signatories that the quinquennial review conferences offer a means of twisting the arms of the nuclear powers on arms control may paradoxically help to keep some states loyal to the treaty. Others, however, will no doubt be able to use the failure to produce an agreed report as an excuse for withdrawing from the treaty, even though those tempted to take such a step will no doubt be impelled in that direction by separate political considerations.

In the wake of the Geneva conference, the meeting of the Committee on Assurances of Supply of the International Atomic Energy Agency, planned for the end of this month at Vienna, assumes greater importance. It is thought unlikely that the nuclear powers will be spurred to further negotiations on strategic disarmament at least until after the American presidential election.

Plutonium

Dounreay loss

Only a few weeks before the British government is due to make an announcement on the future of the fast breeder reactor, the BBC television programme *Panorama* alleged on 8 September that a total of 35 gram of plutonium from the prototype fast reactor at Dounreay was lost in 1973 and 1976. The United Kingdom Atomic Energy Authority admits that the plutonium has never been accounted for, but says that it could not have left the fuel cycle and was most probably reprocessed or even dumped in a waste repository.

The first case of missing plutonium occurred in 1973 when a routine accountancy check revealed that 10 gram of the element was missing from a can containing the remnants of several spent fuel pins. The pins, originally about 0.2 inches in diameter and 2 feet long, had been irradiated in the reactor core for one year and then chopped up for analysis by chemists and metallurgists. The shortfall in plutonium was equivalent to one fuel pin.

The second case concerned a fuel pin which had been irradiated in the reactor core for one day in 1966. It had then been treated in the same way as the first pin and the can containing it had been stored in a cooling pond. It contained 25 gram of plutonium. In 1977, the can that was thought to contain the remains of the fuel pin was found to contain another type of spent fuel.

The UKAEA says that it investigated the losses and reported the second to Euratom, of which Britain was then a member. A driver of a mechanical digger was hired to uncover all the material in a dump of low-activity waste in the hope that the second lot of missing plutonium would be discovered. The contents of the dump were analysed, but the missing spent fuel was not found.

The UKAEA says that each case was investigated thoroughly, and that the to missing irradiated fuel pins must either have been reprocessed or dumped in a depository for highly radioactive wastes, examination of which would be too hazardous to undertake. It says the plutonium could not have been removed from the fuel cycle. Its conclusion is that there must have been an error in the system of keeping records of the movement of plutonium. Since the incidents, the UKAEA says, it has tightened up on its procedures for monitoring the movement of radioactive materials around the plant.

The *Panorama* programme was also critical of operations at Dounreay on health and safety grounds. It claims that the driver of the mechanical digger, a deaf-mute, was not properly aware of the hazards of what he was doing and was not given adequate protective clothing. It also cites another incident in 1979 when eight men were exposed to plutonium after handling radioactive waste. None of them was aware that the waste contained plutonium and at the end of their shift it was discovered that they had been exposed to radiation.

About this incident, the UKAEA says that the waste handled by the men contained only one gram of plutonium and that none of the men was later found to have significant amounts of plutonium in his blood or urine. The incident had not been reported because the level of alpha radiation in the air in which the men were working was well below the level at which notification to the authorites is obligatory. An attempt was made, says the UKAEA, to inform the deaf-mute driver of the hazards of what he was doing. He was told to stay in his cab and air samples were monitored for radiation. The levels found were within the safety limits.

The uncovering of the incidents has provoked a strong reaction from Mr David Steel, leader of the Liberal Party, who has called for a ministerial statement on the affair. Even before the showing of the film, the AEA had issued a statement that *Panorama* had exaggerated the significance of these incidents, and had also charged the BBC with having declared an interest in making a film about this achivements

Judy Redfearn

Academic freedom

Talking shops

The Hague

Three papers by Dr Andrei Sakharov, written since his exile to Gor'kii, *Eksperimental'noi i Teoreticheskoi Fiziki* (*ZhETF*), the most prestigious physics journal in the Soviet Union. This remarkable development was announced by Nobel Laureate Philip Anderson to last week's Conference of the International Sakharov Tribunal of Conscience and Peace.

According to Professor Anderson, the Editor of the *ZhETF* had initially accepted the papers, which deal respectively with time-reversal, quark/gluon interaction and mass formulae for muons and baryons. At a late stage, however, the censors stepped in to stop publication. The matter, said Professor Anderson, was finally "adjudicated" by the Central Committee of the Politbureau, who decided that publication could go ahead.

The story which amplified by Professor Edward Lozansky, Chairman of the International Sakharov Committee, New York, and a former member of the Moscow Sunday Seminar for Jewish "refusnik" scientists. He told the conference how he had brought the three Sakharov papers to the meeting of the American Physical Society (APS) in April, which decided that if the papers were turned down for political reasons by the Soviet journals the APS would be delighted to consider them. This, thought Lozansky, had probably swung the balance in Sakharov's favour.

Ironically, this revelation of how much Western academic pressure can achieve on behalf of a harassed Soviet colleague was announced at a conference which, in the opinion of several campaigners for academic freedom, should not be taking place at all. One of these is Mrs Tamara Yankielevich, Sakharov's stepdaughter-in-law, now resident in the United States. The main grounds for opposing the conference have been the veiled hints from the Soviet side that vociferous action might jeopardize a plan to allow Sakharov quietly to return to Moscow. "Six months after being exiled" was the first date promised for his return; this has now however become "six months after the end of the Olympics".

Unlike the various other "Sakharov" human rights conferences in the past few years, the Hague conference was a human rights conference specifically focused on Sakharov's own plight. As several speakers pointed out, this is a relatively mild plight. For example, Sakharov still has access to a scientific library just across the street from his Gor'kii apartment. Because all the scientific institutes in Gor'kii are involved in classified work, however, there is no possibility of his having any contact with fellow scientists in his place of banishment.

In his presentation to the conference, Professor John Ziman of the University of Bristol suggested that one of the reasons scientists are particularly concerned with Sakharov's case is that his involvement with problems of academic freedom and human rights generally grew out of his disillusionment with a career in nuclear weaponry — what Ziman called "black science" — like black magic, "the application of knowledge in the power of evil".

His "pilgrimage", as Ziman called it, is therefore of particular concern to all scientists, "hard put to it these days to defend our traditional norms — the universality, the disinterestedness, the openness of a transnational community bringing beneficial knowledge to all".

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Coincidentally with the Hague conference, two other meetings concerned with the political repression of scientists also took place last week. In Amsterdam, there was the annual meeting of the International Council of Scientific Unions (ICSU) and of its specialist committees, including the Committees on the Free Circulation of Scientists and Safeguards of the Pursuit of Science. This committee, which compiles a register of cases of scientists subjected to unwarranted restriction, is less well known than it should be. During the past year, only some seventeen such cases were added to the register.

The particular roles of scientific and learned societies were stressed at the other meeting last week — the half-day session on scholarly freedom and human rights at the Salford meeting of the British Association.

At such conferences, the question of how to translate concern into concrete action is usually answered only vaguely. On this occasion, Dr Louis Cohen, secretary of the Physical Society (London), put forward a fourteen-point scheme of progressively more severe responses that learned societies might make (see below).

By way of demonstrating what may be achieved by pressure from professional colleagues, Professor John Charap of Queen Mary College, London, was able to announce at the BA meeting an unprecedented success in the case of Yurii Gol'fand, his fellow researcher on supersymmetry. Gol'fand, who was dismissed some years ago from his post as senior researcher at the Lebedev Institute of Physics in Moscow following his application to emigrate to Israel, was, a few weeks ago, reinstated.

Vera Rich

Marks of reproof

What follows is a summary of Dr Leslie Cohen's suggestions as to how learned societies may help colleagues elsewhere whose academic freedom or human rights are restricted (see text).

1. Statement by the President of the Society.
2. Formal protest by Officers of the Society (published in the Society's bulletin).
3. Provision of facilities for protest meetings, press conferences.
4. Official letter of protest to head of State Party/Academy.
5. Dissemination of information on individual cases to members.
6. Advising members to refuse to
   (a) attend meetings in offending country;
   (b) invite scientists from offending country to conferences;
   (c) allow visits of scientists from offending country, to scientific establishments/laboratories;
   (Note in special cases, visits may be made contingent on discussion of human rights issue in question).
7. Organization of petitions by members on specific case.
8. Granting of recognition and/or publicity to "alternative" meetings and seminars organized by banned scientists.
9. Organizing and/or supporting meetings relating to the work of one particular scientist suffering repression.
10. Sending delegation to investigate cases and intervene if possible.
11. Providing journals free to banned scientists.
12. Providing financial support to exiled scientists.
13. Severing formal relations with academies/societies in offending countries.
14. Causing expulsion of academies/societies of offending country from international organizations.

Hoyle on life

No dissent

It would be hard to imagine an event more like that of Daniel entering the lion's den than last week when Sir Fred Hoyle, brandishing his theory that influenza epidemics are caused by extraterrestrial viral material, gave a seminar at the National Institute for Biological Standards and Controls in Hampstead, London. In the event, Sir Fred escaped almost as unscathed as Daniel, although perhaps for different reasons.

Hoyle has evolved his theory in conjunction with Professor N.C. Wickramasinghe of University College, Cardiff, with whom he has recently collaborated on a series of papers on the occurrence of biochemicals in intersteller space. The theory that viruses might also be present in space is a natural extension of that line of work. It is worth postulating, according to Hoyle, because of some anomalies in the epidemiology of influenza which defy the conventional explanation that the virus is passed from person to person, with animals acting as a reservoir.

The anomalies to which Hoyle points are few but striking. He cites, for example, outbreaks of influenza in boarding schools where the great majority of cases occur simultaneously quite unlike the expected, progressive spread from one or a few initial cases. More strikingly he points to reports of the simultaneous outbreak of influenza in the USA and India during the 1918 pandemic. What better explanation for such phenomena than that a space-borne factor descends to trigger the influenza in all cases at the same time? And, in support of that notion, Hoyle marshalls plenty of evidence of atmospheric events that could account for the odd incidence of influenza.

A version of Hoyle and Wickramasinghe's theory that has been circulating in preprint form proposed that individuals carry as part of their own genes the genetic information for each of the many types of influenza virus and that there was a separate space-derived, activating factor for each.

Now, however, he is persuaded that this version of the theory is inadequate in part because of overlooked evidence and in part because biological systems have a good deal more slack than he, as a physicist, had been aware of. As a result the theory has become more complex and now involves a coincidence of three virus-related components, two of them space-derived, for infection to occur.

In becoming so complex, the credibility of the theory has undoubtedly been stretched more than ever. There is also the question of whether or not the basis of the theory — the anomalous epidemiology — is sound. Thus in the discussion that followed Hoyle's talk, Dr A. J. Smith of the Influenza Research Unit at St Luke's Hospital, Guildford, outlined his unit's study of the spread of influenza in a school. Unlike the evidence cited by Hoyle, Smith's data fitted the classical progressive spread of the disease, from a single person, to all those who finally succumbed.

That, however, was the only criticism of substance put to Hoyle in the discussion period. One respected influenza expert was prepared to venture the view in private that whereas he and others had no time for Hoyle's theory they were too polite to say so; "in the USA he would have been eaten alive".

And so it came to pass that, for reasons perhaps more British than biblical, Sir Fred survived the tame lions of Hampstead.

Peter Newmark

Electric vehicles

UK content

Government and industrial support for British research and development on electric vehicles should continue at its present level even though it is likely to be many years before electric vehicles become commercially viable. This is the main recommendation of the first report of the House of Lords Select Committee on Science and Technology, published last week.

The technical problems of developing advanced batteries suitable for use in private cars and of building an infrastructure for overnight recharging are identified as the main obstacles to the early success of the all-electric car. Another problem is that most of the advantages accrue to society and the electricity generating industry and most of their disadvantages fall on their owners. Their commercial success is therefore unlikely much before the petrol-run car becomes exceedingly expensive to run, probably towards the end of the century.

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