeks, 200 Indians held 3000 miners captive. The Indians said they would not release the miners until the government recognized their claim to the land and gave them a percentage of the profits from the mine and from the shops that sell goods to the miners. The government agreed and the Kayapó today are in a much better position than most of the Brazilian Indians. "This is probably the leading success story of its kind in all of Amazonia," says Turner.

Maybury-Lewis and his wife Pia were profoundly affected by the plight of the Brazilian Indians and, 15 years ago, founded Cultural Survival to help them. "When we did fieldwork in central Brazil, we became more and more aware that we didn't want to just observe indigenous people as in laboratories," says Pia Maybury-Lewis. "We decided to found Cultural Survival to help indigenous people survive in the face of development. We weren't absolutely sure how to do that, but we wanted other people to realize that small traditional societies *can* exist. They do not have to be extinguished. Something can be done. Quite often these societies are eliminated as a result of greed and incomprehension."

The fledgling Cultural Survival began by enlisting the aid of academic anthropologists, asking them to document circumstances that are cause for concern. Then the organization publicized these abuses.

One of the group's first successes was with the World Bank. Cultural Survival and the international network of anthropologist advocates lobbied the World Bank to encourage it to change its policies and to apply its guidelines to protect indigenous people. And the bank did change, drawing up a document that essentially says that no future World Bank projects shall destroy tribal cultures or take away tribal lands. David Maybury-Lewis helped write this World Bank policy, and he and other advocates were highly influential in persuading the bank to adopt the policy in the first place, according to Goodland of the World Bank.

Because of this new policy, the World Bank, about 2 years ago, cut off its funds for the Polonoroeste Project, an effect that "sent a shock wave through the borrowing community," according to Maybury-Lewis. The bank, however, resumed its disbursement of funds several months later and now, says Goodland, "the situation is better."

Goodland argues, in fact, that the bank is now going to great lengths to protect Indian territory. It has even financed a satellite that flies over protected jungle areas and if the

Indian chiefs. *Krenakore chiefs perform a traditional dance in the plaza of their village in the Xingu Indigenous Park. The Xingu were nearly wiped out about 15 years ago. Between 1968 and 1973, Brazilian workmen built a road through their territory and between 80 and 90% of this Indian group died of diseases the workmen introduced. In 1975, the Krenakore were transferred to the Xingu Indigenous Park—a protected area. There they are in the process of trying to reconstruct their traditional culture and society.*

satellite photos show suspicious clearings, the bank sends in a helicopter to investigate. If illegal lumbering is going on, the bank seizes the loggers' assets, according to Goodland, and if the trees are being cut down by poor people, the bank "re-settles them elsewhere before they can cut too much of the forest down," Goodland says.

Cultural Survival provides funds for indigenous groups and, together with the other advocacy organizations, teaches indigenous groups how to get press attention. They also conduct international publicity and letter-writing campaigns to put pressure on governments. In Brazil, they enlist anthropologists to demark Indian lands—the first step in getting the government to protect them.

But, the advocates are often asked, is this a proper role for anthropologists? Should academic anthropologists in particular get involved in special pleadings for the people they study? "It is a *very* difficult situation," says Kracke. "The only way to keep yourself pure is to keep your hands off and let the Indians go under. There is a lot of self-examination and examination of others in the movement."

Yet it must be understood, says David Maybury-Lewis, that the anthropologists in the advocacy movement do not want to keep the Indians frozen in an antiquated society, preventing them from contacting the modern world. What they want to do is to help the Indians to be free to make their own decisions and not be exploited by powerful economic interests. "We do not urge them to be true to their traditions, partly because such a stance would be unbelievably paternalistic, but also because we assume that all societies are constantly changing and some are abandoning their traditions of their own accord. We therefore offer our help to tribal societies and ethnic groups who need it to maintain those aspects of their culture which they consider important," Maybury-Lewis says.

Moreover, he continues, the anthropologist advocates do not want to take over the Indians' struggle. "We want them to fight their own battles. What I consider success is the Indians doing their own advocacy," Maybury-Lewis says. Nonetheless, he notes, "even when they are doing their own advocacy, they need allies."

And, notes Maybury-Lewis, the Indians want the anthropologists' help—they are not insulted by it. "We have never been told by the Indians to back off. The Indians are extremely anxious to have us help and the real problem is that we can't help as many as we would like because we don't have the resources," he says.

Knowing they have an international network of allies has changed the very way Indians behave in the face of threats, says Maybury-Lewis. As an example, he tells of an incident that occurred recently, during the waning days of Brazil's military dictatorship.

One day, a group of chiefs from the Xavante tribe showed up in Brasília and demanded to see the head of the Indian Service. The chiefs were fighting for their land and wanted to stop a group of ranchers from appropriating it. But, says Maybury-Lewis, "the head of the service, a general, said he could not receive them—he said he would see one or two representatives at most. So the chiefs walked up the back stairs and appeared in the corridor in front of his office. There were 10 or 11 of them and they were hefty fellows—6 feet tall and barrel chested. Some of them were carrying ceremonial clubs. They strode into the general's office. The general tried to bluster, but the chiefs moved toward him and told him that he had an obligation to listen to them and to speak politely and that if he didn't, they would throw him out the window."

"Now the question is, Why weren't those 11 chiefs thrown in prison? The reason is that they didn't go on their own to see the general. They took with them deputies from the opposition in Congress and they went with newsmen. It was a very sophisticated use of allies. The Brazilians clearly didn't want the bad publicity of arresting Indians in the Indian agency. The Indians' tough tactics, though, would not have done them any good if they had not had allies."

The Indians did get to keep their land. Although the head of the Indian Service did not agree to the chiefs' demands at the time of the confrontation, he did agree shortly thereafter.

Anthropologists who work with the Brazilian Indians say they are giving these indigenous people not only hope and support but a new vision of themselves. Because of their contact with anthropologists, the Brazilian Indians became aware of the value of their culture. The Indians had in the past been derided for their way of life, says David Maybury-Lewis. Colonists who contacted the Indians frequently laughed at them, or gave them food as they would animals in a zoo and jeered when the Indians were unfamiliar with how to eat it. "Anthropologists have given the Indians the sense that their own culture is valuable and is something that even outsiders can respect," Maybury-Lewis says.

Turner agrees. Culture, he says, "is your way of defining yourselves as a people and as a political community." Yet "in most of Amazonia, there wasn't much consciousness of culture." When the Indians realized that

anthropologists were fighting to help them retain their culture, they realized, for the first time, that "they were special because they had a culture of their own. The work that anthropologists and others did among them did a very important job of politicizing their cultural consciousness," says Turner.

As their cultural awareness grew, the Indians of different groups in Amazonia began getting in touch with each other and started holding national meetings. Five years ago, the Indians founded the Union of Indian Nations.

"A pan-Indian consciousness has grown up in Brazil very rapidly," says Turner. "The Indians collectively pose issues, lobby, and speak out, and hold news conferences. There really has been a revolution in many respects."

Yet despite the encouragement by the anthropologist advocates, the majority of American anthropologists who work in Brazil have not become Indian advocates. One reason is that advocacy is not in the academic tradition and will not necessarily help advance a young anthropologist's career. Advocacy, says Maybury-Lewis, "may be considered seriously worth doing, but it is considered apart from your evaluation as a scholar. I have been struck by the vehemence with which younger anthropologists speak of the professional problems they face. It was brought home to me that I have a very privileged position. I have tenure at a major university and I have a base from which I can do this. For a person with a new Ph.D., advocacy work does not have much reward."

Kracke agrees. Although he too has tenure, he says he still is asked when he is going to get back to doing anthropology. To him, however, what he is doing *is* anthropology.

The situation is somewhat different for Brazilian anthropologists for whom "advocacy is still not the best way to advance a career, but there are not penalties," says Maybury-Lewis. "Here, advocacy work may be considered serious and worth doing, but it is considered apart from your evaluation as a scholar. In Brazil, anthropologists feel an obligation to make their own work relevant to the problems of the country."

Nonetheless, advocacy can have unexpected payoffs even for American anthropologists. Kracke, who says he is strongly influenced by the attitude of Brazilian anthropologists, said he learned more about the Indians' belief systems when he spent time helping them than he ever would have learned as a neutral observer. This is not an argument for advocacy, of course, but it can mean, says Kracke, that time spent helping the Indians is not necessarily time taken from a career. ■ GINA KOLATA

The T Cell Receptor Family Is Growing

Researchers have identified a second type of T cell receptor, which comes in several structural variations, and are now trying to pin down its functions

IMMUNOLOGISTS once underwent years of frustration during their quest for the Holy Grail of immunology, namely the T cell receptor. Now they have been so successful that they have two with which to contend. The original model, which was identified about 4 years ago, is the equivalent of the "on" switch for T cells. It is the cell surface molecule that recognizes and binds foreign antigens, thereby triggering the cells' activities. The function of the second model, discovered last summer, is still largely unknown. Current indications are that it might act both during T cell development and in the mature animal, perhaps in a novel type of killer cell.

The discovery of this second receptor had an immediate consequence in that it laid to rest a mystery that had cropped up during the work on the first. Early on, researchers had shown that the original, antigen-binding receptor contains two protein chains (designated α and β) that have variable structures and are linked to a third, invariant protein called T3.

During the course of the intense efforts to clone the genes for the α and β proteins, Susumu Tonegawa and his colleagues at the Massachusetts Institute of Technology (MIT) identified a clone that had all the earmarks of a gene that might encode a T cell receptor protein. Other researchers had already cloned the gene for the β chain, and the MIT workers accordingly proposed that they had cloned the α-chain gene. When subsequent work showed that this was not correct, the MIT clone became the "mystery gene" of T cell receptor research.

In July of last year, Michael Brenner, Michael Krangel, and their colleagues at Harvard Medical School were the first to report that they might have a function for the mystery gene in encoding a protein for what appeared to be a second T cell receptor. They identified a population of human lymphocytes that carried T3 proteins on their surfaces without any α or β proteins. The T3 proteins were instead associated with two different protein chains, one of them the apparent product of the Tonegawa group's gene (now called the γ gene), and the other (which has been designated the δ chain) of unknown origin.

In short order, other groups, including that of Arthur Weiss of the Howard Hughes Medical Institute at the University of California at San Francisco, Jannie Borst of the Netherlands Cancer Institute in Amsterdam, and John Coligan, Drew Pardoll, and Ronald Schwartz of the National Institute of Allergy and Infectious Diseases (NIAID), also provided evidence that the γ chain might form a part of a second type of T cell receptor in mouse and human cells.

The big question then became whether the new $\gamma\delta$ receptor works the same way the classic $\alpha\beta$ receptor does in triggering T cell activities in response to antigenic stimulation or whether it has some unique function of its own. The answer to this question is not yet in, but identifying the gene for the δ chain is a high priority for investigators because a better understanding of its nature could provide clues to the receptor function.

Recently, Yueh-hsiu Chien, Mark Davis, and their colleagues at Stanford University School of Medicine identified a new T cell receptor gene that may be the one coding for the δ chain.* The gene is interesting not just because of its possible function, but because of its rather surprising location—nested within the gene coding for the α chain of the T cell receptor.

The complete genes for the α and β T cell receptor proteins resemble those encoding antibody proteins in that they are assembled from separate DNA segments. It takes three such segments, designated V (for variable), J (for joining), and C (for constant), to make an α gene. The candidate δ gene is located preceding the J segments of the α gene.

The newly identified gene fits the general pattern of a T cell receptor gene. It, too, is assembled from separate segments of DNA, although it includes a fourth segment, called D (for diversity), in addition to the V, J, and C segments. In addition, the joining of the V, D, and J gene segments occurs at the

*The data were presented at a symposium on "The T Cell Receptor" that was sponsored by Smith Kline & French and the University of California at Los Angeles and held on 26 April to 1 May in Keystone, Colorado.