It seems evident, however, that there has been a retreat from the liberalism assayed under Khrushchev. The group now dominating the Kremlin seem to be "conservatives" in Soviet terms, which is to say that, as authors of the détente, they are probably following a more tolerant line toward dissenters than pleases elements on the Soviet right, who seem to favor a return to Stalinist fundamentals.

The matter of emigration to Israel—leaving aside implications of anti-Semitism—raises serious problems for the Soviet Union with its many nationalities. As it is in other countries, regional and ethnic consciousness is on the rise in the Soviet Union, and special treatment of Jewish citizens is not lost, for instance, on Crimean Tatars or Volga Germans.

As for the dissidents, in the Soviet Union, protest is viewed as criticism of the state and, in ideological terms, very much like heresy in a clerical state. There is no provision for an opposition loyal or otherwise in Soviet law, or for that matter in the Russian experience.

The protesters themselves are far from a united "movement." There seems even to be the traditional split, long antedating Communism, between the westernizers and the Slavophiles. Sakharov, with his espousal of personal freedoms, seems to fit in the former category. The Slavophiles reject European values and advocate the old Russian virtues; the view is said to have strong exponents among the military and even in the Communist youth movement. Medvedev is described as a "party democrat," an advocate of reform of the party from within. Chalidze is a self-made expert on what he sees as the government's illegal use of Soviet law.

The protesters have always been relatively few in number. They have failed to establish any real link with workers on collective farms, in factories or offices, or even, apparently, with university students. The protesters, an extraordinarily courageous group, have mostly been members of the Soviet elite and therefore specially privileged even in being less vulnerable than other Soviet citizens might be in "demonstrating" for their views.

Ironically, now that the categories of the Cold War are beginning to unfreeze, the protesters seem even more isolated and their lot uncertain. And this suggests that redefining coexistence is going to be a very tricky business on both sides.—JOHN WALSH

Herbicides: Agent Orange Stockpile May Go to the South Americans

Since early this year, the U.S. government has been toying with the idea of giving or selling its surplus stockpiles of Agent Orange, a military herbicide that was withdrawn from use in Vietnam in 1970 after concern was raised about its teratogenic properties, to Brazil, Venezuela, Paraguay, and possibly other South American governments.

The U.S. Air Force has a surplus stockpile of 2,338,900 gallons of Agent Orange, of which the original purchase price was $16,540,000. Some of it contains as much as 28 times the maximum acceptable safety limit of dioxin, a chemical which is one of the most potent teratogens known. Apart from the returning prisoners of war, these herbicides are perhaps the most politically sensitive property the United States has retrieved from the Southeast Asia battlefield.

Now, thanks to two enterprising businessmen, the Agent Orange may be used to flood the Latin American herbicide markets in the name of international development and improving the U.S. balance of payments. Jerome F. Harrington, president of IRI Research Institute, Inc., a New York firm and one of the two which have proposed the deal, says that the Agent Orange could be diluted and the barrels could be repainted (to conceal their old military markings) and then sold to farmers for prices as low as $5 per gallon, or a third of the going price of herbicide there of $15 per gallon. Even undiluted, the total military surplus would net $11.5 million, more than this country's herbicide sales in South America in 1971. "It would be developing markets. . . . We're beating swords into plowshares," he says.

The implications of the plan are two. First is the fact that Agent Orange was withdrawn from Vietnam after reports of a possibly worrisome number of stillbirths and defective fetuses in provinces where the herbicide had been sprayed intensively. Since there may have been a threat to the South Vietnamese, presumably there may be some risk to the South Americans were it used there. A second implication is that despite its obvious agricultural utility as a brush killer, Agent Orange is also a proven military weapon. Sources admit that once sold, there would be little further control; there is a remote chance that the recipient countries could use it against guerrillas, or, in the case of Brazil, against the natives in the northwestern portions of the country which the government is trying to "clear" for development. (The Portuguese and South Africans already buy U.S. herbicides commercially.)

Agent Orange is not exactly milk or honey.* It is made up of two chemicals: 2,4,5-T and 2,4-D. The former contains a manufacturing impurity called dioxin, which is highly teratogenic; 2,4,5-T is also somewhat teratogenic itself. In fact, after a lengthy controversy, the Environmental Protection Agency (EPA) has banned most crop-related uses of 2,4,5-T; and rangeland use may also be canceled. As for 2,4-D, the other half of Agent Orange, there are indications that this too is teratogenic, but the issue has not yet been resolved. Samuel S. Epstein of Case Western Reserve University Medical School and an environmental toxicologist who has written on dioxin problems,† says of the proposed Latin American deal: "This is a perfectly preposterous idea."

At the moment, the main thing standing in the way of the transaction is EPA action on an Air Force application to register most of its Agent Orange

* Agent Orange consists of 50 percent 2,4,5-trichlorophenoxyacetate and 50 percent 2,4-dichlorophenoxyacetate. † See Samuel S. Epstein, "Teratological hazards due to phenoxy herbicides and dioxin contaminants," in *Pollution: Engineering and Scientific Solutions* (Plenum Press, New York).

for domestic U.S. use. The State Department has ruled that it will not consider foreign sales unless EPA approves the registration. So far the Air Force has encouraged the two businessmen with the proviso that the recipients accept the herbicide "with open eyes" as to the dioxin problem. One reason for the Air Force's friendliness to the plan is that the stocks, of which 1.5 million gallons are in the open air in Johnston Island in the North Pacific and the remainder largely in Gulfport, Mississippi, are in barrels that are rusting and cost up to $400,000 yearly to maintain. Hence the hurry. (Last year, the Air Force filed a draft environmental impact statement proposing to incinerate the stocks at Sauget, Illinois, and Deer Park, Texas. But the plan ran into opposition as being technically unsound, environmentally dangerous, and expensive. It was eventually dropped.)

In January of this year, Air Force Deputy for Supply and Maintenance Lloyd K. Moseman, II, was approached by Arnold Livingston, chief officer of Blue Spruce International, a firm in New Gretna, New Jersey, with a proposal that the Air Force turn over the Agent Orange to him and he would distribute it in South America. Moseman says he told Livingston that the Air Force could not hand over its property to a private concern. Livingston then approached Harrington of IRI, a nonprofit firm which was founded with Rockefeller family money in 1950 and which runs experimental agricultural programs in South America. Harrington and Livingston apparently then made a variety of proposals, including trying to get officials in Brazil, Venezuela, and Paraguay to express interest directly through U.S. government channels. The Agency for International Development (AID) also was involved in the discussions.

"I said yes, that, if the countries wanted it and have open eyes as to the dioxin content, we would be amenable because it would be a heck of a lot cheaper" than incineration, says Moseman. "I said we would be amenable to requests on this basis."

However, Moseman also decided to seek the advice of the State Department—through Thomas Pickering, Deputy Director of the Bureau of Politico-Military Affairs—and of the EPA by filing an application to register the Agent Orange for commercial use in the United States. The State Department keeps a list of munitions whose export is considered sensitive and which includes "any chemical agent adapted by the military for use against plants."

Pickering ruled in early February that State would not formally take up the Agent Orange export problem until after EPA had ruled on the application for domestic use. "We would never do overseas anything we were not prepared to do at home," said a State Department official. "Until the EPA thing is worked out we are not in a position to decide. I regard this as a nonproblem for us."

Thus, whether Harrington and Livingston succeed in making a deal now depends on EPA's Associate Director of Pesticide Registration, Douglas Campt. His office is studying the application, which covers Agent Orange formulations having 0.4 part per million (ppm) dioxin content. The stockpile of 800,000 gallons at Gulfport ranges from 0.4 to 14 ppm in dioxin: that at Johnston Island is not labeled barrel by barrel, so the Air Force does not know its dioxin content. A random sampling, however, showed an average dioxin content of 1.9 ppm. Moseman admits each barrel would have to be sampled separately.

At present, EPA has banned virtually all uses of 2,4,5-T, except for rangeland, pastures, and right-of-way clearings. Permitted dioxin concentrations are 0.1 ppm for new herbicides and 0.5 ppm for stocks already manufactured.

Agent Orange's Impact

Epstein and others were queried about the possible environmental and teratogenic effects of spraying Agent Orange, as Harrington has proposed, by diluting it with diesel oil and using it only to keep existing rangeland cleared. Harrington says it would increase Brazil's beef production by $400 million per year, and open new inroads for U.S. chemical firms on the Latin herbicide market, where German and Japanese firms compete with the United States. Harrington indicated that to keep rangeland clear, repeated applications would be needed. (Interestingly, EPA's current rule permitting rangeland uses for 2,4,5-T in this country carries the following warning: "Do not graze meat animals on treated areas within two weeks of slaughter.")

As to the utility of the 2,4-D in Agent Orange, the Dow Chemical Company's Ag-Organics Department spokesman, James Hansen, said 2,4-D was highly effective. "You can just stand in a vineyard and think of 2,4-D and the leaves will wither," he quipped.

Epstein, however, listed a variety of problems, of which the possibility of human birth defects was the most obvious, if the herbicide concentrates in human food or water supplies, either inadvertently or through misuse. Dioxin, he said, is highly stable in the environment and would persist "up to a year or so." It is known to be picked up by plants such as soybeans and oats. There would also be the possibility of contamination of watersheds in range areas. Finally, Epstein noted that, in primitive agricultural situations, burning is a common technique for clearing land. "You have to assume that anything released into the environment will be burned," he said. Combustion of shrub or brush sprayed with herbicides containing 2,4,5-T, may produce additional dioxin in the surrounding environment, he says.

Proper application of the Agent Orange could be insured, according to Harrington, by an IRI or AID program of "education and demonstration" to the farmers. But the Dow spokesman admitted that, in general, "Once you sell anything you lose control. . . . Only education and reformulation," could prevent misuse. "All these chemicals are possibly misused," he admitted.

The difficulties of controlling agricultural uses of the Agent Orange obviously are small compared to the problem of prohibiting the material from being appropriated by the military in recipient countries and used as weapons of war. One herbicide expert, who asked not to be named, pointed out that the Brazilian government is currently carrying out what in his view is "one of the largest paramilitary operations against an indigenous people anywhere in the world," in its efforts to "open" the Amazon Basin in northwestern parts of the country and relocate the native populations who live there.

He said that, originally, Agent Orange was developed in World War II specifically for crop destruction and used for this purpose both by the British in Malaysia and by the United States in Vietnam. Hence, it is historically suited to the Brazilians' "paramilitary" activities.

Epstein also expressed concern about the possible military uses of Agent Orange and the world example the United States would be setting in transferring this weapon to foreign nations.

> Clearly we would be turning over to other countries materials which can be used for a wide range of purposes, including some military ones.

It is tantamount to the encouragement

of chemical warfare. It is tacitly permitting the very, very critical possibility that in the hands of foreign countries it will be used the way it was used by the United States in Vietnam.

One cannot exclude the significant possibility that the example of the United States in Vietnam will be mimicked. I view the whole thing with horror.

Overshadowing the possible South American sale, as well as even the forthcoming EPA decision on domestic uses, is Agent Orange's prior history in Vietnam. Moseman warned in an interview, "Don't forget Vietnam. Never forget that. It's the overriding issue that clouds this thing. Anything that has to do with it is suspect." The State Department spokesman said the same thing, but in State's departmentese: "The political and psychological concerns associated with its use in Vietnam are very real."

Harrington, who is hopeful for an agreement with the Air Force, ultimately, was asked whether he felt sensitive about the fact that the herbicide was used in Vietnam. Citing his personal experience as a platoon leader in World War II who "used to clear out the woods after the tanks," Harrington said he thought the herbicide had been used in Vietnam to "save American lives." He cited the reaction of a South American government official who was asked whether he felt the Vietnam connection was a drawback and retorted: "What do you mean war materials? . . . The only thing we're fighting is the brush."

—DEBORAH SHAPLEY

Immunology: Two Immune Systems Capture Attention

There are fashions in science, just as there are in other areas of human endeavor, and fields of science move in and out of fashion in cycles, coming into style whenever the number of potentially answerable questions is high. Today, immunology is one of those fields which is very much in vogue.

Interest in immunology, among the public as well as scientists, has grown remarkably during the last decade. The enthusiasm for human organ transplantation that peaked in the late 1960's certainly gave a new urgency to the questions of immunological rejection that accompany transplantation.

Scientists' enthusiasm for immunological research was also enhanced by basic discoveries about the design of the immune system, which opened the door to an enormous number of experimental approaches to problems in immunity. At the same time, it became increasingly clear that manipulation of the immune system as a workable way of treating a considerable number of human diseases was within reach.

To the extent that funding levels say anything meaningful about what is going on scientifically in any given field, the steady increase in support that immunological research has received from the National Institutes of Health (NIH) is telling. In 1964, NIH (including each of the institutes that spent money in the area) supported primary research grants in immunology to the tune of $13.076 million. Last year, NIH paid for almost $47 million worth of research in immunology. The figures for 1972 can be broken down as follows: research grants, $29.683 million; contracts, $10.391 million; intramural research, $6.822 million. (According to an NIH spokesman, there are no available figures for contract or intramural research in 1964, "probably because there was none, or very little.")

Immunologists may not be overburdened with money, but, from a purely historical standpoint, they are getting richer.

In the beginning—back in 1798, when Edward Jenner discovered those milkmaids who were immune to smallpox —immunology was a field for those whose primary concerns were with infectious diseases, allergies, and questions about how antibodies are made. For a long time, certainly throughout the first half of the 20th century, immunological research continued to be focused on such problems.

Many immunologists who explored the chemical basis of antibody-antigen interactions and the molecular basis of antibody structure were convinced that, in order to understand how antibodies (or immunoglobulins) work, they would have to know precisely what immunoglobulins look like, just as molecular biologists had to know what DNA looked like before they could begin to understand the gene. And considerable progress has been made in this direction. (Last year, Gerald Edelman of Rockefeller University and Rodney Porter of Oxford shared the Nobel Prize for their work in elucidating the molecular structure of immunoglobulins.)

But strictly speaking, the investigators who did so much to put immunology on firm ground scientifically were not immunologists at all. They were chemists or molecular biologists, and their colleagues thought of them that way.

In fact, this still is true. A look at the departmental affiliations of the participants in any recent meeting on immunology shows that immunologists come in all sorts of disguises. Lots of them are pediatricians. Many are geneticists. Others come from departments of microbiology, pathology, radiology, biochemistry, and cellular physiology.

The situation is revealing. On the one hand, it points out the tremendous heterogeneity of immunology as a discipline, reflecting the broad range of the immune system itself. On the other, it shows that immunology even now has not achieved full stature within the biomedical community. Many universities have "sections" on immunology. Very few have full departments. These may come.

Among the most productive studies in contemporary research in immunology are those on the immunodeficiency diseases, in which part or all of an individual's immune system is defective.

To convey something of the direction and rapidity of movement in this field, the News and Comment section—in something of a departure from its usual content—is running two articles on immunology. The first summarizes much of the current knowledge on the nature of the immune system. The second will look at some attempts to use the immune system as a therapeutic tool.