

## For Debate . . .

# Nuclear weapons proliferation, medicine's supreme challenge

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Nuclear proliferation, because of its ability to threaten human survival, is fast coming to overshadow all other global issues.<sup>1-7</sup> When the renowned explorer Jacques-Yves Cousteau addressed the UN General Assembly in 1976 he observed that atomic power had "reshaped what we may fear, what we may dream, how we live and how we may die." He was emphasising as many before him had done that since August 1945, when the 14-kiloton uranium bomb Little Boy was unloaded over Hiroshima reputedly killing 100 000 people and destroying 60 000 buildings, a totally different world had come into being. The nuclear Pandora's box was now unlocked, and as a result mankind had acquired for himself an altogether novel potential for self-destruction.

Since 1945 the earth's nuclear arsenals have expanded enormously. They are now believed to contain 60 000 weapons, both strategic and tactical, and to possess more than one million times the power of the Hiroshima bomb.<sup>8,9</sup> Both superpowers have an overkill capacity that can only be described as daunting. Thus in the early 1970s it was estimated that the USA had enough strategic weapons to destroy 50 times over every Soviet city with a population of 100 000, while the USSR had the ability to raze American cities of comparable size 20 times over.<sup>1</sup>

In the SALT II Agreement of Vienna 1979 strategic force numbers were to be allowed to build up to the following totals in the mid-1980s<sup>10,11</sup> (J Erckson, personal communication). In the case of the USA the total number of launchers (1054 intercontinental ballistic missiles, 656 submarine-launched ballistic missiles, and 390 bombers) would be 2100: total warheads would be 9854 and total megatonnage 3178.5. When the Trident I submarine-launched ballistic missile, short-range attack missiles, and air-launched cruise missiles were added, totals would be 2180 launchers, 736 SLBMs, 13 904 warheads, and 3332.5 megatons. On the Soviet side the assumption was of a build-up to SALT II levels with the addition of the Backfire (TU-22M) bomber, and at the Vienna meeting Leonid Brezhnev confirmed that the production of this bomber would not exceed 30 a year. For the USSR the intercontinental ballistic missile total was to be 1328, submarine-launched ballistic missiles 1003 (955 covered by the SALT Agreement), the launcher total 2438, warheads 8294, and the megatonnage 10 111.

Weapons are constantly being improved, modified, and upgraded. The USA is currently concentrating on its intercontinental ballistic missile Minuteman III, while Trident I is to replace the aging Poseidon, Pershing-II ballistic missiles, land-launched cruise missiles, MX mobile missiles, and highly accurate manoeuvrable re-entry vehicles (MARVs). Since 1969

the USSR has deployed three new intercontinental ballistic missiles (SS-17, SS-18, and SS-19) and three new submarine-launched ballistic missiles (SS/N/8, SS/N/17, and SS/N/18), the last being fitted with multiple independently targetable re-entry vehicles). She also possesses a formidable medium-range ballistic missile in the SS-20.<sup>12-14</sup>

Spectacular qualitative advances have been a feature of the nuclear arms race in recent years. This is reflected in the increasing accuracy—measured as circular error-probable\*—with which warheads can be delivered. The B20 bomber that attacked Hiroshima had a very large circular error-probable. Since then, however, the situation has changed out of all recognition. For example, the new US missile system MX should soon be able to achieve a circular error-probable of only 100 m,<sup>9</sup> while the Soviet Union's SS-18, thought currently to have a circular error-probable of about 500 m, should soon be much more accurate.

### Combat not deterrence

Since the 1950s nuclear deterrence has been based on the American strategy of mutually assured destruction, which threatened retaliation against population centres in the two countries on the outbreak of a nuclear war. Now, however, the much more dangerous counterforce doctrine—the possibility of using weapons capable of destroying those of the other side by a first strike—seems to be gaining ground with both Superpowers.<sup>5,9</sup> Increasingly, weapons are being developed for combat rather than for deterrence, and the view is being sedulously fostered by the military establishments on both sides that "limited" nuclear wars could be both feasible and effective, that casualties could be reduced to an "acceptable level," and that essential industry could be protected against a nuclear detonation.

The Stockholm International Peace Research Institute, founded in 1966 to commemorate Sweden's 150 years of uninterrupted peace, has now become one of the recognised global watchdogs on the armaments race. In recent years the institute has been proclaiming, with an ever-increasing sense of urgency, firstly, that the spread of "peaceful" nuclear technology throughout the world is opening the floodgates to the manufacture of weapons of mass destruction and, secondly, that whereas at one time the situation was manageable now it has become thoroughly anarchic.<sup>15-17</sup> The Institute has continuously emphasised that the proliferation issue, being essentially political rather than technical in nature, is especially dangerous and intractable, and this point was admitted when the International Fuel Cycle Evaluation Programme, set up by ex-President Carter in 1977 to study weapons proliferation in detail, finally reported early in 1980.<sup>18</sup>

\*Circular error-probable can be defined as the radius of the circle centred on a target within which half of the warheads aimed at the target will fall.

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### Proliferation of atomic plants

Since 1954 about one country a year has installed atomic plants. According to the Stockholm International Peace Research Institute there were 234 reactors operating in the world at the end of 1979.<sup>17</sup> These were shared by 22 countries and were generating 120 000 Megawatts (MW) of electricity. The EEC had 73, the Eastern bloc 36, North America 79, and Asia 27. A further 227 reactors were under construction worldwide, and these were designed to generate 206 000 MW. Countries without power plants at present but soon to install them included Brazil, Cuba, Mexico, and the Philippines in the Third World, and South Africa and Yugoslavia in the industrialised world. Looking into the future the Institute forecast for 1985 is for 450 reactors in 35 countries generating 300 000 MW of electricity. For 2000 AD, if nuclear migration is permitted to continue at anything like its present rate, 50 countries could be generating close on 800 000 MW in this way. About 100 000 Kg of plutonium has been accumulated from civilian power reactors by 1980<sup>17</sup>; 20 years later 250 000 Kg of the material could be produced each year, enough in theory to manufacture 50 000 bombs of the type dropped on Nagasaki.

At the heart of the nuclear dilemma is the inability to separate the peaceful from the military use of atomic fission. Nations have always desired to promote the civilian atom for power generation as a means of stimulating economic growth and raising material living standards; on the other hand, they have rightly been fearful of the threat of the atom's military potential. This duality of view has been mirrored in the equivocation and elliptical dialogue that has characterised international negotiations over the past three decades. A dichotomy between the two aspects has never been satisfactorily effected and, barring decisive political action by the States already in possession of nuclear weapons, the establishment of a convincing world security system seems as unlikely in the foreseeable future as it has been in the past.

### Horizontal proliferation

At present there are six "official" nuclear weapons powers—the USA, the USSR, Britain, France, China, and India. The case of the last named is especially instructive.<sup>14</sup> The explosion of a 15-kiloton device in India's Rajasthan desert in 1974 ostensibly for peaceful purposes abruptly destroyed the exclusivity of the nuclear club and showed once and for all that an impoverished, grossly disadvantaged developing country, given the political will, could become a nuclear weapons power without too much difficulty. After 1974 horizontal proliferation—the spread of nuclear weapons to an increasing number of countries—became an omnipresent threat to world peace. And as the decade of the 80s opened it was obvious that the nuclear restraints that had operated since Hiroshima and Nagasaki were in the process of crumbling. Global denuclearisation had made no progress; an increasing number of nation states were producing atomic materials; anecdotal evidence based mainly on press reports suggested that between now and the end of the century the number of nuclear weapons powers would steadily rise.

Pakistan has become an important member of the "nearly nuclear" nations.<sup>19 20</sup> The ambitions of the country vis-à-vis atomic fission were emphasised by the former Prime Minister, Zulfikar Ali Bhutto, who once asserted that the Pakistani people were ready to "offer any sacrifice and even eat grass to ensure nuclear parity with India." In 1976 Pakistan signed an agreement with France for the purchase of a nuclear reprocessing plant; recently, rumours have been circulating that she is attempting to obtain uranium enrichment facilities, possibly with financial assistance from Libya. At present Pakistan's nuclear effort is believed to be centred just south of Islamabad, and fears are being expressed in many Western countries that the Pakistani leader, General Zia-ul-Haq, may be about to permit manufacture of the so-called Islamic bomb for reasons of national prestige.

For some years now there has been intense speculation in world capitals as to whether South Africa has developed a nuclear weapon.<sup>15 21 22</sup> In 1977 the Soviet Government openly accused South Africa of establishing a nuclear test range in the Kalahari Desert, and in September 1979 there were unconfirmed reports of an explosion over a remote area of the Indian Ocean. Pretoria's policy has been dubbed "deterrence through uncertainty" and it seems unlikely that this stance will change in the immediate future. Reports that Israel is already a de facto nuclear power capable of assembling and delivering an atomic bomb within a relatively short time circulate with monotonous regularity. The CIA is said to endorse this view, and recently collaboration between Israel and South Africa in a secret nuclear development programme has been suggested.

Argentina and Brazil are rivals for dominance in the southern cone of South America. Although both gave their blessing to the Treaty of Tlatelolco in 1967 prohibiting the manufacture of atomic weapons anywhere in Latin America, neither has yet signed or ratified the Nuclear Non-Proliferation Treaty, and in 1975 Brazil concluded the biggest nuclear deal in history with the Federal German Republic. The transaction amounted to \$4 billion and undertook to supply Brazil with a complete nuclear fuel cycle including several reactors, reprocessing plants, and enrichment facilities. At the other end of the world two Asian countries, Taiwan and South Korea, both with substantial civilian nuclear programmes (three reactors built and eight under construction), might consider that strategic guarantees from the USA are inadequate and that the only option to safeguard their integrity is to join the group of nuclear weapons States.

### International Atomic Energy Authority

What is the likelihood of a surcease being imposed on nuclear proliferation? The omens are scarcely favourable, for the malady is exceedingly deepseated, its genesis highly complex.

From the start of the nuclear age it was obvious that the spread of atomic weapons was an intolerable threat to humanity and that the only possible answer to it was some type of world level nuclear authority. The Acheson-Lillienthal Report of 1946 recognised that, "the development of atomic energy for peaceful purposes . . . and for bombs are . . . interchangeable and interdependent." On the question of inspection the report was unyielding, "There is no prospect of security against atomic warfare in a system which relies on inspections and similar police-like methods. . . . National rivalries . . . are at the heart of the difficulty. . . . If the production of fissionable materials by national Governments—or by private organisations under their control—is permitted systems of inspection cannot of themselves be made effective safeguards. . . ." The report was bold and prescient, and shortly after its publication Bernard Baruch, President Truman's special representative, appeared in front of the UN General Assembly to outline a definitive plan for the control of atomic energy. In a speech couched with drama he declaimed, "We are here to make a choice between the quick and the dead. . . . We must elect world peace or world destruction." He then recommended the immediate establishment of an International Atomic Development Authority which would place all nuclear materials and facilities under "effective international control," would stop the manufacture of atomic bombs and dispose of all existing stocks, would take punitive sanctions against nations violating the rules laid down by the authority, and would not be subject to a veto by the Security Council.

The global situation in 1981 is much more perilous than in 1946. It is still unlikely, however, that modified versions of the Acheson-Lillienthal Report and Baruch Plan would have any chance of success. The Soviet Union vetoed the latter at the United Nations, proceeded to develop its own bomb, and now possesses a nuclear arsenal of gargantuan proportions. Moscow's fear of weapons proliferation to non-nuclear weapons States is

well documented<sup>24</sup> and is often reiterated. But on the issue of overall global control she is likely to remain just as intransigent as before, mainly because the whole concept of the creation of a supranational authority involving the capitalist world runs directly counter to Marxist-Leninist orthodoxy. Co-operation could not be anticipated from aggressive nuclear vendors, such as France and Federal Germany, which during the 1970s provided nuclear hardware to all and sundry, including politically sensitive nations, such as Pakistan, South Korea, Libya, Iran, Brazil, and South Africa. India, the newest member of the nuclear club, could scarcely be expected to co-operate in global denuclearisation; nor would Pakistan, seemingly determined at all costs to obtain nuclear parity with her powerful neighbour.

China continues to regard herself as the putative leader of the Third World. She has a modest civilian atomic programme which, under Mao Tse-tung's successors, is in the process of expansion.<sup>25</sup> China continues to test nuclear weapons in the atmosphere; she made no criticism of the Indian test in 1974, and she has not so far condemned the horizontal proliferation of nuclear weapons to other developing countries. She is therefore most unlikely to regard supranational control of atomic energy with anything more than extreme disapprobation amounting to derision. Also the initiative of the United States to control proliferation embodied in the International Fuel Cycle Evaluation Programme had a cool reception. Little support was forthcoming even from Western countries, and in particular there was no enthusiasm for the proposal that the basic assumptions underlying the plutonium economy should be rigorously re-examined and that States should seek to discourage the reprocessing of spent reactor fuel and the provision of uranium enrichment facilities.

It has often been stated that nuclear proliferation could be satisfactorily attenuated if the Non-Proliferation Treaty were improved and strengthened. This treaty, drawn up in 1968, came into effect in 1970 and 10 years later had been ratified by 115 nations, the most recent recruits being Japan, Turkey, Indonesia, Sri Lanka, and Bangladesh. The treaty is in essence a bargain between the "haves" and "have nots." The nuclear weapons powers pledged themselves to end the nuclear arms race and to work towards disarmament. The other nations, having foregone the option to develop their own atomic weapons, were entitled by the treaty to derive maximal benefits from the peaceful use of nuclear fission power. Inspections under the control of the Vienna-based International Atomic Energy Authority were an integral part of the treaty but were to be confined to the non-weapons States.

From its inception the flaws in the Non-Proliferation Treaty were rather obvious. Two of the original nuclear weapons powers, France and China, did not sign it; nor did India, nor did other countries such as Pakistan, Israel, South Africa, Brazil, and Argentina—with ill-concealed ambitions in this area. Safeguards in relation to the treaty have been much less effective than originally envisaged<sup>26 27</sup>; and most important of all, the Superpowers, far from restricting production of weapons as laid down in article VI of the treaty, have permitted the arms race to continue at an even more rapid pace than before.

The review conference of 1975 evinced great dissatisfaction with the modus operandi of the Non-Proliferation Treaty and demanded that safeguards be made much more stringent; in particular plutonium recycling should be postponed indefinitely, thus obviating any final commitment to the fast-breeder reactor and the dangers which would flow therefrom. The duplicity of the Superpowers was castigated in the strongest terms. Within the framework of the Strategic Arms Limitation Talks they had visibly dragged their feet; neither seemed to have the political will to effect a reduction in its nuclear arsenals. The second Non-Proliferation Treaty review conference held in 1980 was even less successful.<sup>28</sup> The Superpowers remained intransigent, refusing to provide any concession on nuclear arms control; non-nuclear weapons States including Belgium, Federal Germany, Italy, and Switzerland were highly critical of the universal application of safeguards as laid down by the

International Atomic Energy Authority. Despite a two-day extension of the conference proceedings a consensus could not be reached on a final document.

Is there any possibility that the Non-Proliferation Treaty could be significantly strengthened? An interesting suggestion has recently been made by Shuman,<sup>14</sup> winner of the Rabinowitch Prize Essay for 1980. Recognising that neither Superpower is in favour of the horizontal proliferation of atomic weapons, Shuman proposes that the non-nuclear weapons States should exert maximal political leverage in an attempt to force the United States and the USSR to disarm. Alliances could be abrogated; access to oil, minerals, and other raw materials could be denied. But more importantly, the threat could be made of outright weapons proliferation if the Superpowers continue to ignore the disarmament clauses of the treaty. Over 100 nations announcing their intention to "go nuclear" within a given period could well have a salutary effect at the global level and might go far to reduce and even eliminate the threat of atomic warfare.

### Voice of medicine

In 1977 I wrote that, "it seemed inappropriate and even paradoxical that in the great world debate on nuclear proliferation the voice of medicine has so far scarcely made itself heard."<sup>29</sup> Doctors had failed to take a stance on the issue; although well aware of the ability of ionising radiations to cause various types of cancer and irreversible genetic damage the broader global and political aspects had not been confronted. In particular the medical sequelae of a nuclear war, although carefully documented,<sup>30 31</sup> had remained virtually unread by the profession.

By 1980, however, in the face of yet another acceleration of the nuclear arms race, the situation had changed radically and greatly for the better.<sup>32</sup> In December of that year a little publicised meeting took place in Geneva between delegations of highly placed Soviet and United States doctors and this culminated in the formation of an organisation to be known as International Physicians for the Prevention of Nuclear War. The meeting emphasised the uniqueness of the global danger and called on the caring professions in all countries to "raise their voices against nuclear war and for nuclear disarmament."<sup>33</sup>

Doctors have now begun to write about the medical consequences of nuclear war.<sup>34-38</sup> Even more importantly they are forming pressure groups to oppose nuclear weapons proliferation. In the USA the Physicians for Social Responsibility (PSR) increased its membership from 10 in 1978 to 2500 by late 1980.<sup>39</sup> In Britain a comparable body, the Medical Campaign against Nuclear Weapons (MCANW), is currently attracting members at a very rapid rate in many centres throughout the country. Both bodies rightly take the view that nuclear war is inevitable unless positive steps towards disarmament are taken. Their aim is to educate doctors, dentists, nurses, other paramedical staff, and the general public about the hazards of nuclear weapons technology and the dire consequences of a nuclear holocaust. In particular the groups will emphasise the quite unprecedented lethality that such an exchange would produce, the total inability of medical and nursing services to cope, the magnitude of the ensuing social disruption, dangers to food and water supplies, and the pattern of morbidity among survivors, including psychological sequelae.

Groups such as these must be sustained and encouraged to expand. This is because they confront an issue that above all has the capacity to throw the planet into a supreme convulsion and beside which all other activities, either personal or professional, pale into insignificance. It is in relation to nuclear war that preventive medicine reaches its apotheosis for this is the area with the greatest potential for morbidity, mortality, and environmental depredation. The medical giant has been asleep for far too long; it is pleasing to report that he is now awakening, flexing his muscles, and preparing for his tryst with destiny.

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## Letter from . . . Chicago

### Virgins of Delft

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Some chairmen of large medical departments administer their empires from large offices, patrolled by a bodyguard of lady Cerberuses, who keep out intruders and admit suspect strangers only by appointment. This fortress mentality contrasts with the open-door style, where anybody can walk into the office, though not necessarily to find the incumbent in it. Yet whether you run a closed office or an open office the results are the same: the visitors still get in. In fact, this morning I counted at least three unwelcome guests: one was climbing up the wall; another disappeared into a filing cabinet marked "departmental budget"; and the third was quietly drowning in a cup of coffee.

It was therefore with great pleasure that I learnt about the reactivation of the pest control management programme. This effort is being co-ordinated by the environmental services department and requires a set of new guidelines, revised complaint forms, and new phone numbers for pest problem reports. To allow the pest control technician to co-operate most efficiently (for "remember, preventive pest management as with

preventive medicine is best for all concerned") [sic] one must be specific when reporting a pest problem. "Be specific," the memo urges, "give exact location, area, number of pests seen—for example, two cockroaches seen in cabinets under sink in clean utility room." Yet, although these insects are usually viewed with disgust, they are not devoid of interest, being described in the *Encyclopaedia Britannica* as most primitive of all winged insects and among the oldest fossils known to man. Traditionally they have selflessly, though somewhat passively, furthered the advance of the biological sciences—as shown by the recent discovery that tight junctions between the lateral borders at the luminal aspect of their rectal mucosal cells allow water and ions to be reabsorbed via intercellular spaces by a process similar to that described in the human nephron.<sup>1</sup>

Also illustrative of these insects' dedication to science is the news from Delft, Holland, that 75 000 virgin cockroaches died immolated on the altar of science to allow the extraction of 200 µg of periplanone B. Four research groups subsequently co-operated successfully to conclude a 30-year effort to work out the chemical structure and to synthesise this 10-member ring sexual excitant (pheromone) secreted by female cockroaches to attract the males.<sup>2</sup> Less is known, so far, about the clinical structure of the other female excitant, periplanone A, or about seducin, a compound secreted by males to entrap unsuspecting