

Iran's Disarmament and Arms Control Policies for Biological and Chemical Weapons, and Biological Capabilities

Göran Bucht, John Hart, Karin Hjalmarsson, Anders Lindblad, Roger Roffey, Roger Sundqvist, Lars Trogen, Jean Pascal Zanders and Kristina S. Westerdahl



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Abstract (not more than 200 words) <p>Allegations that Iran has chemical and biological weapons (CBW) are mostly based on intelligence and cannot be evaluated by independent analysts. Therefore, this report studied first-hand information on disarmament policies of Iran, and open source information on research and vaccine production to assess biological capabilities.</p> <p>Iran has been very active in disarmament fora relating to international CBW treaties. The policies were consistent, representing a rational response to the Iranian security situation, with emphasis on abolishing informal export control and enhancing security guarantees. However, some Iranian positions appeared more aimed at prolonging the negotiations than being constructive.</p> <p>The number of research papers on pathogens and toxins clearly increased 1992-1998, partly due to government promotion of biotechnology. Many endemic diseases are caused by potential biological weapons (BW) agents. The number of publications on specific BW agents is low and apparently unaffected by the overall increase of publications in the 1990ies. The domestic vaccine industry covers the need for human and veterinary vaccines, in terms of volumes and endemic diseases targeted. Iran is actively co-operating with many countries in vaccine production, healthcare and research.</p> <p>It is concluded that open source information in proliferation analysis cannot unambiguously show whether or not a state has offensive CBW programmes. Incorrect information or lack of information affects threat perception and the image conveyed of a country's capabilities and intentions. Increased transparency could clearly improve confidence in the CBW area.</p>		
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Sammanfattning (högst 200 ord) Beskyllningar om att Iran innehar biologiska (B-) och kemiska (C-) vapen är oftast grundade på underrättelsematerial och kan därför inte utvärderas av oberoende bedömare. Syftet med denna rapport var att studera förstahandsinformation om Irans nedrustningspolitik samt öppen information om biomedicinsk forskning och vaccinproduktion för att bedöma landets biologiska kapacitet. Iran har varit mycket aktivt inom nedrustningsförhandlingar inom internationella avtal på BC-området. Deras linje har varit konsekvent och ett rationellt gensvar på Irans säkerhetspolitiska situation, med tyngdpunkt på avskaffandet av informella exportkontroller och förbättrade säkerhetsgarantier. Vissa ståndpunkter förefaller emellertid ha varit mer ägnade att förlänga förhandlingarna än konstruktiva. Antalet forskningspublikationer om patogener och toxiner ökade märkbart 1992-1998, delvis efter en statlig satsning på bioteknologi. Många naturligt förekommande sjukdomar orsakas av potentiella B-vapenagens. Antalet publikationer för specifika B-vapenagens är lågt och verkade inte påverkas av den totala ökningen av publikationer under 1990-talet. Den inhemska vaccinindustrin täcker behovet av vacciner för människor och djur, vad gäller volymer och sjukdomar som kan förebyggas. Iran samarbetar aktivt med en rad länder inom vaccinproduktion, hälsovård och forskning. Sammanfattningsvis kan öppen information inte ge ett entydigt svar på om en stat har ett offensivt BC-vapenprogram eller ej. Felaktig information eller brist på information påverkar det upplevda hotet och bilden av ett lands kapaciteter och avsikter. Ökad transparens (insyn) kan klart förbättra förtroendet inom BC-området.		
Nyckelord Iran, biologiska vapen, Biologiska och toxinvapenkonventionen, kemiska vapen, Kemvapenkonventionen, OPCW, mikrobiella patogener, toxiner, vaccinproduktion, anthrax, brucellos, svamptoxiner, proliferation, säkerhetspolitik, nedrustning, rustningskontroll		
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1 Introduction

Iran has been chosen for this study for a number of reasons. Iran has a strategic position in the Middle East and its future decisions concerning its security and economic development will have far-reaching impacts. The United States has said that Iran is part of an "axis of evil", that it develops weapons of mass destruction (WMD) and supports terrorism.¹ Iran was also of major interest before the war on Iraq 2003, and continues to be a focus of interest in the Middle East. The picture in the West is much influenced by the US view on Iran and its purported WMD programmes. The aim of this study is to analyse the situation from a broad perspective giving a background, taking into account the political situation and security policy, official statements, adherence to international arms control treaties, disarmament, research and development base in relevant areas and the industrial base. Attention has been focused on the biological area as the least information exists on a potential biological weapons (BW) programme. The chemical area has its focus on past experiences and some examples rather than a comprehensive review due to the large amount of work that would otherwise have been required. An important aspect has been to see if the methodology and approach could be a model for proliferation studies. The study has been carried out in co-operation between researchers at FOI (Swedish Defence Research Agency), Division of NBC Defence in Umeå, and SIPRI (Stockholm International Peace Research Institute) in Stockholm.

Information about chemical and biological weapon (CBW) programmes in Iran is sketchy and often coloured by the political strains between that country and the Western world. In the 1980–88 Gulf War Iran was repeatedly attacked with chemical weapons (CW). Despite Iran and Iraq both being contracting parties to the 1925 Geneva Protocol, Iraq initiated chemical warfare, first reported in the summer of 1982² and gradually integrated CW in defensive and offensive operations. To the east, the Soviet Union was bogged down in a war in Afghanistan and Western reports alleged it was employing CW against the Afghan guerrillas.³ There has also been mentioned by Alibek that BW were used at least once against the Afghan guerrillas during 1982–84.⁴ Another war involving the use of CW on its eastern border must have appeared as a distinct possibility to the Iranian leadership. According to traditional, realist understanding of national security, Iran arguably had every right and, with regard to its own population, obligation to acquire an offensive chemical warfare capability for purposes of deterrence and retaliation. Such a posture was not in contravention of

¹Bush, G., State of the Union address 2002, *CNN*,
URL<<http://edition.cnn.com/2002/ALLPOLITICS/01/29/bush.speech.txt/index.html>>

²"Iraq's scare tactic", *Newsweek*, 2 August 1982, p. 5. The agent used was a lachrymator. US officials then claimed that Iraq did not possess lethal chemical warfare agents. Iran claimed repeatedly that the first Iraqi CW attack occurred in January 1981. "A chart of chemical attacks by the Iraqi regime, January 1981–March 1988", document distributed by the Embassy of the Islamic Republic of Iran, Brussels, April 1988. See also the Statement by Dr. Ali Akbar Velayati, Minister of Foreign Affairs of the Islamic Republic of Iran before the Conference of States Parties to the 1925 Geneva Protocol and Other Interested States, Paris, 7 January 1989.

³See, for example, Perry Robinson, J., "The changing status of chemical and biological warfare: recent technical, military and political developments", *World Armaments and Disarmament: SIPRI Yearbook 1982* (Taylor & Francis Ltd: London, 1982), Table 10.6, p. 340.

⁴Alibek, K. and Handelman, S. *Biohazard*, (Random House: New York, 1999), p. 268.

international law before the entry-into-force of the Chemical Weapons Convention (CWC) on 29 April 1997. Indeed, since World War I every country confronted with a perceived CW threat has adopted a similar stand, and many countries stated this explicitly in their reservations to the Geneva Protocol. In the 1980s NATO still upgraded its CW deterrence capabilities against the Warsaw Pact countries and the United States began producing new binary chemical munitions. The Soviet Union maintained the world's largest stockpile of chemical warfare agents and had a wide variety of delivery systems.

There are no official statements from Iran confirming the stockpiling or use of CW. One analyst stated in 1989 that Iran was one of the few countries to have admitted to research, development or production of CW⁵, but no evidence was found to support this claim. During the second half of the 1980–88 Gulf War Iranian leaders made several conditional statements about acquiring CW and the circumstances under which the country might resort to chemical warfare, but there was never a formal admission to an offensive CW programme. Under the CWC Iran declared a limited offensive CW programme in 1998, but hinted it destroyed all equipment and facilities before the convention was opened for signature in January 1993. The Organisation for the Prohibition of Chemical Weapons (OPCW) has meanwhile confirmed Iran's declarations. Barring one statement, which was immediately retracted, no Iranian source has hinted at an offensive BW programme. Almost all allegations of CBW proliferation are consequently from non-Iranian sources or opposition groups.

For BW the situation is somewhat different as the Biological and Toxin Weapons Convention (BTWC) entered into force 1975. The United States unilaterally renounced and destroyed its stockpile of BW in 1969. The Soviet Union after signing the Convention though continued and expanded its covert biological warfare programme after 1975. Iran has signed the BTWC why development, production and stockpiling are prohibited and any potential BW activities or intentions must be kept secret.

Armament programmes in Iran are determined by the country's geographical location. The Gulf region is dominated by Iran and Iraq, two long-standing opponents. Until the recent open conflict with and defeat of the Taliban regime in Afghanistan, Iran's external security concerns were mainly to the West. It fought an eight-year war with Iraq in the 1980s. Materially exhausted and without a political or military reply to Iraq's increasingly effective use of CW as well as its missile bombardment of Iranian cities, it was forced to accept a cease-fire. Although it suffered no territorial losses, in view of its repeatedly stated goal to remove Iraqi president Saddam Hussein from power, the Iranian leadership was unable to claim victory. The Gulf Arab monarchies – Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates – individually or as a group, are unable to provide for their own security with respect to Iran and Iraq. They will consequently continue to rely on security guarantees extended by outside powers. This greatly affects the regional balance. The possibility of outside powers, particularly the United States, being involved in any future major conflict influences Iran's security calculations and affects decisions regarding weapon acquisition programmes. The conduct of operations by the US-led international coalition in the 1990–91 Gulf War undoubtedly also influences these decisions.

⁵Adams, V., *Chemical Warfare, Chemical Disarmament: Beyond Gethsemane*, (Macmillan: London, 1989), p. 19.

Following the occupation of Iraq in March-April 2003, US forces are located on Iran's border, an act which must be highly unsettling to the Iranian leadership in the light of the country's inclusion in the "axis of evil". Those fears may be reflected in the extensive nuclear energy programme. Both Gulf wars demonstrated to Tehran that its superior manpower and greater preparedness to sustain casualties can not offset the technological superiority of an adversary.

Western views of Iranian attitudes to security are today still coloured by the events and aftermath of the 1979 Islamic revolution. Carried by a religious ideology, the revolution appealed to all the faithful, irrespective of the country they were living in. The resulting perception (and indeed reality) of exportation of the revolution to other Islamic societies created an acute sense of threat in the West. The United States had lost a major ally and intelligence gathering base on the southern border of the Soviet Union and the steady access for the West to oil from the Gulf was thought to be endangered. More fundamentally, however, by appealing to all Muslims to re-establish the Islamic state the revolution challenged the core of the international system based on the territorial sovereign state. However, the principle of territoriality - however artificially borders may have been drawn in the Middle East by the former colonial powers - has proved a major obstacle to the expansion of the revolution. Today Iran interacts with the international community and commits itself to internationally binding agreements as a sovereign territorial state, although internally many tensions between the religious and secular sources of authority remain.

Iran has a long tradition of participating in international treaties governing the conduct of war. Irrespective of the type of regime in power, it has since the late 19th century been party to almost all agreements restricting the use of poison weapons and CBW. It contracted in both the 1899 and 1907 Hague Conventions Respecting the Laws and Customs of War, which prohibit the employment of poison or poisoned weapons in war. Iran also signed the 1899 Hague Declaration (IV, 2) Concerning Asphyxiating Gases, under which the contracting powers agreed to abstain from the use of projectiles the object of which is the diffusion of asphyxiating or deleterious gases. In 1929 it became party to the 1925 Geneva Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare without reservation. It ratified the BTWC in 1973 and CWC in 1997.

In statements on the value of such agreements, it expressed its opinion in 1969 that it considered the Geneva Protocol a codification of an existing and operational norm.⁶ During the 1980-88 Gulf War it contributed to the formulation of UN General Assembly Resolution 42/37.C, which sets forward certain procedures for the UN Secretary General, after the decision by the UN Security Council, to investigate allegations of CBW use.⁷ Apart from Jordan (which assumed the British international obligations upon independence in 1946), Iran is the only state in the Middle East to have systematically entered into all international agreements governing the use and possession of CBW.

⁶UN Document A/C. 1/PV.1710, pp. 58-60, as quoted in Bothe, M., *Das völkerrechtliche Verbot des Einsatzes chemischer und bakteriologischer Waffen* [The prohibition on the use of chemical and biological weapons under international law] (Carl Heymanns Verlag: Cologne, 1973), p. 247, footnote 440.

⁷Statement by Dr. Ali Akbar Velayati, Minister of Foreign Affairs of the Islamic Republic of Iran before the Conference of States Parties to the 1925 Geneva Protocol and Other Interested States, Paris, 7 January 1989.

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1.2 Short history of Iran

From Iran's more than 2500 years of history, selected milestones are presented below.⁸ The name Iran means the land of the Aryans, whereas Persia was the name given to this nation by the Greek. In 1935 the name was officially changed to Iran and since the revolution 1980 the full name of the country is the Islamic Republic of Iran. The religion of Islam was introduced by the Arabs in the 7th century. Nine hundred years later, the Safavid Dynasty (1502-1736), seeing themselves as the successors of the Prophet Muhammad's son in law, established Shi'ism in the country. The present-day language Farsi became the common language of the country during the Safavid's reign.

⁸Unless otherwise noted, the historical overview is based on "Iran, historia" ["Iran, history"] and "Irak-Iran-kriget" ["Iran-Iraq war"], Nationalencycledin on-line 2003, URL<http://www.ne.se/jsp/search/article.jsp?i_art_id=213137&i_sect_id=213158&i_word=iran&i_history=6>; "History of Iran." Encyclopædia Britannica Online, 2003, URL<<http://search.eb.com/eb/article?eu=109311>>; and URL<<http://emayzine.com/lectures/Iran20Century.html>>.

During the Qajar Dynasty in the 19th century, the central administration was weakened and the country became heavily in debt to Western countries. This contributed to a revolution in 1906 that resulted in the first Constitution but did not rid Persia of continued foreign influence, mostly British and Russian. However, the country managed to maintain its independence through the two world wars. In 1925, the last Dynasty of Iranian rulers, shahs, came to power, modernizing Persia into a more secular society. The latter half of the 20th century was characterized by conflicting interests over the control of Iranian oil that came to a head in 1953. The shah was forced to leave the country but with the help of the US, returned and resumed his leadership. The control over the oil was formalized through agreements with international oil companies. In the years that followed, the shah strengthened his power, becoming more dictatorial, but also carried out land reforms and invested in education and social welfare. Beginning in the 1960s, opposition to the shah grew. Religious leaders opposed reforms and secularisation. Iran was criticised both by domestic and foreign groups for human rights violations by its secret police. Demonstrations in 1978 evolved into violent riots until the shah fled the country in January 1979.

Iran has had to be concerned about perceived regional threats to its security as it is situated in a dangerous environment virtually surrounded by military threats and unstable neighbours. These include perceived threats by the United States, Israel, bordering countries like Iraq, Pakistan and Afghanistan as well as the historical rivalry with Turkey.⁹ Iran will continue to seek to assert its interests in the Caspian, Afghanistan, Central Asia, as well as Turkey and Pakistan never forgetting Russia and the United States. Iran will further try to counter US influence in the region including its security agreements with the Gulf Cooperation Council States and its military presence in the Gulf. Iran will also support Shi'ite's causes in the region. The end of the Cold War has created a new situation for Iran. Now there is increasing importance of economic forms of power which places Iran that lacks this to a larger degree at a disadvantage.

When Khomeini died in June 1989, President Khamenei became Iran's supreme leader. In July Ali Akbar Hashemi Rafsanjani, former speaker of the Majlis (Iran's parliament), was elected president and significant amendments were made to the constitution to resolve conflicts between the Majlis and the Council of Guardians. Iran condemned both Iraq's invasion of Kuwait in August and the subsequent deployment of US troops in Saudi Arabia, but resumed diplomatic relations with Iraq, which dropped its territorial claims against Iran. In the Persian Gulf War (1991), Iran remained officially neutral, but provided refuge for more than 100 Iraqi warplanes, which it later seized. After hostilities between allied and Iraqi forces ended, Iran helped Shi'ite rebels in southern Iraq against the Baghdad government. Rafsanjani supporters won a parliamentary majority in 1992. The civil war in Tadjikistan around 1992-94 resulted in thousands of refugees entering Iran. Developments in Afghanistan became a long-term threat for the whole region. Much of Iran's security concerns are focused on the Western and Eastern borders. Many Afghan refugees have crossed the border into Iran in the 1980s during Soviet times and also during the Taliban regime in the 1990s. Presently there are about 1.5 million refugees from Afghanistan. Iran opposed the Taliban regime from the beginning. In 1998, eight Iranian diplomats were

⁹Haijar, S.G., Security implications of the proliferation of weapons of mass destruction in the Middle East, Strategic Studies Institute, US Army War College, PA, USA, 17 December 1998.

murdered by Taliban troops and 70,000 men were sent to the border of Afghanistan for Iran's largest military exercise in the past decades. Iran also tried to establish a united front against the Taliban and supported the Northern Alliance. An important aspect for US future relations with Iran is the gas and oil resources in Iran. Another important aspect is the relations between the United States, Iran and Russia and how they develop.¹⁰

Iran is also an actor with regional ambitions. Through its rhetoric and active support and armament of Islamic opposition against Israel (mostly in Lebanon), Tehran has crossed other cleavages in the Middle East. Israel feels very concerned about Iran's apparent ambitions to acquire unconventional weapons and long-range unconventional weapons delivery systems. Although the ballistic missile programme was accelerated as a consequence of the 1980–88 Gulf War and not directed against Israel, the gradual extension of the range of the missiles definitely may bring Israel as well as other areas outside the Middle East within Iran's reach.

Iran's relations with the West began to improve under Rafsanjani's leadership. This was due in part to Rafsanjani's role in obtaining the release of Western hostages held by pro-Iranian Shi'ite groups in Lebanon, the last of whom was released in 1992. The Iranian economy fared poorly under Rafsanjani as the national debt grew and inflation rose sharply. In January 1993, however, Rafsanjani reaffirmed the 1989 *fatwa* (death sentence) against Indian-born author Salman Rushdie for his book *The Satanic Verses* (1988), which was considered offensive to Islam. Iran also continued to deny that it is an international sponsor of terrorism and turned aside accusations by both Algeria and Egypt that Iran sponsored terrorist groups in their countries. In June 1993 Rafsanjani was re-elected president.

In May 1995 US president Bill Clinton cut all trade and investment with Iran, including purchases of crude oil by US companies for resale on the world market.¹¹ United States officials believed Iran was planning to develop WMD and was supporting international terrorism. Iran found other buyers for its oil among Western countries that did not join the boycott. In January 1996 Iran and Russia concluded a controversial agreement to complete a nuclear power plant at Bushehr that had been begun by West Germany 12 years earlier. Construction started soon thereafter. International critics feared the plant would give Iran the ability to build nuclear weapons. In May 1997 Mohammed Khatami was elected president of Iran by a wide margin.¹²

The situation after the terrorist attacks against the World Trade Center in New York and Pentagon in Washington, DC, on 11 September 2001 and the global fight against terrorism has also changed the situation for Iran. President Khatami rapidly denounced

¹⁰Löfqvist, H., *Irans roll i Centralasien, Internationella Studier* [The Role of Iran in Central Asia, International Studies], (Utrikespolitiska Institutet: Stockholm, 2002).

¹¹The US senate passed a fourth bill that would punish countries suspected of helping Iran defences, Salt Lake Tribune 25 February 2000.

¹²For a nice summary of Iranian history in the twentieth century, start > from:
URL<<http://emayzine.com/lectures/Iran20Century.html>>

the attacks in strong language. Iran was one of the first states to send condolences to the United States.¹³

During the war 2002 in Afghanistan it offered to assist downed US pilots. Nevertheless, while Iran has made substantial efforts to reassure the United States of its friendly intentions, some prominent conservative and radical commentators viewed that Iran was getting too close to the United States and argued that Israel and American security services rather than Al-Qaida were responsible for the attacks. The head of the Expediency Council, Akhbar Hashemi Rafsanjani indicated that "the terrorist attacks in America had exposed its vulnerability and that, in the future, chemical and biological weapons may even be used in such attacks". In the United States, the fundamentalist Islamic sources of the terrorist attacks reignited the hatred against Iran among some members of the Bush administration. According to the US Secretary of Defence Rumsfeld, Al-Qaida members had been hiding in Iran and that they should be expelled. (The Iranian foreign minister had reported that Al-Qaida members had been hiding and stated that Iran had closed its borders.¹⁴) President Bush included Iran in the "axis of evil" in his State of the Union Address in January 2002. The Iranian Foreign Minister has said that the United States missed the opportunity to improve the relations by calling Iran part of "axis of evil".¹⁵

The United States has recently also renewed its "state sponsor of terrorism" designation for Iran and has identified Iran as last year's "most active state sponsor of terrorism".¹⁶ ¹⁷ Iran has denied these accusations.¹⁸ Iran has claimed that they are absolutely not active in the area of mass destruction weapons and will not have such activities in the future.¹⁹ Iranians view also the purported link between Iranian unconventional weapons programmes and Iran-supported terrorist groups as absurd. Iranians fear Sunni fundamentalist groups like Al-Qaida and believe the terrorist use of unconventional weapons principally comes from this direction. Iranians view their support of anti-Israeli terror groups as constituting a freedom struggle that would not benefit from, and would have no use for, unconventional weapons. Iran is unlikely to hand over any unconventional weapons it might have acquired to terrorist groups that at some future date might be tempted to use them in an intra-Muslim conflict.²⁰ Russia on the other hand does not regard the US approach to Iran as constructive. The positive stand the Iranian leadership took to the counter-terrorism operations by the Russian authorities in the Chechen republic is of principle importance to Russo-Iranian relations.²¹ Iranian government spokesman indicated that Iran opposed any non-UN

¹³Löfqvist, H., *Irans roll i Centralasien, Internationella Studier* [The Role of Iran in Central Asia, International Studies], (Utrikespolitiska Institutet: Stockholm, 2002).

¹⁴Iran and Al-Qaida in the aftermath of 11 September, *BBC Monitoring Middle East*, 8 October 2002.

¹⁵Bush's "axis Iran is of evil" rebuff "choked" Tehran, *Toronto Star*, 22 September 2002.

¹⁶US renews its list of terrorist states, *Africa News*, 22 May 2002.

¹⁷Iran tops State Department list as most active terror sponsor, *The Dallas Morning Star*, 22 May 2002.

¹⁸Iran brushes aside US accusations that it sponsors terrorism, *Associated Press*, 22 May 2002.

¹⁹Iran not developing mass destruction weapons, atomic energy head says, *BBC Monitoring Middle East*, 5 August 2002.

²⁰Kraig, M., An export control policy for Iran: Dealing with the latest proliferation threat, *The Monitor*, International Perspectives on Non-Proliferation, pp. 18-22, Vol. 8, No. 3, 2002.

²¹Russia does not regard US approach to Iran constructive, *ITAR-TASS*, 22 August 2002.

attack against Iraq in connection with the 2003 crisis between the United States and Iraq.^{22 23}

Lately there are signs of some improved relationships and contacts between the West and Iran. Iranian lawmakers have for the first time in two decades debated the prospects of resuming relations with the United States. Khatami has also endorsed "people's contacts".^{24 25} The EU has taken several steps in the direction of improved contacts^{26 27 28} and formal trade ties.²⁹ The Europeans believe there is more to gain by making a steady effort to strengthen the president/parliamentary government than by confrontation. The EU decision on trade ties shows differences over how to deal with Iran between the Europeans and Washington, which imposed unilateral sanctions in the 1990s. There have been reports of talks between British and Iranian officials that have been characterised as positive.^{30 31} Iran is also promoting foreign investments for example with Germany.³²

The Iran-Iraq war also highlighted Iran's strategic vulnerability and the importance of having a powerful deterrence against Iraq. Iran has turned to Russia, China, North Korea and the Ukraine for military technology. Legislation has been passed in the United States primarily aimed at Russia which means that sanctions can be imposed on countries helping Iran to develop unconventional weapons.³³ There are also some indications of growing co-operation between Iran, Syria and Russia in the area of state-of-the-art-weapons,³⁴ with arms deals being signed for the delivery of tanks, missiles and jet fighters as well as help to finish a nuclear reactor.³⁵ The United States has also pressured Russia to limit this co-operation latest at the meeting between

²²Iran cabinet spokesman says Iran opposes non-UN action, *BBC Monitoring Middle East*, 18 September 2002.

²³The war and Iran, *The Washington Post*, 21 September 2002.

²⁴Iranian lawmakers debate US ties, *Chicago Tribune*, 22 May 2002.

²⁵Conservative paper says Europeans have no confidence in Bush policies, *BBC Monitoring Middle East*, 2 June 2002.

²⁶Rafsanjani urges EU "not to be swayed by US or Zionist pressure, *BBC Worldwide Monitoring*, 26 May 2002.

²⁷Rafsanjani blasts western policies towards Iraq, *Agence France Presse*, 21 May 2002.

²⁸EU to cooperate with Iran in campaign against narcotics, *Tehran Times*, 5 June 2002.

²⁹EU backs formal trade ties with Iran, *Financial Times*, 17 June 2002.

³⁰Iranian MP describes talks with British authorities as positive, *BBC Worldwide Monitoring*, 16 May 2002 (Voice of the Islamic Republic of Iran, in Persian, 16 May 2002).

³¹Stempel J. D., Iran: A subtle problem, *The Monitor*, International Perspectives on Non-Proliferation, pp. 15-18, Vol. 8, No. 3, 2002.

³²Iran-German investment agreement to be signed soon, *Asia Pulse*, 7 May 2002.

³³House Oks bill hitting Russia for arms sales, *National Journals Congress Daily*, September 15, 1999.

³⁴ Arens threatening message to Syria, CIA paper reported, *Foreign Broadcast Information Services*, FBIS-NES-1999-0502, 2 May 1999.

³⁵Russia helps Iran's bio-warfare, *The Sunday Times*, 27 August 1995.

President Bush and President Putin in Moscow on 23 May 2002.^{36 37 38} Putin has said that "we are selling conventional weapons to Iran. We have never sold anything to Iran.... that would help Iran develop missiles or weapons of mass destruction". Iran and Russia takes the lead in trying to fashion a compromise over the division of water, oil and gas resources of the Caspian Sea and Iran shares Russian suspicions of a planned US-backed pipeline from Azerbaijan to Turkey designed to bypass both countries.³⁹ There have also been agreements on co-operation in the area of science and technology with Russia,⁴⁰ biotechnology with Cuba,⁴¹ and pharmaceuticals with Egypt.⁴² Contacts have been initiated with Kuwait^{43 44 45 46} and Saudi Arabia as well.⁴⁷ Cooperation in the health field has been initiated between Iran and Iraq,⁴⁸ as well as an agreement on bilateral trade.⁴⁹ Iran also has denied US accusation that Cuba transfers technology to Iran for germ warfare. According to Iran this has only been transfer of life saving technology like interferon or hepatitis B vaccine.^{50 51 52}

There have also been persistent reports that US and Iranian officials have had private diplomatic contact – denied by both sides – after a break of more than two decades.^{53 54 55} Increasing political tensions have also been reported. Ayatollah Ali Khameni has issued a veiled warning that he might have to call on "the forces of the people" if the

³⁶Russia won't cut back military technical co-operation with Iran, *Tass*, 4 February 2002.

³⁷Putin supports US war on terrorism but resists pressure to sever Iran ties, *The Washington Times*, 9 December 2001.

³⁸Russian Iran ties clouding Bush visit, *Los Angeles Times*, 24 May 2002.

³⁹US to pressure Russia over Iranian relations, *The Moscow Times*, 5 December 2001.

⁴⁰Iran, Russia sign agreement on cooperation in science and technology, *IRNA*, 21 September 1999.

⁴¹Iran Radio comments on economic cooperation with Cuba, *Foreign Broadcast Information Services*, FBIS-NES-1999-0711, 11 July 1999.

⁴²Iran, Egypt to establish pharmaceutical company, *Foreign Broadcast Information Services (IRNA)*, FBIS-EAS-1999-0218, 17 February 1999.

⁴³Iranian defence minister concludes visit to Kuwait, *XINHUA General News Service*, 21 May 2002.

⁴⁴Kuwait, Iran study possible military cooperation, *Agence France Presse*, 22 May 2002.

⁴⁵Iranian defence minister calls Kuwait for building regional trust, *Agence France Presse*, 21 May 2002.

⁴⁶Iran, Kuwait sign military accord, *Washington Post*, 3 October 2002.

⁴⁷On a trip to mend ties, Iran's President meets Saudi prince, *The New York Times*, 17 May 1999.

⁴⁸Iraq, Iran discuss cooperation in the health field, *Agence France Presse*, 7 March 1999.

⁴⁹Iranian, Iraq ministers discuss boosting bilateral trade, *BBC Summary of World Broadcasts*, 3 October 1999.

⁵⁰de la Fuente, J. "Wine into vinegar—the fall of Cuba's biotechnology", *Nature Biotechnology*, Vol. 19, No. 10, pp. 905-907, 2001.

⁵¹Gonzalez, D., Carter and Powell Cast Doubt on Bioarms in Cuba, *The New York Times*, 14 May 2002.

⁵²Snow, A., Iran's ambassador denies Cuba transfers technology to his country for use in germ warfare, *Associated Press*, 21 May 2002.

⁵³US quietly turns up the heat on Iran, *The Observer*, 29 September 2002.

⁵⁴Iran denies reports of foreign ministry talks with United States, *Associated Press*, 8 May 2002.

⁵⁵Iran won't talk while Bush uses words of war, *The Guelph Mercury*, 30 May 2002.

main pillars of power structure (the government, the parliament and the judiciary) cannot get their act together they may be swept aside. Tensions are mounting between reformists who control the government and Majlis and the hard-liners who control its judiciary. A death sentence of a liberal reformist academician has further aggravated the situation.⁵⁶ One could say that Iran is divided into two parts one of around 70 % of voters who elected president Khatami twice and the fundamentalist radicals behind Ayatollah Khomeini who still dominate Iran's top government bodies, The Council of Guardians, the intelligence community, the Ministry of National Guidance and some military elements including Pasdaran. There is growing disaffection with President Khatami over his inability to impose his authority on the conservatives despite his overwhelming popular mandate.

1.3 Methodology and information sources in proliferation analysis

In international security studies "proliferation" has acquired a negative connotation and refers to an undesirable process of diffusion of weaponry and technology. Moreover, in most analyses the concept is without definition and no common understanding exists on objective criteria by which a country is deemed to have proliferated. With respect to CBW, is a country a proliferator if it has the scientific, technological and industrial base to manufacture such weapons, if it has a research and development programme, if it produces weapons or weapon components, or if it actually stockpiles the munitions or deploys them with military units? In the absence of objective criteria, there is a risk that proliferation analysis can become a subjective undertaking.

In most cases countries do not admit to having an active offensive chemical or biological weapon programme. Since the 1899 Hague Peace Conference the international norms banning chemical and biological warfare - the 1899 and 1907 Hague Regulations respecting the laws and customs of war on land, which ban the use of poison and poisoned weapons; the 1899 Hague Declaration (IV, 2), which prohibits the use of projectiles whose sole object is the diffusion of asphyxiating or deleterious gases; and the 1925 Geneva Protocol - have been defective and up to the 1980-88 Gulf War were always second to direct military necessity of the belligerents or ulterior geostrategic interests of outside powers. Nonetheless, together the norms have been sufficiently strong to force governments to shroud their CBW programmes in total or near-total secrecy.

Very often only limited information about domestic decision-making processes in the country of interest is available and if it is available its evaluation against the correct setting may still be problematic. The paucity of facts means that the burden of judgement lies with the proliferation analyst, who, invariably, will be influenced by his own social and cultural background. In the context of international security, the term "proliferation" in itself carries a negative connotation and the mere fact that a particular state is selected for proliferation analysis conveys an assumption of undesired behaviour. This initial assumption can, furthermore, easily be reinforced by

⁵⁶Khamenei moves to end Iran deadlock, *BBC News World Edition*, 11 November 2002.

other negative image projections regarding that state, leading to the - possibly unconscious - rejection or devaluation of information contradicting such assumptions.

The lack of a definition of proliferation also affects subjective interpretation of data. Different analysts may have different interpretations of the phenomenon and, as a consequence, use different criteria by which they judge a state to have proliferated. For example, intelligence or other governmental agencies of some countries often release lists of proliferators that vary in the names of states or in the judgment of the status of the programmes. Such variations also occur between the agencies of a single country. Furthermore, the lack of a definition of proliferation and corresponding assessment criteria means that no consensus can exist of when proliferation has occurred or when proliferation starts to pose a risk to international security. One analyst, for instance, stated that "over 100 countries now have the industrial base to produce chemical weapons" based on a definition that "chemical weapons-capable nations are those with a chemical-industrial infrastructure enabling them to produce chemical weapons immediately upon a political decision to do so".⁵⁷ This amounts to stating that all but the least developed nations pose a proliferation threat. Even "capability" is the subject of wide-ranging interpretations.⁵⁸

Statements on proliferation also often lack a time context. One US intelligence estimate in 1998 assessed that "around 30 countries possess, once possessed but no longer maintain, or are possibly pursuing CW capabilities", approximately one-half of which are party to the CWC.⁵⁹ The statement is of little use as it can encompass programmes as far back as World War I. Similarly, allegations against specific countries are rarely accompanied by an indication of the period from which the information stems. With President Bush's introduction of the Axis-of-Evil concept the focus has shifted to a limited number of countries. In this new framework the correlation between the interest in NBC weapons and the support of terrorism play a key role.

Apart from these heuristic considerations, careful attention must also be paid to the source and quality of information. In proliferation studies, certainty of a chemical or biological weapon programme will exist in only relatively few cases: A country may publicly declare such programmes; physical evidence of such programmes, such as production and storage facilities, may be available; or international on-site inspections may confirm allegations, as United Nations Special Commission (UNSCOM) did with respect to Iraq. Even so, the certainty of a programme or a stockpile does not necessarily disclose anything about that country's capability (which, in turn, depends on the definition of capability). India, for example, declared the possession of CW

⁵⁷Bailey, K. C., *Doomsday Weapons in the Hands of Many* (University of Illinois Press: Urbana and Chicago, 1991), p. 58.

⁵⁸See, for example, Perry Robinson, J., "Chemical weapons proliferation: Security risks", in J. P. Zanders and E. Remacle (eds.), *Chemical Weapons Proliferation: Policy Issues Pending an International Treaty*, Proceedings of the 2nd Annual Conference on Chemical Warfare, Vrije Universiteit Brussel, 16 March 1990 (Centrum voor Polemologie, Vrije Universiteit Brussel: Brussels, 1991), pp. 69-92.

⁵⁹Written replies by the Central Intelligence Agency to questions by Richard C. Shelby, Chairman, Select Committee on Intelligence, US Senate, *Current and Projected National Security Threats to the United States*, Hearing before the Select Committee on Intelligence, US Senate, 105th Congress, 2nd session (US Government Printing Office: Washington, DC, 1998), p. 143.

under the CWC, but no details are publicly available about the level of integration of these munitions into Indian military doctrine.

All other public sources of information raise questions of verifiability. There are two aspects to this issue. On the one hand, there are the questions relating to the foundations on which the allegations are based. On the other hand, the medium through which the allegations are reported also has a major impact on the credibility of the allegation. Both aspects are linked to each other in multiple ways.

One particularly complex aspect of proliferation analysis is to establish the link between a country's material characteristics and its geopolitical behaviour (however desirable or despicable these may be) on the one hand and its interest in CBW on the other hand. While empirical research on CBW proliferation in the Middle East has revealed a set of shared characteristics among the known or suspected CBW proliferators, the presence of any one or combination of these characteristics could not be used as a predictor of the likelihood of CBW programmes.⁶⁰

The present study intends to bring together a more detailed description of selected parts of the Iranian scientific, technological and industrial base and in-depth analyses of Iranian policy in the international CBW disarmament fora. The study was initiated in 1998 and the last up-dates to the research material were made at the end of 2002. This report contains analyses of Iranian positions at the BTWC and the CWC, as well as studies of Iranian capabilities in the biological area, more specifically its vaccine industry and microbial pathogens and toxin research. An additional report is planned that will address allegations of Iranian CW and related subjects in more detail.

⁶⁰Zanders, J. P., *Chemical-Warfare Weapons Proliferation in the Gulf Region and the Strategic Balance after Operation Desert Storm*, Pole-Papers, Vol. 2, No. 2 (Centrum voor Polemologie, Vrije Universiteit Brussel: Brussels, 1995), p. 34.

2 Iran's adherence to international treaties on the laws of war and disarmament

2.1 Historical overview

Iran has a long tradition of adhering to international treaties governing the conduct of war. Irrespective of the type of regime in power, it has since the late 19th century been party to virtually all agreements restricting the use of poison weapons and CBW. It has signed or ratified all major international agreements prohibiting the use of poison in war and forms of biological and toxin warfare. Iran ratified the BTWC⁶¹ in 1973 and the CWC⁶² in 1997.

Western views of Iranian attitudes to security are today still coloured by the events and aftermath of the 1979 Islamic revolution. Carried by a religious ideology, the revolution appealed to all the faithful, irrespective of the country they were living in. The resulting perception (and indeed reality) of exportation of the revolution to other Islamic societies created an acute sense of threat in the West. The United States had lost a major ally and intelligence-gathering base on the southern border of the Soviet Union and the steady access for the West to oil from the Gulf came in danger. More fundamentally, however, by appealing to all Muslims to re-establish the Umma (Islamic community) the revolution challenged the core of the international system based on the territorial sovereign state. However, the principle of territoriality—however artificially borders may have been drawn in the Middle East by the former colonial powers—has proved a major obstacle to the expansion of the revolution. Today Iran interacts with the international community and commits itself to internationally binding agreements as a sovereign territorial state, although internally many tensions between the religious and secular sources of authority remain. Understanding this tension is the key to the understanding of the positions adopted with regard to the prohibition of CBW.

During the 1980–88 Gulf War the Iranian leadership declared several times that it did not retaliate in kind against Iraq's CW attacks because of the prohibition on the use of poison in Islam. While these statements enabled Iran to occupy the moral high ground, it also coincided with Iran's technical inability to manufacture chemical warfare agents on a large scale and to mount significant CW attacks during the war. Based on open sources, it cannot be established for certain that Iran used CW in any substantial way. Nevertheless, during the final stages of the war and in the years immediately following it, Iran had an active CW armament programme. Prior to the entry into force of the CWC in 1997 the development, production and stockpiling of CW was not prohibited under international law.

⁶¹ The full text of the BTWC can be found at URL <<http://projects.sipri.se/cbw/docs/bw-btwc-texts.html>>

⁶² The full text of the CWC can be found at URL <http://www.opcw.org/html/db/cwc/eng/cwc_frameset.html>

2.1.1 The use of poison in Islamic law

This section reviews the Islamic prohibition against the use of poison in war and the circumstances in which the prohibition functions. It also investigates the relationship of this religious prohibition with current international law. This is important for two reasons. First, Islamic law is divinely inspired and, therefore, it may not tolerate the authority of laws of secular or other non-Islamic origin.⁶³ Certain sections of the Islamic community that wish to apply a pre-modern understanding of the Islamic laws may reject international agreements regulating the Westphalian state system. Imam Ruhollah Khomeini reportedly expressed his opposition to treaties that contradict Islamic law, suggesting that he believed that at least some international treaties may violate Islamic law.⁶⁴ Other contemporary Islamic legal publicists accept the UN Charter as the foundation of inter-state behaviour, but also accept the Islamic concept of just war, which allows for the initiation of hostilities in circumstances that are prohibited by the UN Charter (e.g., the pre-emptive start of a war to remove a threat against the Islamic community, or the resort to weapons to correct a social injustice). This concept of just war also allows for the principle of military necessity, by which otherwise prohibited acts of war can be divinely sanctioned under certain circumstances. Second, a generally accepted ban on the use of poison under Islamic law can be used as an important building block to incorporate the prohibitions of the BTWC and the CWC into the domestic legislation and professional codes of behaviour of countries founded on Islamic principles.

The centrality of Islam in Iran's social and political organization means that religious precepts govern its conduct with other political entities and its behaviour on the battlefield. During the 1980–88 Gulf War Khomeini was repeatedly reported to have declared that even the retaliation with CW against Iraq goes against Islamic principles.⁶⁵ Iran's non-use of CW during the war is at least in part attributed to his opposition, although it did not form an obstacle to the establishment of a CW production programme.⁶⁶ Although this inconsistency could be resolved by noting that Islamic law prohibits the use and not necessarily the possession of CW (thus echoing the justification of CW armament programmes under the 1925 Geneva Protocol), it is possibly rooted in a deeper contradiction in Islamic law with respect to wars. In the light of Khomeini's reported remark that certain international agreements may violate Islamic law, his statements that even retaliation with CW goes against Islamic principles can be construed that he did not consider international treaties prohibiting chemical and biological warfare or CBW possession to be against Islamic law.

⁶³This is not unique to Islam, but applies to all religiously inspired forms of social organization. In Europe, for instance, the 1648 Peace of Westphalia that followed the Thirty Years War established the principle of secular territorial over religious sovereignty. Fundamentalism in all the great religions challenges this separation of sovereignty, and the sole legitimacy of divinely inspired authority is also one of the reasons why religious sects and cults may clash with the secular authorities of the state.

⁶⁴Mayer, A. E., "War and peace in Islamic tradition and international law", in J. Kelsay and J. T. Turner (eds.), *Just War and Jihad* (Greenwood Press: New York, 1991), p. 201.

⁶⁵Rizvi, A. B., "Iranian armed forces", *Asian Defence Journal*, Vol. 24, No. 9 (1994), p. 36; and Arnett, E., "Iran is not Iraq", *Bulletin of the Atomic Scientists*, Vol. 54, No. 1 (January/February 1998), p. 13.

⁶⁶See the section on the Gulf War.

However, there exist also many tendencies in Islamic legal thought that accept grounds of extreme necessity to justify the resort to war or certain acts in war, which may not be acceptable under current international law.⁶⁷

Islamic legal doctrine evolved essentially in parallel with the expansion of the Islamic empire between the 7th and the 15th centuries (Western calendar). The Qur'an is a compilation of utterances that evolved into a book in a period of over twenty years. The revelations were made at different stages of the establishment of Islam and depending on the threat to the fledgling religion; the book sometimes contains contradictory statements with respect to the conduct in war. Besides the Qur'an, Islamic code of conduct in international relations and war is derived from a variety of sources, including the basic works on *Jihad*, *Fiqh* (Islamic Jurisprudence), *Tafsir* (commentary on the Qur'an), *Asbab al-Tanzil* (direct reasons for revelations), *al-Hadith* (the traditions of the Prophet, or the Sunnah), and *al-Sirah* (Biography of the Prophet).⁶⁸ Contemporary accounts chronicle actual behaviour of the Muslim soldiers on the battlefield and thus also help to interpret the rules as written down.⁶⁹ Classical Muslim law contains many doctrinal divergences, which complicates its application in modern humanitarian law. Modern Islamic legal experts recommend that it be applied and interpreted in function of the needs of the times without violating the letter and the spirit of the Qur'an.⁷⁰

A central principle in the Islamic code of behaviour on the battlefield is the avoidance of all unnecessary suffering.⁷¹ Early in his campaigns Mohammed opposed the then current personalized character of war, whereby the fate of non-combatants depended on that of the soldiers. As a result Islamic law developed precise directives whereby the civilian population and men of religion must be spared and even protected from the suffering of war.⁷² Combat operations must be limited to military objectives. As a corollary, Islam prohibits the use of indiscriminate weapons or modes of warfare that cause generalized destruction, such as flooding and the use of fire. According to some authors, it also appears not to condone or authorize a blockade of nourishment against an enemy.⁷³ Constraints on the use of poison in Islam seem to have been derived from this general principle against indiscriminate warfare. This general principle was

⁶⁷For a discussion, see Mayer, A. E., "War and peace in Islamic tradition and international law", in J. Kelsay and J. T. Turner (eds.), *Just War and Jihad* (Greenwood Press: New York, 1991), pp. 202–205.

⁶⁸Abu-Sulayman, A., *The Islamic Theory of International Relations: Its Relevance, Past and Present*. A dissertation in international relations presented to the Faculty of the Graduate School of Arts and Sciences of the University of Pennsylvania in Partial fulfillment of the requirements for the degree of Doctor of Philosophy, 1973 (U.M.I.: Ann Arbor, MI, 1976), pp. 5–8 and 11.

⁶⁹Ben Ashoor, Y., "Islam and international humanitarian law", *International Review of the Red Cross*, March-April 1980, p. 6.

⁷⁰Ben Ashoor, Y (note 69), p. 11.

⁷¹ Ben Ashoor, Y (note 69), p. 6.

⁷²Ben Ashoor, Y., (note 69), pp. 8–9; Bedjaoui, M., "The Gulf War of 1980–1988 and the Islamic conception of international law", in Dekker, I. F. and Post, H. H. G. (eds.), *The Gulf War of 1980–1988* (Martinus Nijhoff Publishers: Dordrecht, 1992), p. 289.

⁷³Draz, M. A., "Le Droit international public et l'Islam" [International public law and Islam], *Revue égyptienne de droit international*, Vol. 5 (1949), pp. 22–23.

expanded to cover the poisoning of wells and springs. Abu-Bakr, a close advisor to Mohammed and the first Caliph following Mohammed's death in 632, reportedly exhorted his troops in a campaign order to overcome their enemies by bravery and never by poison.⁷⁴ According to Judge Mohammed Bedjaoui, Member of the International Court of Justice, this prohibition must today be extended to all non-conventional weapons.⁷⁵

However, the Qur'an also urges Muslims to arm themselves as strongly as possible against their enemies, although such preparations can only serve purposes of defence and deterrence.⁷⁶ Some Islamic legal scholars referred to the principle of military necessity. One jurist, el-Nohekkik, noted that Muslim legal practice forbade - or at least considered improper - the poisoning of wells and rivers, but thought it permissible if victory was unattainable by other means.⁷⁷ Muslim soldiers are reported to have used toxic, but not necessarily lethal, substances against infidels. In 1342, Moors utilised nauseating agents during their defence of the town of Algeciras in the south of Spain against the siege laid by Alfonso XI of Castile. Turks employed copper bombs that spread a thick smoke and nauseating smell during the siege of Rhodes in 1522.⁷⁸ Arabs reportedly applied ushâr, a heart poison derived from the *Asclepiadaceae calotropis procera*, as an arrow poison in Africa, although it is not known how widespread this usage was.⁷⁹

El-Nohekkik's view, however, was far from a consensus opinion. Regarding the conduct of warfare classical Muslim jurists distinguished between a functional methodology, which considered ultimate benefits and interests, and a moralistic methodology, which upheld the supremacy of certain principles regardless of practical advantage. A sharp tension existed between these methodologies.⁸⁰ It is also unclear whether the constraint, as formulated by el-Nohekkik, applied in wars against non-Muslims or whether it just regulated warfare among Muslims.

2.1.2 Iran and the codification of international law

Apart from Jordan (which assumed the British international obligations upon independence in 1946), Iran (until 1935, Persia) is the only state in the Middle East

⁷⁴Rechid, A., "L' Islam et le droit des gens" [Islam and International law], *Hague Recueil*, Vol. 60 (1937), p. 481.

⁷⁵Bedjaoui, M., "The Gulf War of 1980–1988 and the Islamic conception of international law", in Dekker, I. F. And Post, H. H. G., *The Gulf War of 1980–1988* (Martinus Nijhoff Publishers: Dordrecht, 1992), p. 291.

⁷⁶Draz, M. A. (note 73), p. 24.

⁷⁷L. Lewin, *Die Gifte in der Weltgeschichte* [The poisons in world history] (Verlag von Julius Springer: Berlin, 1920), p. 533.

⁷⁸Apffel, J., "Les projectiles toxiques en 1650", *Revue d'artillerie*, Vol. 103 (March 1929), p. 242, footnote 1.

⁷⁹L. Lewin, *Die Gifte in der Weltgeschichte* [The poisons in world history] (Verlag von Julius Springer: Berlin, 1920), p. 555.

⁸⁰Khaled Abou El Fadl, "The rules of killing at war", *The Muslim World*, Vol. 84, No. 2 (April 1999), p. 144.

that since 1899 has signed all the global agreements that restrict the use of poison and poisoned weapons and biological and chemical modes of warfare. It has ratified all of them except for the 1907 Hague Conventions. It joined these agreements irrespective of the type of governance or social organization. On 11 December 1868 Persia had also signed the St. Petersburg Declaration Renouncing the Use, in Time of War, of Explosive Projectiles Under 400 Grammes Weight.

Iran as an Islamic society has thus systematically accepted the core principle in the laws of war that the means to injure an enemy are not unlimited. As described in the previous section, this principle had already been incorporated into the Islamic legal discourse on the conduct of hostilities before Western jurists began articulating them as part of the just war doctrine.

Persia participated in the 1899 and 1907 Hague Peace Conferences. It signed the Conventions of 1899 (II) and 1907 (IV) respecting the Laws and Customs of War on Land, but it only ratified the former document.⁸¹ Nevertheless, the relevant passages in Articles 22 and 23 in the Regulations Respecting the Laws and Customs of War on Land annexed to respective conventions analysis are identical.⁸² Article 22 states that "the right of belligerents to adopt means of injuring the enemy is not unlimited." According to Article 23 (a) it is especially prohibited "to employ poison or poisoned weapons".⁸³ Persia also signed and ratified the Hague Declaration (IV, 2) Concerning Asphyxiating Gases, whereby it abstained "from the use of projectiles the sole object of which is the diffusion of asphyxiating or deleterious gases".⁸⁴

On 5 November 1929 Persia acceded to the 1925 Geneva Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare without any reservations.⁸⁵ In statements on the value of this agreement, it expressed in 1969 that it considered the Geneva Protocol a codification of an existing and operational norm.⁸⁶ During the 1980–88 Gulf War it contributed to the formulation of UN General Assembly Resolution 42/37.C, which sets forward certain procedures for the UN Secretary General after decision by the UN Security Council to investigate allegations of CBW use.⁸⁷

⁸¹Brown Scott, J., *The Hague Conventions and Declarations of 1899 and 1907* (Oxford University Press: New York, 1915), pp. 232 and 238–39.

⁸²According to Article 4 of the Convention (IV) Respecting the Laws and Customs of War on Land of 1907 the 1899 Convention (II) remains in force for those powers that have not ratified the 1907 Convention (IV).

⁸³Brown Scott, J. (note 81), p. 116.

⁸⁴Brown Scott, J. (note 81), pp. 225–26.

⁸⁵Roberts, A. and Guelff, R., *Documents on the Laws of War* (Oxford University Press: Oxford, 2000), p. 163.

⁸⁶UN Document A/C. 1/PV.1710, pp. 58–60, as quoted in Bothe, M., *Das völkerrechtliche Verbot des Einsatzes chemischer und bakteriologischer Waffen* [The prohibition on the use of chemical and biological weapons under international law] (Carl Heymanns Verlag: Cologne, 1973), p. 247, footnote 440.

⁸⁷Statement by Dr. Ali Akbar Velayati, Minister of Foreign Affairs of the Islamic Republic of Iran before the Conference of States Parties to the 1925 Geneva Protocol and Other Interested States, Paris, 7 January 1989.

Iran signed the BTWC on 10 April 1972 and ratified it on 22 August 1973. It signed the CWC when it was opened for signature in January 1993, but did not ratify it until 3 November 1997 and thus did not become an original state party. Moreover, it took another year before it submitted its initial declarations. These delays stand in contrast to the active role Iran played in the final two years of the negotiation of the CWC, in the Preparatory Commission (PrepCom) phase, during which entry into force of the CWC was prepared, and in the Review Conferences of the BTWC. Possible explanations are efforts to maximize the security guarantees and the opportunities for international technology exchanges and transfers under the disarmament treaties, concern about Iran's worsening geopolitical environment, domestic opposition to the conventions, or perhaps even a need to dispose of its CW stockpile.

2.2 The Biological and Toxin Weapons Convention and the negotiations to strengthen it

Iran's position when it comes to BW, the BTWC and the attempts to strengthen it with a verification mechanism has been presented in statements at Review Conferences to the BTWC. At the Third Review Conference of the BTWC in 1991 Iran voiced its concerns: "The biological weapons which in the opinion of some, had no military value, now, in the light of great scientific progress, particularly genetic engineering and biotechnical achievements are considered as a serious threat". Iran pointed to several areas that in their view were important and needed further attention: Article I of the BTWC lacks definitions of biological and toxin agents as well as of the term peaceful purposes. After widening the scope of this Article, states should declare the quantity and purpose of use of biological and toxin agents. Use of BW should be included in the prohibition of the BTWC. All states should withdraw their reservations to the 1925 Geneva Protocol. An important reference point for Iran is that Israel has not joined the Non-Proliferation Treaty (NPT) or the BTWC. Of special importance to Iran is the establishment of an international fund for Article VII of the BTWC to give assistance to State Parties that have been exposed to biological or toxin weapons.⁸⁸

At that Review Conference, a first step was taken towards a verification mechanism for the BTWC by establishing an Ad Hoc Group of Governmental Experts to Identify and Examine Potential Verification Measures from a Scientific and Technical Standpoint (VEREX). During VEREX, Iran was very active and had a number of technical experts present. Iranian working papers covered for example: Evaluation of on-site interviewing,⁸⁹ evaluation of visual inspection,⁹⁰ need for biotechnology in developing countries⁹¹ and guidelines to differentiate between prohibited and

⁸⁸Statement by Mr. D. Ranjbar, Representative of the Islamic Republic of Iran to the Third Review Conference of the BTWC, Geneva, 12 September 1991.

⁸⁹Evaluation of on-site interviewing, Working paper by the Islamic Republic of Iran, BWC/CONF/VEREX/WP 164, 1993.

⁹⁰Evaluation of visual inspection, Working paper by the Islamic Republic of Iran, BWC/CONF/VEREX/WP 165, 1993.

⁹¹Natural biological bomb: A need for biotechnology in the developing countries. Working paper by the Islamic Republic of Iran, BWC/CONF, paper 2, 3 April 1992.

permitted activities with examples of prohibited activities.⁹² There was also a proposal for elements of BW monitoring system where the WHO should annually inspect all biological facilities and transfers of biological agents, equipment and technology that should be free between States Parties and supervised by WHO to non-States Parties.⁹³ They presented a review of all vaccine producers in developing countries.⁹⁴ This very active participation in the negotiations show that Iran really wanted to influence the process that was to follow after VEREX.

The Special Conference of the states parties to the BTWC in 1994 endorsed the VEREX report of governmental experts, where 21 potential verification measures were evaluated. The Special Conference decided to establish the so called Ad Hoc Group to negotiate a legally binding instrument for verification, the Protocol, including potential verification measures. Iran continued its active role as shown by its statements: "In its examination of the VEREX report it was concluded that much more work is needed towards strengthening of the Convention before devising any effective verification mechanism". "The tasks of the Ad Hoc Group should be to review all the measures examined by VEREX, identify agents, types and quantities, the thresholds and the definition of BW, and the full implementation of Article X of the BTWC".⁹⁵ The information that so far had been exchanged in the Confidence-Building Measures (CBMs) was not specific enough and too selective according to Iran. Major powers should further be made to give more detailed information. States in the Middle East are faced with a threat of unconventional weapons being stored in Israel, and that Israel has the capability to produce BW. Iran also again stated that all restrictions in the biological area not compatible with the Convention should be abolished. The Protocol strengthening the BTWC should become an integral part of the Convention and be binding on all States Parties without separate ratification.⁹⁶

At the Fourth Review Conference of the BTWC (25 November–6 December 1996) similar views were presented.

Formulation of a verification system needs to continue seriously. The BTWC has three main pillars disarmament, material and technological transfer and peaceful co-operation. It is an oversight that the BTWC does not prohibit use of biological and toxin weapons.

Formally Iran presented specific amendments of the title and Article I of the Convention to the Depositaries and submitted them again to be considered by the State Parties at this Review Conference. Iran also supported a statement by the States of the Non-Aligned Movement (NAM) in the General Assembly adopted by the First Committee, which was in line with this proposal. According to Iran, no interpretation

⁹²Guidelines to differentiate between prohibited and permitted activities, BWC/CONF III/VEREX/WP 28, 7 April 1992.

⁹³Elements of biological weapons monitoring systems, Working paper by the Islamic Republic of Iran, BWC/CONF III/VEREX/, 2 April 1992.

⁹⁴Concerns and views of a vaccine producer of the developing countries, Working paper by the Islamic Republic of Iran, BWC/CONF, 3 April 1992.

⁹⁵Working paper by China, India and Iran, BWC/SPCONF/WP 15, 22 September 1994.

⁹⁶Report from the Swedish Mission for Disarmament, Ministry for Foreign Affairs, report on Iranian statement, 22 September 1994.

of the Convention may justify imposing restrictions on transfer of material, equipment and technology for peaceful purposes. States Parties should collectively agree on guidelines for transfer of material, equipment and technology and dispose any unilateral arrangements. Guidelines should be established within the framework of the BTWC.⁹⁷ One Iranian proposal was to add the word "use" in the title of the Convention and adding "use" in Article I.⁹⁸

On the opening day of the Fourth Review Conference, Iran submitted an unannounced proposal to amend the BTWC by inserting the word "use" both in the title and Article I of the Convention, arguing that in its present form it does not "contain specific stipulation banning the use of these barbaric weapons" and that the Review Conference "provides the first opportunity, following the conclusion of the CWC, to address this serious shortcoming".⁹⁹ In his plenary statement, the Iranian permanent representative expanded on the motives. First, the BTWC as it stands now relies on the 1925 Geneva Protocol to cover the prohibition of use. The latter agreement, however, is subject to reservations by some contracting parties so that instead of a complete ban on use it only prohibits first use. In addition, Article VIII of the BTWC rejects an interpretation of the Convention that may detract from the commitments of States Parties under the Geneva Protocol, so that states with reservations to the 1925 document may consider use of BW legitimate under certain circumstances. Second, Iran doubted the assumption that the prohibition of development, production and stockpiling precludes use under all circumstances. Iran demanded a similar clarity on the prohibition of use as in the CWC.¹⁰⁰

In private discussion an Iranian delegate pointed to the threat his country felt from Iraq, the United States, which as recent as 1975 expressed its reservations to the Geneva Protocol, and Israel, which has neither signed nor ratified the BTWC.¹⁰¹ Although Iran had begun preparations for its amendment in the spring of 1996, it saw its concerns confirmed by the advisory opinion of the International Court of Justice that a state could resort to nuclear weapons, the use of which is not explicitly prohibited under international law, in the case of extreme self-defence. Several neutral and non-aligned countries supported the Iranian request for the amendment. South Africa, referring to the preamble of paragraphs 9 and 10 of the BTWC, stated that prevention of use was the ultimate goal of the Convention. It proposed language for the final declaration of the Fourth Review Conference that the use of microbial or other biological agents or toxins for other than peaceful purposes would constitute a

⁹⁷Statement by Ambassador S. Nassir, at the Fourth Review Conference, Geneva, 26 November 1996.

⁹⁸A proposal, Islamic Republic of Iran, BWC/CONF.IV/CRP.1, 25 November 1996.

⁹⁹BWC/CONF.IV/CRP.1, 25 November 1996. BWC/CONF.IV/COW/WP.2, 28 November 1996.

¹⁰⁰ Statement by H.E. Mr. Sirous Nasser, Ambassador and Permanent Representative of the Islamic Republic of Iran to the United Nations Office in Geneva, to the Fourth Review Conference of the States Parties to the Biological Weapons Convention (Islamic Republic of Iran, Permanent Mission to the United Nations: Geneva, 26 November 1996), pp. 3-5.

¹⁰¹Zanders, J. P., private conversation with a member of the Iranian delegation at the Fourth Review Conference, Geneva, 29 November 1996.

violation of Article I of the BTWC.¹⁰² France and the Netherlands, on the other hand, submitted language for Article VIII acknowledging that by prohibiting bacteriological methods of warfare the 1925 Geneva Protocol forms an essential complement to the BTWC and calling for the withdrawal of all reservations to the Geneva Protocol.¹⁰³

According to Article XI of the BTWC any state can propose an amendment, which can enter into force upon its acceptance by a majority of states parties and thereafter for each remaining State Party on the date of acceptance by it. The article had not been invoked before, but at the Third Review Conference (1991) it was agreed that "the provisions of Article XI should in principle be implemented in such a way as not to affect the universality of the Convention".¹⁰⁴

The Fourth Review Conference was unable to act on Iran's proposal on formal grounds because of the requirement under Article 40 of the Vienna Convention on the Law of Treaties that "any proposal to amend a multilateral treaty as between all the parties must be notified to all the contracting States". The Fourth Review Conference 1996 thus did not take any decision on the Iranian proposal to amend the Convention by adding "use". In the Final Document of the conference it is though confirmed under Article I that the BTWC covers use. The results were though seen as a first step in the right direction by Iran.¹⁰⁵ The real reason for the Iranian proposal can always be discussed and one aim could be to delay the ongoing negotiations, especially if they had succeeded in opening the Convention for amendments. Although this did not happen, this question of "use" caused some problems also in the (now suspended) Ad Hoc Group of State Parties negotiating a protocol to the BTWC.

In the Ad Hoc Group, Iran presented several working papers in the area of model to mathematically evaluate the VEREX measures,¹⁰⁶ threshold quantities for toxins,¹⁰⁷ animal pathogens,¹⁰⁸ vectors and pests,¹⁰⁹ and Article X.^{110 111} The Iranian position can be summarized as follows. The substantive outcome is more important than a rapid conclusion of the negotiations. Iran sees the need for a mechanism for follow-up to declarations but this could be voluntary visits rather than mandatory. A mechanism of

¹⁰²The use of BTW: A violation of Article I of the BTWC, Working Paper by South Africa. Document BWC/CONF.IV/COW/WP1.

¹⁰³BWC/CONF.IV/COW/WP.3, 28 November 1996.

¹⁰⁴Final Declaration of the Third Review Conference, BWC/CONF.III/23.

¹⁰⁵Report by the Swedish Mission for Disarmament, Ministry for Foreign Affairs, 6 December 1996.

¹⁰⁶Evaluation of the identified potential verification measures, a quantitative approach, Working paper by the Islamic Republic of Iran BWC/CONF/VEREX/1/WP 30, 1992

¹⁰⁷Working paper submitted by the Islamic Republic of Iran, Threshold quantities for toxins, BWC/AD HOC GROUP WP 40, 5 December 1995.

¹⁰⁸Working paper submitted by the Islamic Republic of Iran, Animal pathogens, BWC/AD HOC GROUP/WP 44, 7 December 1995.

¹⁰⁹Vectors and pests, Working paper by the Islamic Republic of Iran, Animal pathogens, BWC/AD HOC GROUP/WP 322, 6 October 1998.

¹¹⁰Article X, Economic and technological development, Working paper submitted by the Islamic Republic of Iran, BWC/AD HOC GROUP/WP 149, 20 March 1997.

¹¹¹Declaration on the implementation of Article X of the Convention, Working paper submitted by the Islamic Republic of Iran, BWC/AD HOC GROUP/WP 227, 23 September 1997.

consultation, co-operation and clarification should precede any verification measure. In order to prevent abuse of "investigations" (in CWC challenge inspections) Iran preferred a so called "green light" mechanism for decision-making of the future organisation. This means that a majority of States Parties in the Executive Council must vote in favour of an investigation before it can proceed. The other principle is the so called "red light" when an investigation will proceed if not a majority (2/3) of States Parties in the Executive Council votes against it.

Further, the Protocol must include multilateral agreed guidelines for transfer of agents, equipment and technology for peaceful purposes.¹¹² In Iran's experience, the present export control regimes discriminate between users on the basis of political preferences and, for example, one non-State Party is benefiting, namely Israel. Iran did not specify how and by which body the proposed guidelines should be implemented. In the Iranian paper it is argued that some developed countries are maintaining export control regulations against States Parties to the Convention, contrary to the letter and spirit of the Convention. In order to promote transparency in the biological trade, the States Parties may agree on arrangements for exchanging end-user certificates related to biological exports in a manner that will entail no restrictions or impediments on access to biological materials, equipment or technological information by all States Parties. This would replace all existing *ad hoc* regulations in the biological trade at the time of entry into force of the Protocol for States Parties.

For the Article X of the BTWC regarding co-operation (Article VII of the Protocol) Iran emphasises that the idea of a Cooperative Committee is important, also for the developing countries. The discussions have focused on what mandate this committee should be given, and a number of Western countries including Sweden have proposed language for the rolling text on this issue at the 17th session of the Ad Hoc Group.¹¹³ Iran has also been working for the inclusion of a reference to the prohibition of use of BW in the Preamble of the Rolling Text with language from the final document of the Fourth Review Conference.¹¹⁴

Iran has already established a National Authority for the implementation of the Protocol. Iran has also presented a working paper giving results from a trial random visit to a facility in Iran. In its conclusion they are favourable to this type of visit if confidential and national security information can be protected. They note that these types of random visits are a necessary measure for an effective compliance regime.¹¹⁵

At the Fifth Review Conference of the BTWC, the US named six countries - North Korea, Syria, Iraq, Libya, Sudan and Iran - demanding that they should "terminate

¹¹²Transfer guidelines, Working paper submitted by the Islamic Republic of Iran, BWC/AD HOC GROUP/WP 148, 19 March 1997.

¹¹³The cooperative committee, Proposed changes to the text by Australia, France, Germany, Sweden and Switzerland, BWC/AD HOC GROUP/, 29 November 1999.

¹¹⁴Language for inclusion in Preamble, Islamic Republic of Iran, BWC/AD HOC GROUP/, 29 November 1999.

¹¹⁵Report of a national trial visit to a vaccine and serum production facility, Working paper submitted by the Islamic Republic of Iran, BWC/AD HOC GROUP/WP 345, 14 January 1999.

their offensive BW programmes and fully comply with their obligations”.¹¹⁶ In the General Debate US Under Secretary of State for Arms Control and International Security J R Bolton said ”We are also quite concerned about Iran, which the United States believes probably has produced and weaponised BW agents in violation of the Convention”.¹¹⁷ In its official response Iran said the allegation was baseless and categorically rejected it. In Iran’s view this kind of allegation will cause confrontation instead of co-operation and may lead the conference to total failure.¹¹⁸

At this Review Conference, Iran together with India, China, Indonesia, Libya and Sri Lanka presented a proposal to establish a mechanism where denials of export control could be discussed. The Western countries could not accept this proposal and divergence over this issue did not help the negotiators. As a result of the US rejection of the work done for seven years in the Ad Hoc Group to strengthen the BTWC, countries like Iran became verbally more in favour of the verification protocol. Iran now advocated a strong protocol including those parts the US could not accept. Further Iran supported NAM papers with proposals for the Final Declaration to continue the work in the Ad Hoc Group and keeping its mandate. Iran also presented a paper on universality of the BTWC, one on use of BW, and measures to strengthen Article X. Due to the US confrontational manner and rejection of seven years of negotiations where the US on the last day wanted to terminate the mandate for the Ad Hoc Group, the Conference had to be postponed until November 2002 to give States Parties time to consider the situation.

2.3 The Chemical Weapons Convention

Iran deposited its instrument of ratification to the CWC on 3 November 1997 (the treaty entered into force on 29 April 1997). Already at the 1989 Paris Conference of the parties to the Geneva Protocol, the then Iranian Foreign Minister Dr. Ali Akbar Velayati underscored the importance to have incentives for states to join the CWC included in the Convention. He argued that some states might otherwise take their absence as a political signal that CW might still be legitimate and useful and therefore refrain from joining the treaty.¹¹⁹

During the final stages of the negotiations of the CWC (1990–92) and in particular during the preparations for entry into force (1993–97) Iran was a leading voice for the equitable implementation of all provisions of the CWC. At the time of writing Iran has signed and ratified the CWC. It is understood that Iran has so far submitted an initial and a full declaration of its CW programmes to the OPCW in The Hague.

¹¹⁶Bioweapons treaty in disarray as US blocks plans for verification, *Nature*, Vol. 414, p. 675, December 2001.

¹¹⁷Speech in the General Debate of the Fifth Review Conference of the BTWC by US Under Secretary of State for Arms Control and International Security J R Bolton, 19 November 2002.

¹¹⁸Reply of the Islamic Republic of Iran to the US statement of 19 November at the Fifth Review Conference of the BTWC General Debate, November 2002.

¹¹⁹Statement by Dr. Ali Akbar Velayati, Minister of Foreign Affairs of the Islamic Republic of Iran before the Conference of States Parties to the 1925 Geneva Protocol and Other Interested States, Paris, 7 January 1989.

Besides Jordan, Iran is the only country in the Middle East that is a member of all major multilateral disarmament agreements including the BTWC and the CWC. Declarations have also been submitted to the OPCW. Iran has presented its views on CW and on the CWC. Iran emphasizes, as presented in statements, that "being the last victim of chemical warfare give them a unique position". "A tendency in the industrialized world to condone or even justify the use of chemical weapons has been some of the peculiarities, which has made our experience a unique one". The Iranian ambassador also added:

The aspiration of my country for the success of the CWC and elimination of these weapons, therefore, go beyond short-lived political considerations and derived from a firm, deep and sincere commitment. We continue to be one of the most active proponents of the Convention and an advocate of its full implementation.¹²⁰

Iran has admitted to past possession of CW production facilities but does not admit to any current possession of CW and is complying with its CWC obligations.¹²¹

The association of Victims of weapons of mass destruction in Iran lodged a complaint with the United Nations against states that supplied unconventional weapons to Iraq during the Iraq-imposed war (1980-88). The letter mentioned that over 60 Iranian soldiers succumbed to the CW injuries in the last 12 months.¹²²

2.3.1 Iran's positions

Shortly after the work of the PrepCom to the OPCW began in 1993, negotiations were divided into two working groups: Working Group A, which essentially dealt with financial and personnel issues, and Working Group B, which considered issues connected with establishing and implementing the treaty regime. Within Working Group A, Iran's interests were largely focused on the treaty's technological assistance and co-operation provisions and ensuring that the CWC's principle of "equitable geographic distribution" was taken into account where relevant. Within Working Group B, the Iranian delegation appeared to be moderately active. It was neither among those delegations that were most actively engaged, nor was it among the majority of delegations who played little, if any, active role during meetings.

Two areas in which the Iranian delegation showed a particular interest were questions of sea-dumped CW and a desire for the PrepCom to elaborate an illustrative, non-comprehensive list of CW "munitions and devices" specifically designed to cause death or other harm through the toxic properties of those toxic chemicals as specified

¹²⁰Statement by Ambassador R. Alborzi, Head of delegation of the Islamic Republic of Iran to the Third Session of Conference of States Parties of the CWC, The Hague, Netherlands, 16-20 November 1998.

¹²¹News chronology, *CBW Convention Bulletin*, Issue No. 46, December 1999, p 25, includes Iran in a list of nine countries (China, France, India, Iran, Japan, Russia, the UK, US and South Korea) that have declared production sites as of August 31, 1999. It is not on the list of four countries that have admitted to possession of chemical weapons (USA, Russia, India and South Korea).

¹²²Iran seeks apology from Western states for supplying unconventional weapons to Iraq, *IRNA*, 7 January 2002.

in Article II, paragraph 1(a) of the CWC. There was a great reluctance among most delegations to pursue either. It was generally understood that once a topic received more than a certain level of attention, there was a risk that the subject could be added to the then growing list of unresolved PrepCom CWC implementation issues and would therefore complicate that body's efforts to prepare for the treaty's entry into force. (This in fact happened with other issues.) There was concern that attempts to clarify the CWC's provisions regarding dumped CW might lead to open-ended discussions with less than optimal, and more costly, proposals. There was also a great reluctance among some delegations to develop an illustrative, non-comprehensive list of examples of CW munitions and devices, as any such list could, in principle, be used as a basis for not declaring, for example, unfilled chemical weapon (possibly dual-use) munitions or devices. The Iranian positions gave rise to speculation that perhaps it had dumped CW into the Caspian Sea and that it might also possess munitions and devices (perhaps dual-use), which it did not wish to declare. There has been related speculation at the margins that Iran had a CW production and/or storage facilities near the south shore of the Caspian Sea.^{123 124}

Finally, it should be noted that countries, on occasion, take positions on issues not because they are interested in the issues themselves, but rather to relinquish them in exchange for concessions in other areas. In Iran's case, one may safely conclude that the area of technological assistance and co-operation is of fundamental interest. This is partly borne out by the positions consistently taken by Iran at the OPCW and the internal debate which took place within the Iran over whether ratifying the CWC was in the country's best national interest.

Following entry into force of the CWC, the Iranian delegation has, on occasion, raised the issue of developing an illustrative, non-comprehensive list of CW munitions and devices specifically designed to cause death or other harm through the toxic properties of those toxic chemicals specified in paragraph 1 of Article II, but without apparent success.

Discussions are continuing within the OPCW, including in the Executive Council and at the margins, on what additional, if any, parts of a country's chemical weapon establishment (both in terms of prior offensive programmes and current defensive programmes) should be declared to the OPCW. There have been discussions on whether any field test site should be declared and, if so, under what criteria. Should, for example, a site used for conventional munitions testing, but which has also been used in the past for the test firing of a dozen or so CW-filled shells, be declared? Similar discussions have taken place on whether research facilities that may have been peripheral to prior offensive chemical weapon programmes should be declared and, if so, under what criteria. Some States Parties believe that additional information should be provided in these and other areas. Other States Parties are generally opposed. Such

¹²³Special Report: Middle East Chemical Weapons, *Middle East Defense News*, Vol. 2, No. 2 & 3, 24 October 1988.

¹²⁴ There have been discussions among the countries bordering the Caspian Sea on agreeing on boundaries and consequent oil and fishing rights. One approach has been to divide the Caspian Sea into equal parts, while the other has been to have considered the central part of the Sea as international waters open to all the bordering countries. It would be interesting to note what the Iranian and Russian positions are on this matter, especially in view of suggestions that both countries have dumped chemical weapons in the sea.

discussions partly touch on the two broad approaches that States Parties have taken towards implementing the CWC. Some interpret treaty provisions narrowly ("to the letter"), while others interpret the provisions more broadly according "to the spirit" of the agreement. Some States Parties advocate one approach in implementing some treaty provisions, but take the other approach in implementing other treaty provisions.

Countries which interpret the CWC's provisions more narrowly have sometimes cited opposition to conducting what they view as historical "research projects". This perhaps reflects a desire not to reveal more than the general aspects of how national defence establishments are structured and operate. In addition, there is perhaps a concern that providing certain types of information or "too much" information could assist in laying the foundation for a politically motivated challenge inspection.

Iran declared a prior CW capability to the OPCW, including two CW production facilities, but no stockpile.¹²⁵ The United States in particular has voiced public concerns that Iran may be violating the CWC, but has so far not made any formal complaints to the OPCW and has not pursued the formal instruments in the CWC to have its compliance concerns verified. When the OPCW completed its 1,000th inspection, an inspection of an industrial facility in Iran, the organization's official journal stated that the "inspection team enjoyed the *fullest co-operation* of the Iranian authorities" [emphasis added].¹²⁶ Iran does have a well developed and experienced CW defensive capability. Iran has offered its services to assist other OPCW States Parties if, in the future, they are threatened or attacked with CW.

2.4 General discussion

Iran's arms control policies have been remarkably consistent and represent a rational response (as seen through Iranian eyes) to the security situation in which that country finds itself, as pointed out by the Middle East arms control analyst Peter Jones.¹²⁷ Iran has a clear, long-standing set of threat perceptions and these security concerns are not entirely unreasonable. It can also be noted that Iran has played a very active role in the disarmament fora. Tehran has paid particular attention to what it regards as discriminatory policies of Western countries when they restrict access to dual-use technologies, including in the biological area. Iran has repeatedly suggested that such discriminatory supplier's groups (like the Australia Group¹²⁸) be abolished and that, in their place, the international verification mechanisms associated with multilateral treaties, like the BTWC and the CWC, be strengthened. Iran has also placed great

¹²⁵ "Technical Secretariat Background Paper, Consolidated Unclassified Verification Implementation Report (April 1997-31 December 2002)", OPCW document RC-1/S/6, 24 April 2003, paragraph 4.3, pp. 43-44.

¹²⁶ "The OPCW completes its 1,000th inspection", *OPCW Synthesis* (Autumn/September 2001), p. 39.

¹²⁷ Jones, P., "Iran's Threat Perceptions and Arms Control Policies", *The Non-Proliferation Review*, Vol. 1, No. 6, 1998, pp. 1-17.

¹²⁸ The Australia Group is an informal group of Western countries that regularly meet to harmonize their national legislation on export controls concerning biological agents, toxins and chemical precursors as well as production equipment of dual use nature that could be misused. The group also exchange information on the proliferation of BW and CW.

emphasis on the security guarantees that are often associated with these treaties, both positive and negative, and has called for negotiations to make such assurances legally binding.

What could the motives be for Iran to acquire and develop a biological warfare capability? As the possession of BW is prohibited this can not openly be declared or presented in a military doctrine to give greater prestige in the region. To have BW can have a political and strategic value for Iran. The knowledge that Iran probably has BW and other unconventional weapons can help to decrease the US influence in the region. Unconventional weapons can help to create a balance between the Islamic world and Israel. One way for Iran to become a regional military power that can not be neglected could be to acquire and develop unconventional weapons including BW. The strategies to prevent proliferation of unconventional weapons implemented by the West can be said to have slowed the rate of progress of the unconventional weapons programmes in the region, but have so far had limited success. The possession of unconventional weapons that the West do not want Iran to acquire can give Iran a better negotiating position with EU and the United States as long as both firmly believe that this is true. Comparisons can be made with the North Korean nuclear programme and its dealing with the United States.

The main reasons for any Iranian attempts to acquire unconventional weapons were (up to this year) probably to balance Iraq's capabilities and to be able to retaliate against Iraq. Until the US attack on Iraq, there was also a high risk that Iraq had or very soon would resume its programmes for unconventional weapons. Before this years war on Iraq, very little confirmed information was at hand regarding the current status of the suspected CBW programmes. The capabilities for BW are the ones that could be most intact and probably, to some extent, have been concealed from UNSCOM's inspections in Iraq. The successor to UNSCOM, United Nations Monitoring, Verification and Inspection Commission for Iraq (UNMOVIC) received a strong mandate in UNSCOM Resolution 1441 (2002), but the inspections never progressed beyond a preliminary stage in January 2003. Iran has legitimate security concerns, foremost of which was Iraq. Iran is also concerned about the permanence of the US presence in the Gulf since the 1990-91 Gulf War and notably, since March 2003, in Iraq. As long as Iran could not match the conventional strength of Iraq, or now the United States in the region, it will not abandon unconventional or asymmetric warfare or even terrorism. It can though be mentioned that the threat posed by the United States and Israel is focused primarily towards the Iranian nuclear weapons programme and to a lesser extent on the CW and BW programmes. If such programmes exist, their protection, so that nothing is disclosed that can indicate their location or activities, would be essential for Iran.

As Iraq has been seen as Iran's main threat, it would not be surprising if Iran has been trying to acquire a capability also concerning unconventional weapons to deter Iraq. If these capabilities are more probably nuclear, than perhaps BW, or less probable CW, these would primarily be intended to act as deterrence to perceived threats. As BW are banned, hence no one is entitled to possess or use them and can therefore not threaten to use them officially or set out strategies for their use in a military doctrine. In the area of BW, it is well known that states that possess them do not openly declare this, yet their existence will anyway convey a threat and instil a form of deterrence. This can be achieved by not officially declaring possession but giving hints and making ambiguous statements.

During the Iran-Iraq war, Iran was unable to retaliate to Iraq's extensive missile bombardment of Tehran, and was forced to accept Iraq's demand for a ceasefire. There is still no peace agreement between the two countries. This experience during the war with Iraq has been a strong incentive for Iran to improve and develop its missile capabilities. One aspect of this has been to expand research and development (R&D) to gain an indigenous capability in this area.

It has been noted that Iran has been fairly active in the negotiations for the CWC and the protocol to strengthen the BTWC. Iran's views are in line with the positions taken by many other States Parties belonging to the NAM. In some respects Iran is advocating a radical and hard-line view with limited support in the NAM when they demand that the Australia Group export controls must be abolished. Some of their other negotiating positions on lists of agents and equipment, thresholds and including the word "use" in the BTWC and the future Protocol appear to be more aimed at prolonging the negotiations than being constructive. The motive indicated in this context was that the content and aims of these issues were more important than concluding the negotiations. The demand to define terms in Article I of the BTWC is more serious as it would mean redefining and limiting the scope of the Convention and a discussion or negotiation on this would be detrimental for the Convention. There must though be in Iran's interest to establish some kind of verification mechanism but only if it gains wide support in the Middle East. Presently Israel has not signed the BTWC and some states have only signed but not ratified due to the Israeli position. It can also be noted that not only has the political cost of breaching the BTWC increased but also the risk of being exposed has increased. Furthermore, if an effective verification Protocol to the BTWC would have entered into force, it would have made it harder to conceal illegal activities. This will of course depend on the efficiency of the regime, and a weak Protocol or other verification measures might instead be counterproductive as it could create a false aura of compliance. Now, as the negotiations on a Protocol were stopped, it is unclear if or when a legally binding instrument to strengthen the BTWC could be taken up again.

The Arms Control and Regional Security (ACRS) talks could be revived and Iran could be invited to separate talks on arms control and regional security in the Gulf that could include nuclear and BW free zones. The West could initiate talks on the implementation of the BTWC and its future verification measures, assuring Iran that other states in the region will not develop BW that could threaten Iran.¹²⁹

An unconventional weapons free zone could be created in the Middle East that could be a central goal for a regional security regime. Such a unconventional weapons free zone should include special verification provisions for intrusive and reciprocal regional inspections, including challenge inspections. These should adhere to international regimes when it comes to unconventional weapons.¹³⁰

One conclusion can also be the need to more actively engage Iran from the EU (which is also being done) and other Western countries including the United States. This could

¹²⁹Cordesman, A. H., *The US and Iran: Options for co-operation*, (Center for Strategic and International Studies: Washington DC, 1998).

¹³⁰Jones, P., *Towards a regional security regime for the Middle East: Issues and options* (SIPRI: Stockholm, 1998).

cover wide areas of activities including trade but also R&D. A policy in this direction or at least verbal indications could diminish the need to turn to countries like Russia and China. This approach would at the same time give better insight into Iran and offer opportunities to influence their policies, including Iran's perceived need for unconventional weapons. Co-operation and engagement could be more fruitful than the present isolationistic policies employed by the US.

3 Capabilities in the biological area

3.1 References to a potential BW programme

It is of interest to examine the biological capabilities of Iran in areas potentially related to BW as allegations of an Iranian BW programme have been made for over a decade. As a background to our attempt to describe the Iranian vaccine industry and certain areas of biomedical research, a review of the allegations is provided here. Concerning research, development, production or acquisition of BW, agents or equipment there are very few reports before 1990. In 1980's there were reports that Iran had tried to acquire mycotoxins from Canada and the Netherlands. It was then implied that these were aimed for a BW programme. No facts that prove or disprove that this was the case have though been found in open literature. Another example is from 1993 where biological containment equipment and advanced biotechnology equipment destined for Iran were destroyed in Switzerland and Germany.¹³¹ These are instances that are frequently referred to as examples of attempts of procurement for a potential BW programme even if very few facts are known in the specific cases. The procurement of biotechnology equipment destined for Iranian end-users have been closely monitored by Western governments but few facts have been made public, which makes assessment very difficult.

In the following is given a compilation of what the United States has stated over the years regarding a potential Iranian BW programme. The US assessment according to the Arms Control and Disarmament Agency (ACDA) report was the following in 1995:

The Iranian BW programme has been embedded within Iran's extensive biotechnology and pharmaceutical industries so as to obscure its activities. The Iranian military has used medical, educational and scientific research organisations for many aspects of procurement. Iran probably has produced biological warfare agents and apparently has weaponised a small quantity of those agents.¹³²

The 1996 ACDA report gives more details on the alleged BW programme:

Iran began its biological warfare programme in the early 1980s during the Iran-Iraq war. It made agreements with numerous countries for co-operative research, scientific exchanges and technology sharing. The Iranians are conducting research on toxins and organisms with biological warfare capabilities ... Iran has evolved from piecemeal acquisition of bioprocessing equipment and is now pursuing complete biological production plants that could be converted to producing biological warfare agents. Some of its major universities and research organizations may be linked to its biological warfare program.¹³³

¹³¹Cordesman, A. H., *National developments of biological weapons in the Middle East: An analytic overview*, (Center for Strategic and International Studies: Washington DC, 2001).

¹³²Adherence to and compliance with arms control agreements, May 30, 1995, US Arms Control and Disarmament Agency, p. 16.

¹³³Proliferation, Threat and Response, US Office of the Secretary of Defence, April 1996, p. 16.

The programme is said to be controlled by the Islamic Revolutionary Guards Corps and production of BW agents is carried out at Danghan, west of Tehran and at another facility in Tehran.¹³⁴ Israeli sources have indicated that stocks of anthrax and *Botulinum toxin* are kept in Tabriz.¹³⁵ A further US assessment of the Iranian biological warfare programme states that research is carried out on BW and that small quantities of biological agents are believed to exist. As Iran can manufacture some of the hardware needed to produce these agents in large quantities, the Pentagon estimates that within 10 years, from 1997, Iran's military forces may be able to deliver biological agents effectively.¹³⁶ Biological warfare programmes are becoming more self-sufficient making deterrence or detection more difficult. Iran is acquiring the ability to domestically produce raw materials and the equipment to support indigenous agent production according to the CIA.¹³⁷ CIA has further said that strict international export controls have partly driven Iran to produce its own raw materials and equipment.¹³⁸ Iran has investigated both toxins and live organisms as BW agents, and for BW dissemination could use many of the same delivery systems – such as artillery and aerial bombs – that it has in its CW inventory.¹³⁹ ¹⁴⁰ According to the US Government report to Congress in 2001, Iran has expanded its efforts to seek considerable dual-use biotechnology materials and expertise from entities in Russia and elsewhere, ostensibly for civilian reasons. Iran is believed to be pursuing offensive biological warfare capabilities and its efforts may have evolved beyond agent research and development to the capability to produce small quantities of agent.¹⁴¹

These US assessments of a potential Iranian BW programme have not changed much over a number of years, yet these assessments are used by most Western governments when they refer to suspected Iranian BW activities. The United States and Israel continue to claim that Iran is seeking CBW, improving its long-range missiles that can carry WMD, and pursuing nuclear capabilities.¹⁴² ¹⁴³ This means that almost all information comes from one or two major sources, and this has to be borne in mind when trying to arrive at an independent view. As the US assessments are based on intelligence, no further information or details have been given to substantiate the claims.

¹³⁴Russia helps Iran to build bio-weapons, *The Sunday Times*, 27 August 1995.

¹³⁵Iran builds biological arsenal, Israelis warn of Tehran's plans to poison Europe's water supplies, *The Sunday Times*, 11 August 1996.

¹³⁶Proliferation, Threat and Response, US Office of the Secretary of Defence, November 1997, p. 27.

¹³⁷Weapons detection is difficult, *Business Daily*, 23 March 2000.

¹³⁸Australia: CIA fears biological weapons, *Australian Business Intelligence, The Australian Financial Review (Abstracts)*, 23 March 2000

¹³⁹Bioterror threat grows as more seek weapons, CIA analyst says, *Cox News Service*, 26 August 2002.

¹⁴⁰Lauder, J. A., "Statement by John A. Lauder, Director, DCI Non-Proliferation Center to the Senate Committee on Foreign Relations on Russian Proliferation to Iran's Weapons of Mass Destruction and Missile Programs", testimony before the United States Senate, 5 October 2000.

URL<http://www.cia.gov/cia/public_affairs/speeches/archives/2000/lauder_WMD_100500.htm>

¹⁴¹*Annual Report to Congress and Performance Plan*, issued in July 2001 by the Department of Defense's Chemical and Biological Defense Program.

¹⁴²*Associated Press*, 3 February 2002.

¹⁴³Israeli defense chief warns of Iran's non-conventional weapons threat, *Agence France Presse*, 5 February 2002.

The Russian Foreign Intelligence Service published assessments of the WMD capabilities of several countries, including Iran. According to this assessment, Iran was believed to have started a BW research programme around 1990, subsequently strengthening it with development and procurement. There had possibly been development of small munitions with biological agents, but the assessment was that Iran did not possess biological arms. The Russian assessment specifically mentions that the Western suspicions against Iran were mainly based on Iran's covert way of procurement of biological materials and equipment.¹⁴⁴

Lately, there have been reports that Iran is actively trying and has intensified its attempts to recruit scientists from Russia that have been involved in the Soviet biological warfare programme. It is so far unclear how successful these attempts have been or how critical they are for a potential Iranian BW programme.¹⁴⁵ In case there is any Russian involvement, it is unclear if it has covert support of the Russian government or if it is more of a freelance nature. Some US analysts believe this help has been crucial, saying about Iran that "they have saved years of experiments and have been able to go straight from basic research to production, and an effective delivery system".¹⁴⁶ There is no detailed open information what these contacts involved or exactly the type of research that were to be carried out. In some cases, it is reportedly pure basic research on microbial pathogens, and in other cases it involves teaching students. Russia has several government-to-government agreements with Iran in a variety of scientific and technical fields. Because of the dual-use nature of much in these areas, Iran could possibly exploit these agreements to procure equipment and expertise that could be diverted to its BW effort.¹⁴⁷ No evidence to support these claims has been presented. To this can be added that so far the number of scientists that have gone to Iran to work for longer periods is limited, but shorter stays for giving advice and lecturing is not uncommon. Another way of co-operation is that the scientists can remain in Russia but are paid to do work for Iran. The extent of this practice is not known.

¹⁴⁴ The Russian Federation Foreign Intelligence Service Report, *Novyj vyzov posle "kholodnoj vojny": rasprostranenie oruzhiya massovoga unichtozheniya* [A new challenge after the cold war: Proliferation of weapons of mass destruction], 1993, URL<<http://svr.gov.ru/material/2-1.html>>, accessed 2 June 2000.

¹⁴⁵Iran trying to recruit Russias germ warriors, *The New York Times*, 8 December 1998.

¹⁴⁶Russia helps Iran to build bio-weapons, *The Sunday Times*, 27 August 1995.

¹⁴⁷Lauder, J. A., "Statement by John A. Lauder, Director, DCI Non-Proliferation Center to the Senate Committee on Foreign Relations on Russian Proliferation to Iran's Weapons of Mass Destruction and Missile Programs", testimony before the United States Senate, 5 October 2000. URL<http://www.cia.gov/cia/public_affairs/speeches/archives/2000/lauder_WMD_100500.htm>

To begin with, these recruiting attempts were directed towards the former leading institutes in the BW programme, such as Vector, but when this was not successful attempts were directed to less important institutes. A pharmacologist, Mehdi Rezayat, who works as a "scientific adviser" directly for President Khatami, is said to be a key figure in these activities.^{148 149} It can be noted that the co-operation between Russia and Iran has become closer lately and now covers broad areas. The military in Iran is also consuming a large proportion of science and technology.¹⁵⁰ The allegations of Iran's search for Russian BW expertise have been rejected by Rafsanjani.¹⁵¹

The US intelligence has been following contacts between Russian scientists and Iran within several months, and US Government representatives have followed up suspected or known contacts to try to clarify the situation and dissuade Russians from leaving for Iran. Most Russians, if given the opportunity, would probably prefer to work in Europe, Canada, Australia or the United States. US efforts to halt Russian transfers of dangerous technologies to Iran have met with little success and the United States probably have to offer Russia economic incentives to limit the economic losses from this trade.^{152 153 154}

President Putin denies helping Iran to acquire WMD.¹⁵⁵ Beginning in January 1998, the Russian Government took a number of steps to increase its oversight of entities involved in dealings with Iran and other states of proliferation concern. In 1999, the Russian Duma adopted a new export control law. Russian firms, however, faced economic pressures to circumvent these controls and did so in some cases. The Russian Government, moreover, failed to enforce its export controls in some cases regarding Iran'.¹⁵⁶ In 2001 Russia harmonized its export control laws on biological and chemical agents and equipment with the EU laws.^{157 158} However, there is no information on whether these laws have affected any transfer of agents or equipment

¹⁴⁸Iran trying to recruit Russia's germ warriors, *The New York Times*, 8 December 1999.

¹⁴⁹ This person is possibly identical to the scientist active at the School/Faculty of Medicine, University of Tehran, section 3.3.4.1.

¹⁵⁰President stresses importance of research, *IRNA*, 8 February 1993; English translation in *Foreign Broadcast Information Services*, 1993, FBIS-NES-93-025, p. 63.

¹⁵¹Rafsanjani blasted US over alleged biological weapons, *Asia Africa Intelligence Wire*, 14 December 1998.

¹⁵²Put a cork on Iran's weapons program, *Christian Science Monitor*, 9 May 2002.

¹⁵³US concerned about expanded nuclear cooperation between Russia and Iran, *Interfax Diplomatic Panorama*, 1 August 2002.

¹⁵⁴US seek to block new Russian nuke deal with Iran, *Middle East Newslite*, 3 August 2002.

¹⁵⁵Russia denies helping Iran develop weapons, *USA Today*, 6 November 2001.

¹⁵⁶"Unclassified report to Congress on the acquisition of technology relating to weapons of mass destruction and advanced conventional munitions, 1 January through 30 June 2000", CIA report, released 23 February 2001, URL<http://www.cia.gov/publications/ban/bian_feb_2001.htm>

¹⁵⁷Ukase of the President of the Russian Federation, No. 1082: Establishing the list of chemicals, equipment and technologies that can be used to produce chemical weapons and in this relation are subject to export control, *Rossiyskaya Gazeta*, 28 August 2001.

¹⁵⁸Ukase of the President of the Russian Federation, No. 1004: List of human, animal and plant pathogens, genetically modified organisms, toxins, equipment and technology subject to export control, *Rossiyskaya Gazeta*, 11 August 2001.

to Iran. Other countries have also been alleged to help Iranian CBW efforts. China has also been said to support Iran with equipment for its BW programme and this has been denied by Iran.¹⁵⁹ The United States has imposed new sanctions on Chinese, Armenian and Moldovan firms accused of aiding Iran's WMD programmes.¹⁶⁰

There are though deep differences between the United States and Europe on how to handle Iran. The European Union will instead open talks on establishing a Trade and Co-operation agreement with Iran as a sign of improved relations. This will also give European companies an advantage over US companies. The Iranian defence minister has also commented on the defence co-operation with Russia and criticized the US policy on Iran.¹⁶¹ Annual meetings are held between Russian and Iranian experts and, in 2002, discussions focused on international security, disarmament, non-proliferation and export control. The topics were the NPT, the Comprehensive Test Ban Treaty (CTBT), CWC, BTWC and the resolution on missiles by Iran to the UN.^{162 163}

The National Council of Resistance, a major Iranian opposition group active both outside and in the country, has published a report detailing the Iranian BW programme.¹⁶⁴ According to this report there are four groups involved in the production of BW:

- The Special Industries Organization of the Ministry of Defence with 5000 people,
- The Research Centre of the Construction Crusade (Construction Jihad) with four branches in Isfahan, Shiraz, Tabriz and Mashad,
- Revolutionary Guards Corps, Iman Hossein University, and
- The Biotechnology Research Centre with five biotechnology groups.

The report also said that there are six more facilities involved, naming one called the VIRA Laboratories. This information is more limited than the previous report 1990 by the same opposition group, and most of the information is already well known from the open press. It can thus be questioned how reliable this information is. The opposition has also claimed from sources inside the Khatami's regime that significant amounts of anthrax and aflatoxin have been developed,¹⁶⁵ and that the development of BW is accelerating. The Ministry of Defence Special Industries is said to oversee the programme.

To the above can be added that Iran has in one case been mentioned in connection with the threat of terrorist use of BW. A Muslim cleric in London has in a letter to Osama

¹⁵⁹Radio comment says China rejects selling biological weapons to Iran, *BBC Monitoring Service*, 23 March 2002 (Voice of the Islamic Republic of Iran external service 22 March 2002).

¹⁶⁰Washington slaps ban on Iran 'weapons' companies, *The Morning Star*, 10 May 2002.

¹⁶¹Defence minister describes talks with Russian counterpart as "successful", *BBC International Reports*, 30 December 2000.

¹⁶²Russia and Iran discuss world security, disarmament issues, *BBC World Wide Monitoring*, 23 August 2002.

¹⁶³Russian, Iranian diplomats discuss missile non-proliferation, *Diplomatic Panorama*, 23 August 2002.

¹⁶⁴Arsenals of germs in Iran?, *The Washington Times*, 26 January 1999.

¹⁶⁵Siegle, S., Iran is accelerating WMD, claims opposition, *Jane's Defence Weekly*, 10 February 1999.

Bin Laden, published on the internet, advocated the use of germ agents against westerners occupying holy lands:

Using any BW in self-defence is, in Islam, permissible, and I believe we are currently operating under a defensive jihad. Obviously, we regret what could happen to innocent people, but there are always people who are war casualties or, if you like, victims.¹⁶⁶

The Government of Iran repeatedly denies that it has any WMD.¹⁶⁷ Iran's Foreign Minister denied that Iran is seeking WMD and said that it – unlike the United States – was adhering to international weapons treaties. He further accused the United States of torpedoing efforts to give teeth to the BTWC and of trying to undermine the CWC.¹⁶⁸ Ali Akbar Rafsanjani, a top advisor to Iran's supreme leader Ayatollah Khamenei, said in a meeting with senior Iranian generals that: "Although Iran to today is one of the leading arms makers in the world, it has never been after non-conventional weapons and will never do so". He further said "Iran has never thought of, and will never think of, using nuclear, chemical or BW against another nation".^{169 170}

During the last years, the question of biological warfare and bioterrorism has been discussed at conferences in Iran. On the home page of the Ministry of Health, information can be found on bioterrorism, probable agents and ways of protection just as can be found in the West. Some of this information is based on translated US Center for Disease Control (CDC) material. There is no official information on any specific biodefence programme and very little in general on CBW defence, e.g. a facility for production of chemical and biological warfare protective suits was commissioned 1999.¹⁷¹ In 2002, Iranian armed forces were reported to have carried out anti-biological drill in a central city¹⁷² and practiced chemical defence measures.¹⁷³ In the framework of the BTWC, the parties to the Convention has agreed to annual information exchange on a politically binding basis, the so called CBMs. Iran has submitted only one declaration according to the CBMs agreed at the Third Review Conference of the BTWC. This declaration is from 1998, but the form for a national biological defence programme was not filled in, why it is difficult to say if such a programme exists or not.¹⁷⁴ (Nor was there any information on past offensive activities after 1945.) Iran, being a close neighbour of Iraq, where a large biological warfare programme was revealed by UN inspections, would certainly have a biological defence capability and programme. It would be very surprising if this was not the case,

¹⁶⁶London based Muslim calls for holy war, *The Sunday Times*, 5 September 1999.

¹⁶⁷Iranian resistance accuses regime of biological weapons program, *Associated Press*, 26 January 2002.

¹⁶⁸US says Iran making headway on nuclear weapons program, *Associated Press*, 11 February 2002.

¹⁶⁹Iran not seeking unconventional weapons, *United Press International*, 6 January 2002.

¹⁷⁰Accusations of seeking WMD unfounded, *Associated Press*, 6 February 2002.

¹⁷¹Iran: Chemical-biological warfare protective suit production plant commissioned. *BBC Monitoring Service*, 23 September 1999.

¹⁷²Iranian forces hold antibiological arms drill in central city, *Agence France Presse*, 24 October 2002.

¹⁷³Iran's army prepares to confront eventual chemical strike, *Agence France Presse*, 13 October 2002.

¹⁷⁴Iran (Islamic Republic of), in Annual information exchange of States Parties on confidence-building measures, as agreed at the Third Review Conference of the parties to the Convention, DDA/BWC/1998/CBM/Add 1, pp. 45-64.

but there is no open official information on this. The reasons for not making this public can be national security. Transparency of biological defence activities is very important, so that information on such activities that might leak out is not interpreted as being part of an offensive BW programme.

For Iran, the development of biotechnology has become a priority. This involves developing the scientific as well as the industrial base. During recent years, Iranian scientists (educated in Iran and abroad) have gained good knowledge in genetics and molecular biology, as well as good laboratory skills in the application of molecular tools and DNA/protein technology. Many Iranian universities offer courses in biotechnology at different faculties. However, the capacity of these courses is limited and cannot meet the demand. Tehran emphasizes co-operation with foreign partners in the biotechnology field to overcome insufficient budgets, lack of personnel, and unclear government policies. Most countries with developing economies are suffering from the move of senior scientists to more industrialized countries. In Iran, the trend is the opposite. More scientists are returning home, and the number of qualified scientists in universities and research institutions is significantly increasing. Although, it is too early to see the results from all these efforts, Iran is nowadays almost self-sufficient in making disposable medical instruments and most of domestically needed medicines and vaccines according to the government.

Iran is in need of biotech know-how, why it has turned to countries like Russia, Cuba, India and China as the Western countries will not at present get involved in formal co-operation. There could therefore be perfectly legitimate reasons for the co-operation with Russia in this area. President Khatami in January 2001 established a National Biotechnology Committee (NBC) that works under the supervision and permission of the Ministry of Science, Research and Technology to address pre-defined goals. There are 46 institutes/centres in Iran involved in biotechnology. They include a range of well-developed and well-equipped modern institutes. Of these, there are 12 institutes involved in medicine, eight in basic science and seven in industry.¹⁷⁵ In the following, the vaccine industry, and research and development on pathogenic micro-organisms and toxins in Iran will be further discussed and analysed.

3.2 The Iranian vaccine industry

Major efforts have been undertaken in Iran during the past decade to further develop the biomedical and biotechnology sectors, including meeting the domestic needs for vaccines. Iran's ambition has been to reach the same level of development as other countries have achieved. Scientific exchanges and co-operation are encouraged through national and international contacts and projects. The government participates actively in the research and development of biomedical and biotechnology in the private sector.

Iran has a fast growing industrial and academic biomedical/biotechnology programme and base, supported by for example the relatively new National Research Center for Genetic Engineering and Biotechnology (NRCGEB), under the supervision of the Ministry of Culture and Higher Education. A new building complex for the NRCGEB is under construction on a 15-hectare site 16 km west of Tehran. The 60,000 square

¹⁷⁵*Radio Free Europe/Radio Liberty*, 2001.

meter facility will allow the Center to be expanded and equipped with up-to-date equipment for research and education.¹⁷⁶

There is a substantial pharmaceutical industry in Iran. In 1982 it was reported that the country had to import 80 % of its veterinary pharmaceuticals.¹⁷⁷ According to figures from Iran's first five-year plan, the country's local pharmaceutical production increased about five-fold in 1989-94.¹⁷⁸ The Minister of Health Treatment and Medical Education said in February 1995 that 93 % of the drugs needed for domestic consumption were produced in Iran.¹⁷⁹ In 1998, about 95 % of the medicines needed in Iran were produced domestically in August,¹⁸⁰ and in December that year, the figure had risen to 97 %.¹⁸¹ It is unusual to find reports indicating any lack in production, self-sufficiency or inability to meet domestic demands for vaccines, but a news report in 1993 mentions a shortage of sera.¹⁸² The government has a policy promoting self-sufficiency in pharmaceutical production and nationalising the industry,¹⁸³ but in the last decade there has been a move to privatise Iran's pharmaceutical industry.¹⁸⁴ The ten largest pharmaceutical companies, according to annual sales, in Iran in the beginning of the 1990s are listed in Table 1.

¹⁷⁶National Research Center for Genetic Engineering and Biotechnology (NRCGEB) of IRAN, URL<<http://www.nrcgeb.ac.ir/Main.htm>>, accessed 5 December 1998.

¹⁷⁷Vet drug production stepped up in Iran, *Animal-Pharm*, No. 10, p. 10, 4 June 1982.

¹⁷⁸Exclusive: health budget devoted to medical manufacturing., sciences and imports, *Iran News*, 16 February 1995.

¹⁷⁹Exclusive: health budget devoted to medical manufacturing., sciences and imports, *Iran News*, 16 February 1995.

¹⁸⁰Some 95 % of country's medicine needs produced domestically, *BBC Monitoring Service*, 6 August 1998.

¹⁸¹Iranian-Saudi trade expected to reach 7.5 billion Saudi riyals next year, *BBC Monitoring International Reports*, 21 December 1998.

¹⁸²Certain industries to be turned over to private sector, Habibi, *IRNA*, 17 May 1993.

¹⁸³Iran's progress towards self-sufficiency, *Scrip*, No. 1173, p. 16, 23 January 1987.

¹⁸⁴Iran pharmaceutical privatisation moves continue, *Scrip*, No. 1706, p. 13, 3 April 1992.

Table 1. The ten largest pharmaceutical manufacturers in Iran 1990^a

Company	Sales (millions of US\$)	Number of products
Darou Paksh	235.9	235
Toulidarou	109.6	185
Parsdarou	97.9	43
Jaber-ebn-Hayyan	93.3	33
Chemidarou	83.7	70
Sobhan	69.9	56
Alborzdarou	67.9	37
Loghman	65.3	53
Kosar	58.3	21

^a March 21, 1989, to March 20, 1990¹⁸⁵

3.2.1 Sources of information

Information on the Iranian vaccine production and pharmaceutical industry has been sought in a number of published sources, whether printed or in electronic formats. A large part of the information originally emanates from the company or organization itself and to a lesser degree from other sources. This is the case for the vaccine production data for the Iranian manufacturers obtained from the WHO, the CBMs within the BTWC as well as pharmaceutical business magazines such as *Scrip*. Due to the difficulty in corroborating the material, the information has been accepted as presented. The *Kompass Database* for the Middle East/Africa/Mediterranean has been used to search for enterprises of interest. The key words used are included in the references to this database.

3.2.2 Human vaccines

Iran has a population of about 70 million people (1997), and the focus of the vaccine programme is to have a capacity to produce biomedical products (e.g. vaccines) for its own domestic need. Other important goals are to enhance the level of know-how and competitiveness in this field through research, or by collaboration with entities outside Iran. Iran has students in many countries round the world bringing home recent scientific knowledge. Although most of the biomedical production is intended for its own need, limited amounts of biomedical products are also produced for donation or export. These main biomedical companies are geographically concentrated to the region around the city of Tehran.

The two major vaccine facilities, the Razi Vaccine and Serum Research Institute, also known as the Razi State Serum Institute, and the Pasteur Institute of Iran are owned by

¹⁸⁵Iranian pharmaceutical sales in 1989, *Scrip*, No. 1550, p. 21, 19 September 1990.

the state. The vaccines produced at these two institutes cover most of the domestic needs for human vaccines, both in terms of the diseases covered and the volumes of the manufactured vaccines (see Table 2).

As a result of the efforts to expand vaccine production, Iran has been lauded by the WHO as the most successful country of the region in immunizing children against polio. Furthermore, the Razi Institute was one of the first institutes in the world able to mass-produce the poliomyelitis vaccines. Reportedly, Iran has almost eradicated neonatal tetanus, and significantly decreased the incidence of measles. Before the safety programmes became operational, about 494 out of 100,000 children suffered from measles. That number has been now been reduced to only 4 children out of 100,000 (in 1999). The neonatal tetanus that earlier claimed thousands of deaths annually, has been reduced to about eight cases in 2002.¹⁸⁶

The total vaccine production in Iran at the end of the 1990s was 2.8 billion doses and these volumes reportedly covered immunisation of the population and were sufficient also to allow exports.¹⁸⁷ ¹⁸⁸ In 1998 there were 6.8 million children under the age of five and 24.9 million children under fifteen, in Iran. The number of doses of vaccines against childhood diseases reportedly produced in the country (Table 2) tally with these populations' statistics and also the high immunization coverage reported to the WHO.¹⁸⁹

¹⁸⁶ WHO Country Profile, URL< <http://www-nt.who.int/vaccines/GlobalSummary/Immunization/countryprofileresult.cfm?C='IRA'>>

¹⁸⁷ The Iranian declaration for the year 1997 to the UN within the Confidence Building Measures, UN Department of Disarmament Affairs, 10 September 1998.

¹⁸⁸ Institute Increases Output of Polio Vaccine, *IRNA*, 13 April 1997.

¹⁸⁹ WHO Immunization Profile for the Islamic Republic of Iran. *WHO*, URL<<http://www-nt.who.int/vaccines/GlobalSummary/Immunization/countryprofileresult.cfm?C='IRA'>>, accessed 8 January 2003.

Table 2. Production of vaccines for humans in Iran

Target disease	Type of vaccine	Pasteur Institute of Iran Production capacity	Razi Vaccine and Serum Institute Production capacity
Cholera (Ogawa strain/Inaba mix)	Heat-Phenol-killed	Yes ^a	
Diphtheria (toxoid)	Adsorbed, Purified		1 million doses ^a
Diphtheria Antitoxin	Equine serum		300 000 000 I.U. (30 000 vials) ^a
Diphtheria and tetanus toxoids	Adsorbed liquid		14 million doses ^{a, c} 13 332 854 doses ^b
Diphtheria, tetanus and pertussis	Purified and adsorbed		8 million doses ^{a, c} 6 901 461 doses ^a
Measles	Live attenuated, freeze dried		5 million doses ^a 3 618 103 doses ^a
Measles, mumps, rubella	Live attenuated, freeze dried		250 000 doses ^{a, c} 62 350 doses ^a
Mumps	Live attenuated, lyophilized		200 000 doses ^{a, c} 43 031 doses ^a
Polio	Oral, liquid, Sabin type		15-20 million doses ^a 49 674 050 doses ^a
Rabies	Sheep brain vaccine	Yes ^a	
Rubella	For humans		32 452 doses ^a
TAB (Typhi/Paratyphi A and B)	Heat-Phenol-killed	Yes ^a	
Tetanus	Toxoid adsorbed		4-6 million doses ^{a, c} 2 842 212 doses ^a
Tuberculosis (BCG)	Freeze-dried	Yes ^a	

^a References: WHO List of International Availability of Vaccines, WHO, Geneva, 1995; WHO List of International Availability of Vaccines, WHO, Geneva, CD-rom, August 1999.

^b The figure in Table 2 is the sum of 12 962 096 doses for adults and 370 758 doses for children (The Iranian declaration for the year 1997 to the UN within the Confidence Building Measures, 980910. UN Department of Disarmament Affairs, 10 September 1998.)

^c The figure given may represent a minimum since the surplus capacity indicated in the references may not be included. (WHO List of International Availability of Vaccines, 1995; WHO List of International Availability of Vaccines, electronic version, August 1999.)

3.2.3 Veterinary vaccines

Iran has a substantial agricultural sector. In 1996 there were about 8 million heads of cattle, 52 million sheep and 25 million goats in the country.¹⁹⁰ For these and other animals, Iran has domestically produced vaccines. The Construction Jihad is involved in promoting animal husbandry and veterinary health, e.g. through the National Veterinary Organization.¹⁹¹ The responsibilities of the latter include supervision over the production, import, export and purchasing of vaccines as well as providing vaccines against animal diseases in the country and abroad.¹⁹²

In Iran there are several manufacturers of veterinary vaccines. In February 1999, the head of the Veterinary Organization stated that 32 Iranian companies produce sera and vaccines for livestock and poultry, meeting 95 % of domestic demands, and the remainder of the required vaccines were imported.¹⁹³ The present study found a total of eight manufacturers (Table 3). Another possible producer is the Pasteur Institute, which manufactures a rabies vaccine that could also be for animal use (Table 3, footnote b). A more detailed description with the available information on location and production for each manufacturer in Table 3, is given in Appendix 1. In the pharmaceutical industry, there are three groups of industries, government-owned, government-controlled and private. There are vaccine production facilities of each of these categories (Appendix 1). Note that the term "private enterprise" may not have entirely the same meaning in Iran as in the West. Some of the facilities, like other industries, brought under government control after the revolution have later been privatised,^{194 195 196 197 198} but activities at these facilities are still subject to licensing.¹⁹⁹

¹⁹⁰Office International des Épizooties "World Animal Health in 1996." Paris, 1996.

¹⁹¹Jihad Striving for Development and Construction, Public Relations of Jihad-e-Sazandegi (Booklet), Summer 1993.

¹⁹²Jihad Striving for Development and Construction, Public Relations of Jihad-e-Sazandegi (Booklet), Summer 1993.

¹⁹³1,400,000 tons of red meat produced in Iran annually, *IRNA*, 17 February 1999.

¹⁹⁴Razi Institute produces mumps and rubella vaccine, *Scrip*, No. 1278, p. 9, 29 January 1988.

¹⁹⁵Iran-Qatar investigating outlooks for joint pharmaceutical plant, *IRNA*, 25 January 1994.

¹⁹⁶Privatization program begins soon, *Iran News*, 29 April 1995.

¹⁹⁷Privatization should speed up economic development, *IRNA*, 8 November 1993.

¹⁹⁸2nd International seminar on privatization starts work, *IRNA*, 7 November 1999.

¹⁹⁹Jihad Striving for Development and Construction, Public Relations of Jihad-e-Sazandegi (Booklet), Summer 1993.

Table 3. Producers of veterinary vaccines in Iran^a

Producer	Vaccines for cattle and small ruminants	Vaccines for poultry	Vaccines against rabies
Asaban Ltd. Co.	+		
Darou Pakhsh Co.	+		
Iran Veterinary Pharmaceutical Co.	+		
Jahad Razi (Jahad-e-Razi Co.)	+	+	
The Razi Institute	+	+	
Tamin Ehtiajate Dam (TAD)		+	
Vetaque		+	
The Pasteur Institute ^b			+?
Institute for Research on Livestocks and Production of Biologic Products ^c	+?	+?	+?

^a Based on Appendix 1.

^b Rabies vaccine is used in Iran and the Pasteur Institute produces such a vaccine²⁰⁰ and also is a WHO Collaborating Center for Reference and Research on Rabies,²⁰¹ it is a likely candidate for the production of veterinary rabies vaccine.

^c This institute manufactures different kinds of vaccines, presumably for animal use.²⁰²

The domestic vaccines are mainly for cattle, sheep, goats and poultry (Table 3). There are vaccines against viral agents as well as bacteria (Table 4), of the two the classical types with live attenuated agents or inactivated agents. The Razi Institute is reported to be the largest producer of vaccines in Iran, and it is probably the biggest producer of veterinary vaccines, although a large part of its total production is human vaccines (see above).²⁰³ However, no data was found on volumes, doses and/or value of vaccines produced at other facilities, so the total production volume in Iran cannot be calculated or approximated.

Data both for the number of vaccinated animals and the production volumes were sought. Almost all information obtained relates to the production at the Razi Institute. Comparing the available data, the production apparently corresponds to the domestic needs (Table 4), allowing for stored vaccines and possibly some export.^{204 205 206} Also,

²⁰⁰Iran develops new rabies vaccine, *Animal-Pharm*, No. 303, p. 15, 1 July 1994.

²⁰¹WHO Veterinary Public Health Programme. Report of Activities 1994, World Health Organization, URL<<http://www.who.int/cds/vph/activity.html>>, accessed 11 May 1999.

²⁰²President inaugurates industrial unit, research institute, *IRNA*, 19 June 1995.

²⁰³Vaccine production at Razi Institute, *Animal-Pharm*, No. 146, p. 15, 22 January 1988.

²⁰⁴Jihad Striving for Development and Construction, Public Relations of Jihad-e-Sazandegi (Booklet), Summer 1993.

²⁰⁵Razi Institute production, *Scrip*, No. 1187, p. 22, 13 March 1987.

²⁰⁶Iran in overseas partnerships, *Animal-Pharm*, No. 372, p. 13, 9 May 1997.

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data on outbreaks of various diseases indicate the need for the domestically produced veterinary vaccines (Table 4).

Table 4. Veterinary vaccines in Iran^a

Target disease	Target animals	Outbreak data^b Number of cases (year)	Number of vaccinated animals in 1996^c	Capacity at Razi Institute^{d,e} Millions of doses
Anthrax	Cattle, sheep, goat	32 (1996)	63 million	112
Combined anthrax and tetanus				0,015
Brucellosis	Cattle	(Infection rate 1996: 0,23%)	613 000 ^f	0,80
Brucellosis	Sheep and goat	(Infection rate 1996: 0,6%)	13,9 million ^f	17
Agalactia	Sheep and goat	597 (1996)	4,5 million	5,8
Enterotoxemia				75
Sheep pox	Sheep	144 in sheep & goats (1996)	48,5 million	59
Goat pox	Goat	144 in sheep & goats (1996)	17,9 million	23
Rinderpest	Cattle	N.A. (1994)	8 million	12
Blackleg	Cattle			1,4
Haemorrhagic septicaemia	Cattle and buffalo	33 (1996)	1 million	0,13
Blackleg and haemorrhagic				1,4
Bovine theileriosis	Cattle	825 (1996)	Yes	0,27
Ovine theileriosis	Sheep and goat	165 (1996)	Yes	0,64
Foot-and-mouth disease	Cattle, sheep, goat	270 (1995); 651 (1996)	20,3 million	14
Black disease	Sheep and goat			8,9
Leptospirosis				0,066
Fowl infectious laryngotracheitis	Poultry			32
Fowl Newcastle disease	Poultry	403 (1996)	987 million doses	1 812
Fowl infectious bronchitis	Poultry			289
Fowl pox	Poultry			55

Target disease	Target animals	Outbreak data ^b Number of cases (year)	Number of vaccinated animals in 1996 ^c	Capacity at Razi Institute ^{d,e} Millions of doses
Fowl cholera	Poultry			289
Gumboro (infectious bursal) disease	Poultry		741 million doses	Other manufacturer(s) ^g
Rabies	Domestic and wild	108 (1996)	106 000 dogs	Other manufacturer(s) ^h
Grand Total			1906 million doses/animals	2 886

Footnotes to Table 4:

^aFor the clarity of the table, blank spaces indicate that data was not available.

^bReferences: Office International des Épidémiologies, "World Animal Health in 1996", Paris, 1996. Office International des Épidémiologies, on-line disease information for 980320-990917, URL<http://www.oie.int/info/A_info.htm>.

^cIn total, there were 8 million heads of cattle, 52 million sheep and 25 million goats in Iran 1996. (Office International des Épidémiologies "World Animal Health in 1996." Paris, 1996.)

^dReferences: The Iranian declaration for the year 1997 to the UN within the Confidence Building Measures, 980910. UN Department of Disarmament Affairs, 10 September 1998.

^eThe following companies also produce vaccines for cattle and small ruminants: Asaban Ltd Co., Daru Pakhsh Co., Iran Veterinary Pharmaceutical Co. and Jahad-e-Razi Co. (according to the KOMPASS Database searched in 1998 and internet pages). (Export Directory of Pharmaceutical Products, Iran Export, URL<<http://www.iran-export.com/exporter/ch9/ch9-1.htm>>, accessed 11 May 1999. Amison International Internet homepage, URL<<http://www.amison.com/index.htm>>, accessed 12 May 1999.)

^fOnly calves and lambs are vaccinated.

^gPossibly produced by Jahad-e-Razi Co., Tamin Ehtiajate Dam (TAD), Vetaque and/or others, according to the database KOMPASS searched in 1998 and internet pages. (Export Directory of Pharmaceutical Products. Iran Export, URL<<http://www.iran-export.com/exporter/ch9/ch9-1.htm>>, accessed 11 May 1999. Amison International Internet homepage, URL<<http://www.amison.com/index.htm>>, accessed 12 May 1999.)

^hPossibly produced by the Pasteur Institute that produces rabies vaccines for humans and also has a WHO Collaborating Centre for Reference and Research on Rabies within the network of WHO Veterinary Public Health. (WHO Veterinary Public Health Programme. Report of Activities 1994." World Health Organization, URL<<http://www.who.int/cds/vph/activity.html>>, accessed 11 May 1999.)

3.2.4 Future direction of Iranian vaccine production and development

In the years following the revolution, the Iranian government clearly spelled out self-sufficiency as a major goal, including in the medical and pharmaceutical field.^{207 208} The reports on vaccine production over the years, mainly from the Razi Institute, indicate that Iranian vaccine production is aimed at fully covering domestic needs. There is also some export, e.g. donation of polio, measles and tetanus vaccines to Afghanistan.²⁰⁹

In 1985, the Razi Institute produced 24 million doses of human vaccines against diphtheria, tetanus, pertussis, measles and polio.²¹⁰ In 1997, the production of these vaccines had been increased to 76 million doses.²¹¹ The annual production of polio vaccine increased from 10 million doses in 1993 to 50 million doses in 1997.^{212 213} The head of the Razi Institute said in 1997 that the institute had increased its production five-fold as compared to 1993.²¹⁴ In 1997 and 1998 the annual production of all vaccines was around 2,8 billion doses^{215 216} and expected to rise to 3 billion doses in 1999.²¹⁷ In addition to covering domestic demand, vaccines are now exported to 19 countries in Asia, Africa and Europe.²¹⁸

The number of different vaccines manufactured at Razi has also increased over the years. In 1987 vaccines against mumps and rubella reached production volumes that covered domestic demand.²¹⁹ These two vaccines were not part of the production data presented for 1985.²²⁰ In 1994, the Razi Institute had a commercial product range of 21 human and veterinary vaccines.²²¹ The next year another 10 human and

²⁰⁷Iran's progress towards self-sufficiency, *Scrip*, No. 1173, p. 16, 23 January 1987.

²⁰⁸Iran boosts competitiveness and exports, *Scrip*, No. 2233, p. 19, 20 May 1997.

²⁰⁹Iran set to begin vaccinations in Afghanistan, *Iran News*, 13 November 1994.

²¹⁰Razi Institute production, *Scrip*, No. 1187, p. 22, 13 March 1987.

²¹¹The Iranian declaration for the year 1997 to the UN within the Confidence Building Measures, 980910. UN Department of Disarmament Affairs, 10 September 1998.

²¹²The Iranian declaration for the year 1997 to the UN within the Confidence Building Measures, 980910. UN Department of Disarmament Affairs, 10 September 1998.

²¹³Institute Increases Output of Polio Vaccine, *IRNA*, 13 April 1997.

²¹⁴Institute Increases Output of Polio Vaccine, *IRNA*, 13 April 1997.

²¹⁵The Iranian declaration for the year 1997 to the UN within the Confidence Building Measures, 980910. UN Department of Disarmament Affairs, 10 September 1998.

²¹⁶Iran moves to combat drug shortages, *Scrip*, No. 2445, p. 17, 11 June 1999.

²¹⁷Iran moves to combat drug shortages, *Scrip*, No. 2445, p. 17, 11 June 1999.

²¹⁸Successful tests for leishmaniasis vaccine." *Info-Prod Research (Middle East) Ltd.*, 10 March 1999.

²¹⁹Razi Institute produces mumps and rubella vaccine, *Scrip*, No. 1278, p. 9, 29 January 1988.

²²⁰Iran develops new rabies vaccine, *Animal-Pharm*, No. 303, p. 15, 1 July 1994.

²²¹Iran plans export of poliomyelitis vaccine, *Scrip*, No. 1922, p. 28, 13 May 1994.

veterinary vaccines had been added, and two more vaccines were being finalized.²²² A vaccine against Newcastle disease was being finalized in 1997²²³ and is now part of the production.²²⁴ A total of 31 different vaccines were manufactured at the Razi Institute in 1997, comprising nine vaccines for humans, 18 veterinary and five poultry vaccines.²²⁵ Yet another vaccine, against leishmaniasis, is being introduced into large-scale production in 1999.²²⁶ Concomitant with the expansion in production volumes and product range, the Razi Institute added five new production lines for vaccines and started a major scale breeding of laboratory animals in 1995.²²⁷

In the vaccine and pharmaceutical fields, Iran is active in technology transfer, both acquiring new, advanced technology (from Cuba and France) and disseminating know-how through co-operation with a number of other countries. Iran also exports vaccines, e.g. donating 500 000 doses of veterinary vaccines to a programme run by the UN Food and Agriculture Organization in Africa in 1997.²²⁸ In 1994 the Razi Institute planned to export its polio vaccine,²²⁹ and eight million doses of this vaccine and an unspecified volume of vaccines for measles and tetanus were given to Afghanistan in 1994.²³⁰

Iran has actively sought contact with a number of other countries in the health care, pharmaceutical and veterinary fields. For example, in the nineties there have been contacts with Armenia,²³¹ Croatia,²³² Cyprus,²³³ India,²³⁴ ²³⁵ Iraq,²³⁶ ²³⁷ and South

²²²2 billion doses of vaccine produced saves Iran dollars, 60 million annually, *IRNA*, 30 July 1995.

²²³Razi Vaccine and Serum Institute to start Newcastle disease (ND) vaccine production." *Animal-Pharm*, No. 364, p. 18, 10 January 1997.

²²⁴The Iranian declaration for the year 1997 to the UN within the Confidence Building Measures, 980910. UN Department of Disarmament Affairs, 10 September 1998.

²²⁵The Iranian declaration for the year 1997 to the UN within the Confidence Building Measures. 980910. UN Department of Disarmament Affairs, 10 September 1998.

²²⁶Successful tests for leishmaniasis vaccine, *Info-Prod Research (Middle East) Ltd.*, 10 March 1999.

²²⁷ Rafsanjani inaugurates major laboratory project, *IRNA*, 12 June 1995

²²⁸ Iran in overseas partnerships, *Animal-Pharm*, No. 372, p. 13, 9 May 1997

²²⁹ Iran plans export of poliomyelitis vaccine, *Scrip*, No. 1922, p. 28, 13 May 1994

²³⁰ Iran sets to begin vaccinations in Afghanistan, *Iran News*, 13 November 1994

²³¹ Iran targets Commonwealth of Independent States (SIS) for pharmaceutical collaboration, *Scrip*, No. 2203, p. 16, 4 February 1997

²³² Croatian ambassador calls for relations with Iran, *Compass Middle East Wire*, 17 November 1997

²³³ Iran, Cyprus medical co-operation discussed, *IRNA*, 26 October 1994

²³⁴ Iran and India in veterinary agreement, *Animal-Pharm*, No. 320, p. 12, 10 March 1995

²³⁵ India, Iran to sign four pacts to enhance economic ties, *Asia Pulse*, 25 February 1999

²³⁶ Iran, Iraq review expansion of medical co-operation, *IRNA*, 7 March 1999

²³⁷ Iranian, Iraqi ministers discuss boosting bilateral trade, *IRNA*, 3 October 1999

Korea.²³⁸ ²³⁹ In 1999, Saudi Arabia, Syria and Jordania expressed interest in Iranian support in health care services and medical co-operation.²⁴⁰ The Construction Jihad (Jihad-e-Sazandegi) is engaged in many aspects of rural development, including providing medical care and improving animal husbandry, both within Iran but also in some African and third world countries.²⁴¹ In 1993 the Construction Jihad had established branch offices in Tanzania, Ghana, Lebanon, Sudan, and Sierra Leone.²⁴²

A number of countries are also co-operating with Iran in the production of vaccines. Iran is receiving know-how and technology, and essentially up-grading its vaccine industry with the help of Cuba and France.

Iran and Cuba have close ties.²⁴³ Both countries are being sanctioned by the US and this has been a starting point for political relations and co-operation.²⁴⁴ Areas of co-operation include: Agriculture, animal husbandry, fishery, oil and oil products, mines, genetic engineering, biotechnology, pharmaceuticals, food stuffs as well as technical and scientific exchange.²⁴⁵ The latter is viewed as a matter of vital importance and was discussed by the Iranian first vice-president and senior Cuban officials.²⁴⁶ ²⁴⁷

Different kinds of vaccines are among joint research projects between the two countries²⁴⁸ and a Cuban vaccine has undergone testing in Iran.²⁴⁹ In addition to buying hepatitis B vaccine²⁵⁰, Iran signed a contract with Heber-Biotic, a Cuban state-owned R&D and technology transfer organization in 1995, for the purchase of technology and know-how for a recombinant hepatitis B vaccine.²⁵¹ ²⁵² A vaccine

²³⁸ Iran targets Commonwealth of Independent States (SIS) for pharmaceutical collaboration, *Scrip*, No. 2203, p. 16, 4 February 1997

²³⁹ Haitai International to Supply Antibiotics Plant to Iran, *The Korea Herald*, 20 November 1997

²⁴⁰ Iranian Health Minister Meets Saudi Counterpart, *IRNA*, 23 September 1999

²⁴¹ Jihad Striving for Development and Construction, Public Relations of Jihad-e-Sazandegi (Booklet, summer 1993)

²⁴² Jihad Striving for Development and Construction, Public Relations of Jihad-e-Sazandegi (Booklet, summer 1993)

²⁴³ Iran, Cuba ready to bolster ties, *IRNA*, 10 July 1999

²⁴⁴ Cuba has always supported Iran, *Iran News*, pp. 1, 11, 2 January 1999

²⁴⁵ Iran-Cuba economic co-operation expands, *Voice of the Islamic Republic of Iran*, 11 July 1999

²⁴⁶ Iran-Cuba economic co-operation expands, *Voice of the Islamic Republic of Iran*, 11 July 1999

²⁴⁷ "Iran moves to combat drug shortages", *Scrip*, No. 2445, p. 17, 11 June 1999

²⁴⁸ Iranian Lands in Havana; Cuba Helping Fight Drought, *IRNA*, 10 July 1999

²⁴⁹ Fragaso H., Rad P.H., Ortiz M., Rodriguez M., Redondo M., Herrera L. and de la Fuente J. Protection against *Boophilus annalatus* infestations in cattle vaccinated with the B. microplus Bm86-containing vaccine Gavac. off., *Vaccine*, Vol. 16, No 20, pp. 1990-2, 1998

²⁵⁰ Cuba has Always Supported Iran, *Iran News*, pp. 1, 11, 2 January 1999

²⁵¹ Cuba has Always Supported Iran, *Iran News*, pp. 1, 11, 2 January 1999

²⁵² Iran collaborates with Cuba on hepatitis B vaccine, *Scrip*, No. 2083, p. 17, 5 December 1995

plant is being constructed in Hesarak by the Pasteur Institute in co-operation with the Cuban centre²⁵³, and when it is completed Iran will take over its operation.²⁵⁴ For this purpose, 50 Iranian biotechnology experts were trained in Cuba in 1999, and will return to take over the operation of the vaccine facility.²⁵⁵ Also, up to July 1999, about 20 Iranian university students had attended scientific and educational courses, lasting from six months to two years, at the Cuban centre.²⁵⁶

In Tehran in 1995, Iran's first vice-president Habibi met with the head of a French vaccine company.²⁵⁷ This company had already established co-operation with the Razi Institute.²⁵⁸ Vaccine research and production were among the topics discussed, more specifically how to improve the quality of vaccines from the Razi Institute to meet international standards, transferring technological know-how for vaccine production, joint research on vaccine production, training of Iranian and French experts, as well as equipping and expanding the Razi institute.²⁵⁹ Furthermore, both representatives expressed interest in establishing a joint French-Iranian scientific foundation.²⁶⁰ The aim of it would be expansion of research in the third world and marketing Iranian vaccine and other biological products in French-speaking countries, including those in North Africa.²⁶¹ The Razi Institute and the French company would be partners in this joint foundation.²⁶²

Iran is also disseminating knowledge, technology and equipment for vaccine production to several countries. Iran, as a member of the Economic Cooperation Organization (ECO)²⁶³, worked out programmes for vaccine production by ECO member states together with Turkey, Pakistan and Uzbekistan in 1994.²⁶⁴ In 1997, Iran

²⁵³ Iranian Lands in Havana; Cuba Helping Fight Drought, *IRNA*, 10 July 1999

²⁵⁴ Cuba has Always Supported Iran, *Iran News*, pp. 1, 11, 2 January 1999

²⁵⁵ Cuba has Always Supported Iran, *Iran News*, pp. 1, 11, 2 January 1999

²⁵⁶ Iranian Lands in Havana; Cuba Helping Fight Drought, *IRNA*, 10 July 1999

²⁵⁷ Iran-France-Meriver: Iran, France to conduct joint research on vaccine production, *IRNA*, 4 October 1999

²⁵⁸ Iran-France-Meriver: Iran, France to conduct joint research on vaccine production, *IRNA*, 4 October 1999

²⁵⁹ Iran-France-Meriver: Iran, France to conduct joint research on vaccine production, *IRNA*, 4 October 1999

²⁶⁰ Iran-France-Meriver: Iran, France to conduct joint research on vaccine production, *IRNA*, 4 October 1999

²⁶¹ Iran-France-Meriver: Iran, France to conduct joint research on vaccine production, *IRNA*, 4 October 1999

²⁶² Iran-France-Meriver: Iran, France to conduct joint research on vaccine production, *IRNA*, 4 October 1999

²⁶³ <http://www.ecosecretariat.org/>

²⁶⁴ Iran able to meet domestic vaccine needs, *IRNA*, 24 January 1994

signed an agreement with Tajikistan, also a member of ECO, to build plants for vaccines there.²⁶⁵

The African countries Egypt, Senegal, Sudan and Tanzania all have co-operation with Iran in the medical field that includes vaccines. Iran and Egypt are building more close contacts with each other.²⁶⁶ An agreement was reached between the two countries in 1998 to exchange technology in the field of vaccines and blood derivatives.²⁶⁷ The Egyptian Minister of Health and Population has expressed interest in Iran's experiences in e.g. production of vaccines^{268 269}. In 1999 representatives from Iran and Egypt discussed the formation of a joint pharmaceutical company.^{270 271} The two countries are also investigating how to profit from Iran's expertise in vaccine production, notably through the Razi Institute.²⁷²

A meeting between Iranian and Senegalese ministers in February 1999 resulted in an agreement on co-operation for vaccine production, transfer of technical know-how, medical equipment and pharmaceuticals²⁷³. The Iranian Minister of Health said that this could lead to expansion of co-operation in the fields of health, research, pharmaceuticals and production of medical equipment²⁷⁴.

In 1994, bilateral health and pharmaceutical co-operation between Sudan and Iran was discussed.²⁷⁵ Four years later, the two countries agreed to expand their co-operation, and notably, Iran offered training courses to Sudanese experts for production of vaccines and sera for livestock.²⁷⁶ The Construction Jihad also has a branch office in Sudan.²⁷⁷

²⁶⁵ Iran targets Commonwealth of Independent States (CIS) for pharmaceutical collaboration, *Script*, No. 2203, p. 16, 4 February

²⁶⁶ Radio Comments on Resuming Ties with Egypt, *Tehran Voice of the Islamic Republic of Iran*, 10 February 1999

²⁶⁷ Weekly Economic Report: Egypt: Agreement Reached with Iran on Marketing Pharmaceutical Products, *BBC Summary of World Broadcasts*, 14 July 1998

²⁶⁸ Iran, Egypt to Establish Pharmaceutical Company, *IRNA*, 17 February 1999

²⁶⁹ Egyptian minister visits, joint company to be set up, *BBC Summary of World Broadcasts*, 23 February 1999

²⁷⁰ Egyptian minister visits, joint company to be set up, *BBC Summary of World Broadcasts*, 19 February 1999

²⁷¹ Iran, Egypt in joint pharma venture, *Script*, No. 2428, p. 21, 14 April 1999

²⁷² Iran, Egypt in joint pharma venture, *Script*, No. 2428, p. 21, 14 April 1999

²⁷³ Iranian, Senegalese Ministers Discuss Medical Cooperation, *IRNA*, 7 February 1999

²⁷⁴ Iranian, Senegalese Ministers Discuss Medical Cooperation, *IRNA*, 7 February 1999

²⁷⁵ Iran's charge d'affaires in Sudan, *IRNA*, 1 December 1994

²⁷⁶ Iran, Sudan to Expand Ties in Agriculture and Transport, *BBC Summary of World Broadcasts*, 21 July 1998

²⁷⁷ IROST homepage, <http://www.irost.com/>, accessed October 1999

After contacts between the Razi Institute and the Ministry of Health and Agriculture in Tanzania in 1986,²⁷⁸ the institute planned to establish a research and manufacturing institute there in 1987 to be called the Tanzanian Razi Institute.²⁷⁹ Laboratory equipment and batches of animal and human vaccines and sera were sent to Tanzania, and some Tanzanian students were to be trained at the Iranian Razi Institute.²⁸⁰ At the end of a visit to Iran, the Tanzanian premier said that many Iranian products, including vaccines, were in demand in Tanzania and its neighboring countries.²⁸¹ The Construction Jihad has a branch office in Tanzania^{282 283} and has founded numerous clinics that teach hygiene as well as treat patients.²⁸⁴ It is reported that every year 10 000 people in Tanzania benefit from the services of the Jihad Construction Services.²⁸⁵

3.2.5 Dual-use equipment in Iran

Various equipment common to the biotechnological and pharmaceutical industry can potentially be utilized also for the manufacture of BW agents. Certain dual-use components are highly sophisticated whereas some of it can be similar to dairy equipment.^{286 287} It would not be unlikely that Iran would have manufacturers of at least some dual-use equipment. A search for fermenter manufacturers in an industrial database was performed and the results are presented in Table 5. This list should be seen as an example of companies that manufacture civilian technical equipment of a dual-use nature. Obviously the list is far from comprehensive and shows that Iran has some capacity for manufacturing dual-use equipment.

²⁷⁸ Iran aids Tanzanian vaccine production, *Scrip*, No. 1107, p. 16, 2 June 1986

²⁷⁹ Iran develops new rabies vaccine, *Animal-Pharm*, No. 303, p. 15, 1 July 1994

²⁸⁰ Iran develops new rabies vaccine, *Animal-Pharm*, No. 303, p. 15, 1 July 1994

²⁸¹ Ayin, M.P., "A look at The History of Relations between Iran & African States", *The Journal of African Studies*, Vol. 1, pp. 13-28, 1994

²⁸² Jihad Striving for Development and Construction, Public Relations of Jihad-e-Sazandegi (Booklet), Summer 1993

²⁸³ Tanzania interested to broaden relations with Iran *IRNA*, 4 March 1993

²⁸⁴ Ayin, M.P. "A look at The History of Relations between Iran & African States", *The Journal of African Studies*, Vol. 1, pp. 13-28, 1994

²⁸⁵ Ayin, M.P. "A look at The History of Relations between Iran & African States", *The Journal of African Studies*, Vol. 1, pp. 13-28, 1994

²⁸⁶ Koblenz, G., Countering dual-use facilities: Lessons from Iraq and Sudan, *Jane's Intelligence Review*, Vol. 11, pp. 48-53, March 1999

²⁸⁷ Alibek, K. and Handelman, S., *Biohazard*, (Hutchinson: London, 1999) p. 60,98

Table 5. Iranian companies manufacturing fermentation and other potential dual-use equipment

Company	Fermentation equipment	Other potential dual-use equipment	Comments	Staff
Disal P.J.S ^a Address: No. 77, Ressalat Exp'way, Tehran 16316 Factory: 10th km of Transit Road, Abhar	Producer of industrial chemical fermentation plant, for miscellaneous processes.	Producer of steam machines, pumps, heat exchangers, mixers, mills, centrifuges, vacuum dryers for the chemical industry, vacuum evaporators, metal reactors for the chemical industry, dryers and drying plant, filtration plant and machinery.	Provides technology and construction of chemical plants, manufacturing different types of chemical equipments. Imports from European countries and Korea.	90
Machine Darou Ind. (P.J.S) ¹ Address: No.189, 7th floor, Northern Iranshahr St., Tehran 15846 15846. Factory: Eastern Mirdamad St., Alborz Ind.Town, Qazvin, P.O.Box 25	Producer of industrial chemical fermentation plant, for miscellaneous processes.	Producer of jacketed vessels, heat exchangers, filter presses, mixers, blenders, centrifuges, dryers, steam machines, storage tanks and pumps.	Designs and manufactures machinery and equipment for a variety of clients in the pharmaceutical, chemical and food industries. Imports from Germany, Italy, France, Switzerland and the United Kingdom.	90
Niroo Plastic ^b Address: No.310 Aparteman No.314 Western Mir Damad Ave., Tehran IR- 19697	Producer of plastic fermentation tanks for the food and beverage industry.	Producer of protective and safety devices.		
Saboohi ¹ Address: Opp. of Azar Factory, Jey Ave., Esfahan 81000. Factory: 8th Military Base Ind. district, Esfahan		Producer of freeze drying plant and equipment, centrifugal type, high vacuum. Producer of freeze drying plant and equipment for the pharmaceutical industry.		6

^a KOMPASS Middle East/Mediterr 1999/Jul, searched for "ferment*"^b KOMPASS Middle East/Africa/Mediterr 1997/Apr, searched for "ferment*"

3.2.6 Summary

A country's biomedical and biotechnology sector represents a potential basis for a BW program, as it comprises dual-use technologies and equipment, and certain areas are of special interest in this context. Large-scale fermentation was used to produce BW agents for weaponisation in the USSR, and the fermentation equipment for BW agents is essentially the same as used in the vaccine industry.²⁸⁸ The level of sophistication will influence the quality of the end product but even rather simple vats and culture vessels can be suitable for BW production. Therefore, the vaccine industry and its production capacity and the level of vaccine technology are of interest from a BW perspective. In this area the search for information for the present study was successful in that both a substantial volume of data was obtained and, moreover, from several sources that appear to be independent of each other.

Fermentation is also used in the pharmaceutical industry to produce some antibiotics. However, the difficulty in obtaining data in this area, partly because it is industrial proprietary information, and therefore only those pharmaceutical companies for which some details of activities were obtained, have been included in Appendix 1.

Domestic manufacture of fermentation equipment is also relevant to the potential capacity for BW production. In the Soviet Union some equipment for what is reputedly the world's largest facility (at Stepnogorsk, now in Kazakhstan) was made at a factory normally furnishing dairies.²⁸⁹ This sector of Iranian industry was also studied, albeit with limited results.

The focus of this chapter is therefore on production of vaccines for humans or animals and its possible relevance for a BW program. The vaccine industry and its production capacity in Iran is described above. To summarize, Iran has a domestic vaccine industry that produces enough vaccines to cover the country's legitimate needs for human and veterinary vaccines, both in terms of volumes and diseases targeted. The latter do not include diseases that that never or very rarely occur in Iran. On the other hand, Iran, and many other countries, has endemic diseases that are caused by agents often considered as potential BW agents.²⁹⁰

At least some, if not most, of the equipment for vaccine production can probably be produced in the country. The strive for self-sufficiency in Iran includes the vaccine sector and both volumes and the types of vaccines have been expanded in recent years. Iran is actively co-operating with a number of other countries to improve its know-how and production facilities, as well as in turn spreading know-how and technology to other countries.

²⁸⁸ Alibek, K. and Handelman, S., *Biohazard*, (Hutchinson: London, 1999), p. 60.

²⁸⁹ Alibek, K. and Handelman, S., (note 288), p. 98.

²⁹⁰ Australia Group List of Agents for Export Control, URL<http://www.australiagroup.net/en/control_list/bio_agents.htm>.

3.3 Microbial pathogens and toxin research

3.3.1 Introduction

Higher education, which has an ancient past in the dynamic culture and civilisation of Iran, reached the peaks of prosperity at the time of the Sassanids (200-600 AD). In the middle of the 7th century the Arabs conquered the Sassanid empire and Islam was introduced. Scientific centres were expanded and developed during the 7th, 8th and 9th centuries.

In the modern age, the "House of Techniques" was founded in 1848 and higher education centres were established in Tabriz and Urmieh. From 1934 and onwards, the universities of Tehran, Mashhad, Isfahan and Tabriz were opened. With the establishment of the Ministry of Science and Higher Education in 1967, public and private universities and other higher education centres were given a uniform structure in higher education.

The "Scientific Research Council" was established to assist in policy-making in research and to provide support for researcher. The "Supreme Planning Council" formulates and adopts all educational programs and regulations with the assistance of university lecturers. The "Higher Education Expansion Council's" at the Ministry of Culture and Higher Education and the Ministry of Health, Treatment and Medical Education are responsible for planning and monitoring of the establishment and expansion of higher education and research units.

The universities and other higher education and research institutions are administered and managed under the supervision and financial support of "Boards of Trustees". The "University Council" is responsible for planning the educational and research programs.

During the last ten years a range of new programmes to upgrade the national technology base, improving facilities and personnel for basic and applied research have been launched.²⁹¹ Under the Second Five-Year Plan (1995-2000), science and technology has been a top national goal with the stress on infrastructure, research and education. It is understood that this involves co-operation with the Western scientific establishment.

In 1995 Iran's R&D infrastructure was judged as poor. Of 36 882 scientific and technical employees, 68 % were employed by the government and 14 % in the private sector. Of those employed by the government 26 % were involved in science and engineering, 22 % in social sciences, and 20 % in the medical field. The government has sought to remedy this by promoting science and technology programmes. Government research centres (both university centres and those attached to government ministries) have witnessed rapid growth since 1989.

According to the official website of the Islamic Republic of Iran Government, there are today 165 universities or research centres affiliated with the Ministry of Culture and Higher Education, the Ministry of Health, Treatment and Medical Education or other

²⁹¹ Hashim, A.S., Iranian science and technology capacity: Implications of ideology and the experience of war for military research and development, in E. Arnett (ed.), *Military Capacity and the Risk of War. China, India, Pakistan and Iran* (Oxford University Press: Oxford, 1997), pp. 216-222.

ministries (Table 6).²⁹² Foreign sources, like the Swedish Institute of International Affairs, gives a number of 36 for Iranian universities, of which 15 are located in Tehran.²⁹³

Table 6. Ministries and number of affiliated universities or research centres

	Number of Affiliated Universities	Number of Affiliated Research Centres
Ministry of Culture and Higher Education	50	23
Ministry of Health, Treatment and Medical Education	33	6
Other ministries	53	
TOTAL	136	29

The government has increased support for education in science and technology. Top universities are being expanded and new universities in outlying areas have been founded. In 1989 the university student population were 400 000.²⁹⁴ According to the 1996-97 statistics, the total number of students at government-run universities is about 600 000. Out of these, 15 % study at the post-diploma level, 72 % at the bachelors level, 5 % at the masters level, 7 % at the medical doctor level and 1,5 % at the PhD-level according to the official web site of the Islamic Republic of Iran Government.²⁹⁵ In the same year, the total number of graduates were about 83 000 and the total number of full scientific staff members were about 28 000. Higher education institutions are divided into two main groups: (i) government and (ii) non-government institutions. The total number of students studying at various levels at non-government universities or research institutes is about 650 000.

The study of Iranian microbial pathogens and toxin research described in this chapter is a follow-up of a Canadian report published in 1992.²⁹⁶ The Canadian case study was conducted on Iranian publications between 1966 and 1992 on the subject of biological and toxin research and had three objectives. The first objective was to identify specific

²⁹² www.iran-embassy.org.uk

²⁹³ *Länder i fickformat: Iran* [Pocket-Sized Countries: Iran], (The Swedish Institute of International Affairs:Stockholm, 1999).

²⁹⁴ Hashim, A.S., Iranian science and technology capacity: Implications of ideology and the experience of war for military research and development. *In: Military Capacity and the Risk of War. China, India, Pakistan and Iran*, E. Arnett (ed.), (Oxford University Press: Oxford, 1997), pp. 216-222.

²⁹⁵ www.iran-embassy.org.uk.

²⁹⁶ Collateral Analysis and Verification of Biological and Toxin Research: A Second Case Study. Canada, November 1992.

areas of published research activity, secondly to identify institutions and scientists associated with such activity, and thirdly to identify the absence of published research activity in the specified areas.

Table 7. Key words

#1	#2	#3	#4	#5	#6	#7	#8
· Microbiology	· Toxins	· Recombinant DNA	· Large-scale production	· Vaccine technology	· Aerosol	· Bacteria	· Bioregulators
· Virology	· Neurotoxins	· Gene-cloning	· Fermentation	· Immunology	· Lyophilization	· Viruses	· Angiotensin, Atrial natriuretic peptide, Bombesin, Bradykinin, Cholecystokinin, Delta sleep-inducing peptide, Dynorphin, Endorphin, Endothelin, Enkephalin, Gastrin, Gonadoliberin, Neurotensin, Neuropeptide Y, Somatostatin, Substance P, Thyroliberin, Vasopressin
· Bacteriology	· Abrin, Apamin, Brevetoxin, Batachotoxin, Botulinum toxin, Bungarotoxin, Conotoxin, Diamphotoxin, Latrotoxin, Mycotoxin, Palytoxin, Phospholipase, Ricin, Sarafotoxin, Saxotoxin, Tetanus toxin, Tetrodotoxin, Tubocurare	· Biotechnology	· Bioreactors	· Immunization		· Tulare?, Anthrax, Anthracis, Brucell?, Glanders, Pseudomonas, Cholera, Salmonella, Plague, Typhoid, Typhi, Q-fever, Influenza, Ebola, Marburg, Lassa, West Nile, Congo-Crimean, Dengue, Yellow fever, Smallpox	
· Infectious disease							

Iranian publications were identified in five major scientific databases (BIOSIS Previews, Embase, Medline, CAB Abstracts and CS Search) and specific key words were used to identify certain types of research (Table 7). The records of the published research were analysed in terms of: (i) Sites of research, (ii) patterns of publication over time, (iii) authors of the publications, and (iv) apparent nature of the research.

3.3.2 Review of Iranian publications

Research publications were selected on the basis of the specific key words shown in Table 7. The objective was to identify research in key subject areas dealing with recombinant DNA, viruses, bacteria, toxins peptides, bio regulators and other areas of biological research.

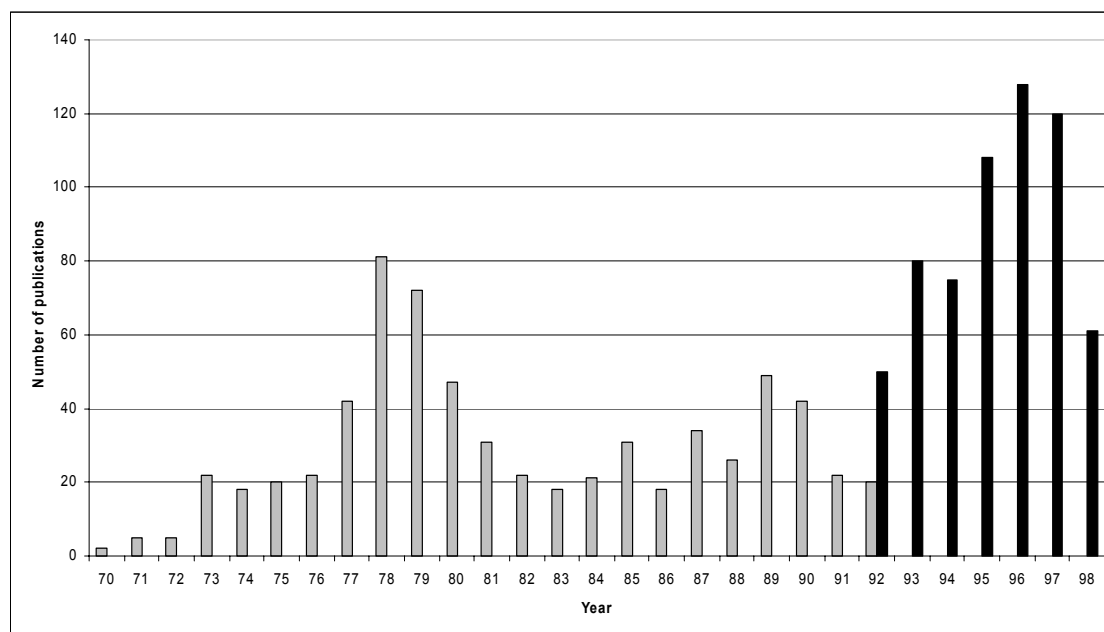


Figure 1. Iranian biological and toxin publications during the periods 1970-92 and 1992-98. Data for the period 1970-97 are taken from.²⁹⁷

Figure 1 shows the time course of 672 publications from Iran during the period 1970 to 1992²⁹⁸ and of 622 publications during the period 1992-98 (this study). The output from Iranian laboratories started to increase in 1973 with a peak number of publications in 1978. The annual number of publications decreased between 1979 and 1992. From 1993 and further on the number of publications per year has steadily increased.

²⁹⁷Collateral Analysis and Verification of Biological and Toxin Research: A Second Case Study. Canada, November 1992.

²⁹⁸Collateral Analysis and Verification of Biological and Toxin Research: A Second Case Study. Canada, November 1992.

The Islamic revolution took place 1979, and the war against Iraq started 1980 and lasted to 1988. During 1980 to 1988 there was a severe economic crisis in Iran. These factors have presumably influenced the activities at universities and research centres in Iran, manifested in the low number of publications.

3.3.3 Universities and their publications

In order to provide more detailed analysis, the research contained in the 672 publications between 1970 and 1992 was further broken down to describe the major laboratories publishing this research. In the Canadian study 18 major Iranian laboratories publishing biological research were identified (Table 8). The publications of these laboratories constituted 81 % of all references in the key word based database search for the time period 1970-92. In the corresponding search for the period 1992 to 1998 the publications of these laboratories only constituted 43 % of the identified publications. In Table 9 are listed universities or research centres (with more than five publications 1992-98) not identified in the Canadian study. When adding the publications of these institutes the percentage of identified publications for the time period 1992-98 is raised to 64.

Table 8. Major Iranian laboratories publishing biological research

University/Research Centre/Company	School/Faculty/Department	Number of publications	
		Time period 1970-92	Time period 1992-98
University of Tehran, Tehran	Faculty of Medicine	87	34
-"-	Faculty of Veterinary Medicine	34	21
-"-	Institute of Biochemistry and Biophysics	22	8
-"-	Department of Biology, Faculty of Science	14	0
-"-	Faculty of Agriculture	21	13
Tehran University of Medical Sciences, Tehran	School of Public Health	64	25
Razi State Vaccine and Serum Institute/Razi Institute, Tehran		59	25
Pasteur Institute, Tehran		26	25
Plant Pests and Disease Research Laboratory, Tehran		49	36
Iranian National Blood Transfusion Service, Tehran		19	1
Pharmaceutical Research Centre, Darou-Paksh Company, Tehran		10	1
Shiraz University, Shiraz	Department of Medicine	40	0
-"-	School of Veterinary Medicine	20	21
-"-	Department of Plant Protection, College of Agriculture	17	9
-"-	Department of Microbiology,	16	5
Isfahan University, Isfahan	School of Medicine,	22	19
-"-	College of Agriculture	17	15
Mashad Medical Sciences University, Mashad		6	12
	Total number of publications	543 (out of 672, 81%)	270 (out of 622, 43%)

Table 9. Additional Iranian laboratories publishing biological research during 1992-98. Listed are all laboratories with five or more publications.

University/Research Centre/Company	School/Faculty/Department	Number of publications
		Time period 1992-98
Shahid Chamran University, Ahvas		9
Agricultural Research Centre Gorgan and Gonbad, Gorgan		5
Seed and Plant Improvement Institute (SPII), Karaj		9
Kerman University of Medical Sciences, Kerman		5
Ferdowsi University, Mashhad		5
Mazandaran University, Sari		6
University of Tabriz, Tabriz		7
Iran/Tehran University of Medical Sciences	Sina Hospital	5
-?-	Centre for Research and Training in Skin Diseases and leprosy	5
-?-	Shariati Hospital	13
-?-		12
Shaheed Beheshti University of Medical Sciences		22
Tarbiat Modarres University, Tehran		14
National Research Institute, Tuberculosis and Lung Disease		5
University of Urmia, Urmia		7
Total number of publications		129 (out of 622, 21%)

In this study a total of 21 research institutions in Iran are described more in detail regarding publication frequency, research focus and main authors. Of these, the five facilities with the most publications since 1970, and the two facilities appearing after 1991 with the most publications were chosen to be presented below. The remaining research facilities are presented in Appendix 2.

3.3.4 Selected Iranian research facilities

3.3.4.1 School/Faculty of Medicine, University of Tehran, Tehran

The pattern of publications over time from the School/Faculty of Medicine is shown in Figure 2.

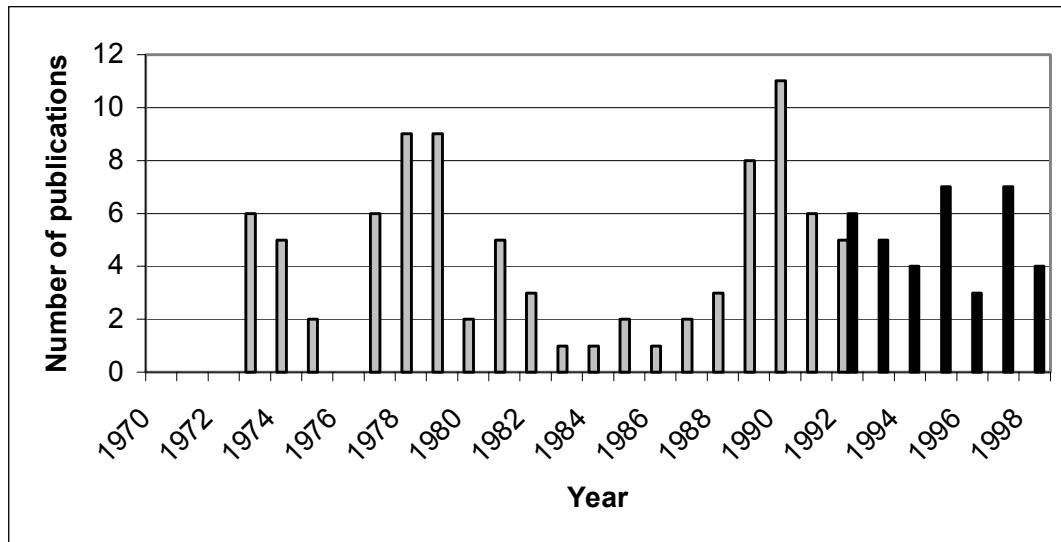


Figure 2. Annual publications from the Faculty/School of Medicine, University of Tehran

The time course of publications follows the same pattern as the time course for all biological and toxin publications during 1970-92. There is a peak number of publications between 1977 and 1980, a lower number of publications from 1981 to 1988 and an increased annual number from 1989.

During the time period 1970-92 the Faculty of Medicine published research on a wide range of biological, biochemical and microbiological subjects. Some of the apparent research priorities included aflatoxins, brucellosis, pentagastrin, pharmacology, Q-fever, ricin, tetrodotoxin and vasopressin.

Table 10. Research priorities

Research	Number of publications
Receptor studies (purinergic, dopaminergic), adenosin and gamma-aminobutyric acid (GABA) systems, drugs	18
Cholecystokinin octapeptide receptor, morphine-related effects	8
Opioidergic neuromodulation	1
Sarcoidosis	1
Vasopressin receptor mediated effects	2
Gentamycin-induced release of N-acetyl-beta-D-glucosaminidase	1
Clonidine-induced rhythmic muscle activity	1
Lead-exposure effects	1
Urease-positive bacteria, infected stones	1
TOTAL NUMBER	34

As can be seen in Table 10, there is an emphasis on biochemical and biomedical research during the period 1992-98, as deduced from published articles. During this period there seems to have been a specific interest for neurobiology. There are no publications concerning aflatoxins, brucellosis, pentagastrin, Q-fever or ricin. None of the 38 authors, except two, on the publications from 1970-92 in the aforementioned areas can be identified in the key word based database search for the time period 1992-98.

Table 11. Main authors

Main authors 1970-92^a		Main authors 1992-98^b	
Name	In 1992-98 list	Name	In 1970-92 list
Ala, F	No	Zarrindast, MR	Yes
Khoyi, MA	No	Dehpour, AR	Yes
Mahmoudian, M	No	Rezayat, M	No
Shafiee, A	No	Ghazi-Khansari, M	No
Zarrindast, MR	Yes	Samini, M	No
		Ghafourifar, P	No
		Sharifzadeh, M	No

^a Authors with five or more publications

^b Authors with three or more publications

Only one of the main 1970-92 authors, MR Zarrindast, seems to have been affiliated with the Faculty of Medicine during 1972-98 (Table 6). This author also appears on publications from the Shaheed Beheshti University of Medical Sciences and the Tarbiat Modarres University, both Tehran. The author MA Khoyi appears to have moved to USA, and the authors M Mahmoudian and A Shafiee appear on publications from the School/Faculty of Pharmacology, Tehran University of Medical Sciences and Pasteur Institute, Tehran, respectively.

3.3.4.2 School of Public Health, Tehran University of Medical Sciences, Tehran

During the years 1970 to 1998 there has been on average three annual publications from the School of Public Health (Figure3). During the time period from 1979 to 1990 there was only a slight decrease in the number of publications.

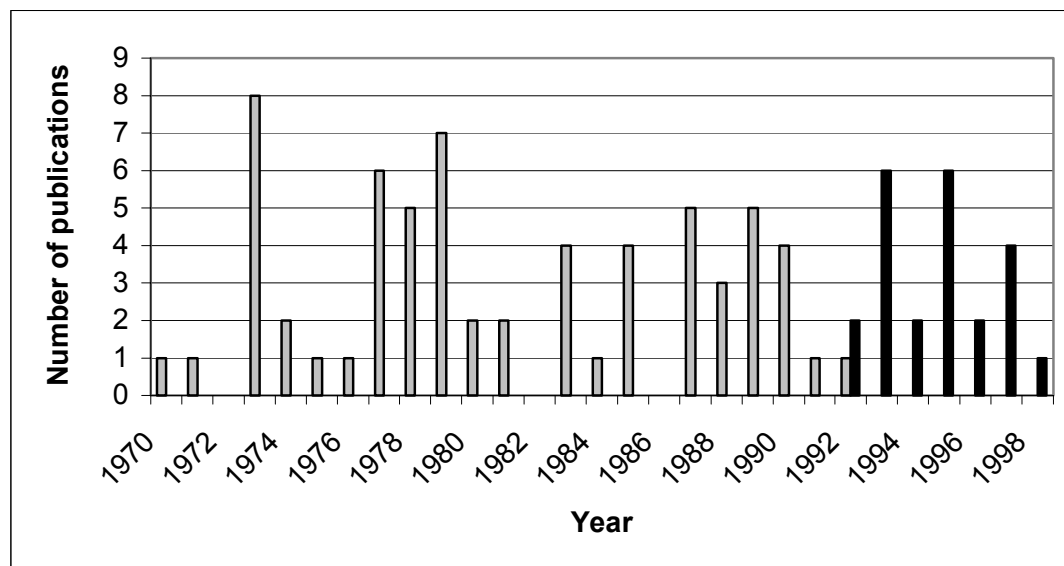


Figure 3. Annual number of publications from the School of Public Health, University of Medical Sciences, Tehran

The School of Public Health was during the period 1970-92 publishing research related to the epidemiology of infectious diseases in Iran. Some of the topics of interest were related to anthrax, biological control of insects, botulism, brucellosis, cholera, Japanese encephalitis, and vaccines and immunization.

During the time period 1992-98 there has been a focus on different aspects of leishmania and malaria (>60 % of the published articles) (Table 12). There have been no publications on *Yersinia*, tularemia, brucellosis, cholera, influenza virus or anthrax. In the Canadian study the articles on these subjects were published between 1970 and 1978. Of the 33 authors on these articles, only three are found in the 1992-98 list. Two Russian authors can be found in the 1970-92 author list. One of these, VM Neronov, is affiliated with the Russian Academy of Science on a publication from 1997. The main authors during the 1992-98 time period are listed in Table 13.

Table 12. Research priorities

Research	Number of publications
<i>Leishmania</i> , spread & vectors & occurrence & vaccine	10
Hepatitis B, vaccine	1
Malaria, spread & vectors & occurrence & treatment	6
Primary Sjögrens syndrome	1
Leukemia and Burkitts lymphoma, Ig gene products	3
Mycobacteria, environmental	1
Pseudomonas infections, burns	1
Salmonella typhi, treatment	1
Bacterial peritonitis, treatment	1
TOTAL NUMBER	25

Table 13. Main authors

Main authors 1970-92		Main authors 1992-98^a	
Name	In 1992-98 list	Name	In 1970-92 list
Afshar, A	No	Yaghoobi-Ershadi, MR	Yes
Edrissian, GH	Yes	Javadian, E	Yes
Eshgy, N	No	Shokri, F	No
Ghorbani, M	No	Manouchehri, AV	Yes
Imandel, K	No	Rastegar, LA	No
Javadian, E	Yes	Zaim, M	Yes
Manouchehri, AV	Yes	Edrissian, GH	Yes
Mohammad, K	No	Moheballi, M	No
Nadim, A	Yes	Nadim, A	Yes
Nasserri, K	No		
Sabbaghian, H	No		
Zaim, M	Yes		

^a Authors with two or more publications

The scientist A Afshar is presently publishing work from the Animal Diseases Research Institute, Ontario, Canada. Between 1985 and 1993 he was publishing work both with a Canadian and an Iranian affiliation. The present affiliation of K Nasserri seems to be Free

University Hospital, Amsterdam and University Hospital Vrije University, both Netherlands, and Isfahan University of Medical Sciences, Iran.

3.3.4.3 Razi State Vaccine and Serum Institute, Tehran

During the 1970 to 1998 period there has been in total 84 publications from the Razi State Vaccine and Serum Institute including the Razi Institute. On average the number of annual publications has been between two and three with a slight increase for each ten-year period (Figure 4).

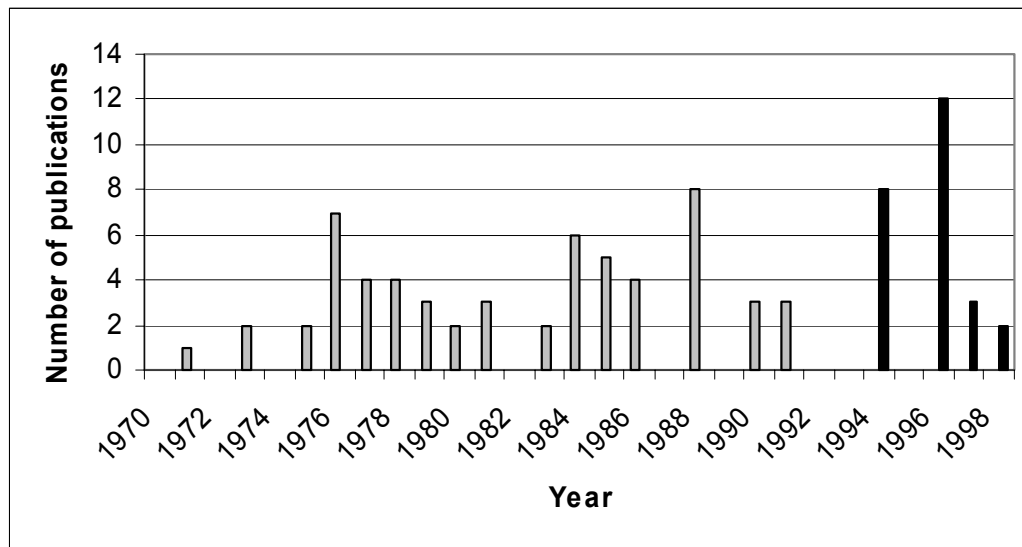


Figure 4. Annual number of publications from the Razi State Vaccine and Serum Institute and Razi Institute, Tehran

The research activities during 1970 to 1992 covered surveys of endemic diseases in Iran and potential treatments. A major area concerned vaccines for human and animal disease. Some of the research priorities were anthrax, *Brucella melitensis*, *Brucella* vaccine, brucellosis, *Clostridium perfringens* vaccine, *Mesobuthus eupeus* venom, Pit Viper venom and rinderpest virus. After 1991 there seems to have been no change in the direction of the research (Table 14).

Table 14. Research priorities

Research	Number of publications
Avian viral infections, survey	1
Bursal disease virus, avian, vaccine	3
Fowl pox vaccine	1
New castle disease vaccine	1
Bovine tumors	1
Bovine rhinotracheitis, vaccine	1
Cattle vaccine, blackleg and haemorrhagic septicaemia	1
Rinderpest virus, seroepidemiology	1
Theliaria annulata, vaccine, animal	2
Scorpion venoms, antivenoms and treatment	2
Anthrax, occurrence	1
<i>Brucella</i> , vaccine	1
<i>Clostridium perfringens</i> , isolates and toxin and antitoxin	4
Toxoplasma gondii, seroprevalence	1
Tick-borne diseases	1
Diphtheria and tetanus, vaccine	3
TOTAL NUMBER	25

More than half of the most frequent authors during 1970-92 period are still present at the institute, which is in accordance with the continuity in its research activities (Table 15). One of the authors, S Bahrami, who is not present in the 1992-98 list, has published articles with Austrian and Chinese affiliations.

Table 15. Main authors

Main authors 1970-92^a		Main authors 1992-98^a	
Name	In 1992-98 list	Name	In 1970-92 list
Aarabi, I	Yes	Moosawi, M	Yes
Ahourai, P	Yes	Ardehali, M	Yes
Ardehali, M	Yes	Hashemi-Ferarki, R	Yes
Bahrami, S	No	Pilehchian, R	No
Darakhshan, H	No	Abshar, N	No
Ebadi, A	Yes	Aghakan, N	No
Farzanpay, R	No	Fereidouni, SRN	No
Hashemi-Ferarki, R	Yes	Marunesi, C	No
Kamali, M	No	Mirchamsy, H	Yes
Latifi, M	No	Momayies-Siahkal, R	No
Mahinpour, M	Yes		
Mirchamsy, H	Yes		
Nazari, P	No		
Shafyi, A	No		
Zowghi, E	Yes		

^aAuthors with three or more publications

3.3.4.4 *Pasteur Institute, Tehran*

During the 1970-98 period there has been in total 48 publications from the Pasteur Institute, Tehran. In the first ten-year period there were 15 publications, after that the annual number drastically dropped, and from 1993 there has been a steady increase in the number of articles published each year (Figure 5).

Research priorities that were reported in the Canadian study encompassed cytotoxins, *Yersinia pestis*, plague, *Salmonella typhi*, enterotoxins, meliodosis, rabies vaccine and tularemia. After 1991 there have been no publications concerning *Yersinia*, plague, *Burkholderia* or tularemia (Table 16).

Only two of the most frequent authors during the 1970-92 period are still present at the institute and only one of the nine most frequent authors 1992-98 was active as an author between 1970 and 1992 (Table 17). This, together with the low number of publications between 1980 and 1989, could imply a major change in the research programme. In the 1992-98 list are several authors with Russian names. Of these, VV Bakayev has published work of the Institute of Molecular Biology, USSR Academy of Sciences, Moscow, and T Medvedeva has published work from the D.I. Ivanovskii Institute of Virology, Academy of Medical Sciences, Moscow.

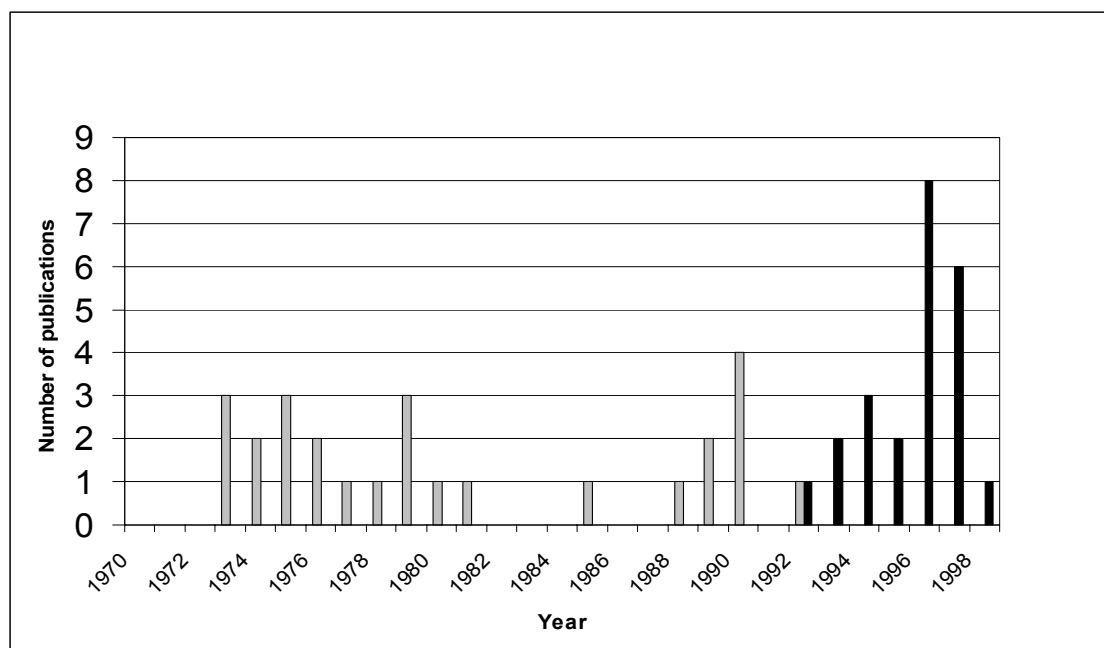


Figure 5. Annual number of publications from the Pasteur Institute, Tehran

Table 16. Research priorities 1992-98

Research	Number of publications
Mycobacterial infections and identification	5
<i>Mycobacterium tuberculosis</i> , PCR ^a identification and resistance to antibodies	3
Food-borne botulism, outbreak	2
Enterotoxinogenic <i>Escherischia coli</i>	1
Non-enteropathogenic <i>E. coli</i> , diarrhea	1
<i>Salmonella</i> , adhesion and invasion and resistance	2
<i>Shigella</i> , plasmids and resistance	1
<i>Leishmania</i> , occurrence and treatment	3
Hepatitis B, seroepidemiology	1
Hepatitis B surface antigen in potatoes	2
Rotavirus infections, children	1
<i>Borrelia</i> , cultivation	1
Human epidermal growth hormone, expression, potatoes	1
Toxoplasmosis, seroepidemiology	1
TOTAL NUMBER	25

^aThe abbreviation used in the Table are: PCR - polymerase chain reaction.

Table 17. Main authors

Main authors 1970-92		Main authors 1992-98 ^a	
Name	In 1992-98 list	Name	In 1970-92 list
Bahmanyar, M	No	Bahrmand, AR	No
De Almeida, CR	No	Pourshafie, M	No
Jafari, A	Yes	Alimohammadian, MHR	No
Karimi, Y	No	Babaei, MH	No
Katouli, M	Yes	Bakayev, VV	No
		Domansky, N	No
		Farhoudi-Moghaddam, AA	Yes
		Samar, G	No
		Shokouhi, F	No

^aAuthors with three or more publications

3.3.4.5 Plant Pests and Disease Research Laboratory, Tehran

Since 1976, the Plant Pests and Disease Research Laboratory has published 87 articles with an increasing annual number (Figure 6). No drastic effects could be seen on the production of publications during the years of economic crisis and war with Iraq. This could be interpreted as the areas of research performed by the institute have a high priority.

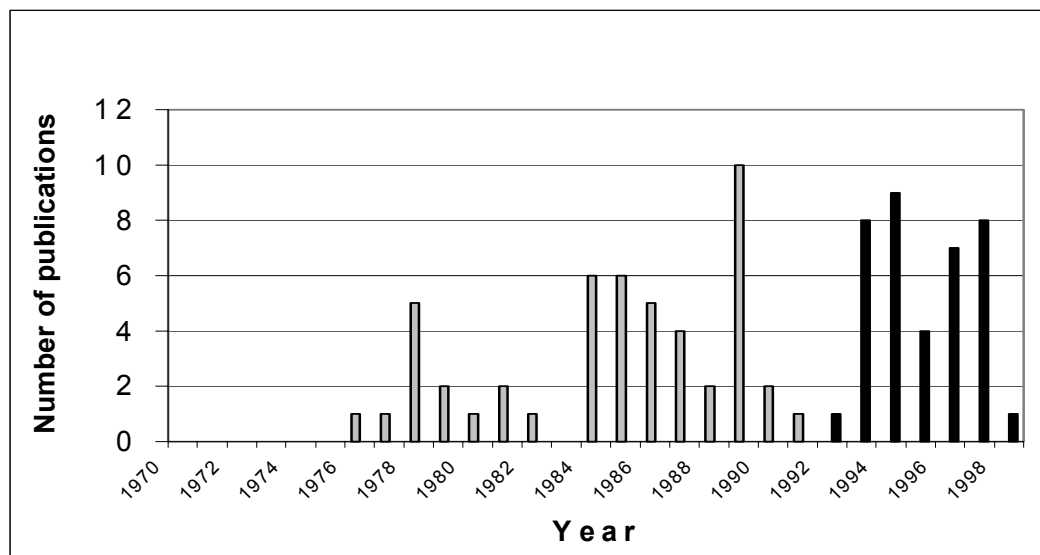


Figure 6. Annual publications from the Plant Pests and Disease Research Laboratory, Tehran

During the 1970-92 period the research priorities included work on *Pyricularia oryzae* and *Fusarium* species, the agents causing rice blast disease and a producer of mycotoxins,

respectively. Published work also described studies of aflatoxins. More than half of all publications during the last seven years describe work on fungal plant diseases (Table 18). The institute also performs studies of bacterial and viral plant pathogens, as well as on methods for preventing or limiting plant diseases.

Table 18. Research priorities 1992-98

Research	Number of publications
Fungi, rust and smut and mildew	5
Fungi, apples & yucca & mulberry & conifer & roses	6
Fungi, Fusarium	1
Fungi, Septoria	1
Fungi, Phytophthora	3
Fungi, Aphyllphorales and Gasteromycetes	1
Fungi, Puccinia	1
Fungi, pleurotoid	1
Sunn pest, hormone mimic	2
Bacterial pathogens, canker and fire blight	4
Pasteuria, parasite of nematode	1
Ice nucleation bacteria	1
Viral pathogens, alfalfa & cucumber & tomato & watermelon & peanut	5
Viroid, citron	1
Biopesticide and pesticides, biological control	2
Chemical control, grasses in wheat	1
TOTAL NUMBER	36

Of the seven most frequent authors 1970-92 only two can be found in the 1992-98 list (Table 19). The author A Fassihiani has published an article on *Fusarium* from Fars Research Centre of Agriculture, Zargan. The author M Izadyar is found on an article from the Agricultural Research Centre of Guilan, Rasht, and M Torabi has published an article from the Seed Plant Improvement Institute, Karaj. Finally, the author J Zad now seems to be affiliated with the College of Agriculture, University of Tehran. None of the authors that earlier published work on aflatoxins appear in the 1992-98 list.

Several of the authors from the Plant Pests and Disease Research Laboratory in the 1992-98 list also appear on publications from other universities or research institutes. Most of them focused on research areas connected to agriculture and plant diseases. This could indicate an effective research network and also a given importance of research issues in this area.

Table 19. Main authors

Main authors 1970-92		Main authors 1992-98 ^a	
Name	In 1992-98 list	Name	In 1970-92 list
Barooti, S	No	Ershad, D	Yes
Ershad, D	Yes	Abbasi, M	No
Fassihiani, A	No	Mirabolfathy, M	Yes
Izadyar, M	No	Bananej, K	No
Saber, M	Yes	Hajimorad, MR	No
Torabi, M	No	Hassanzadeh, N	Yes
Zad, J	No	Mazarei, M	No

^aAuthors with three or more publications

3.3.4.6 *Shaheed Beheshti University of Medical Sciences*

Since 1992 the Shaheed Beheshti University of Medical Sciences in Tehran has published 22 papers in the field of biological and toxin research (Figure 7). The average output is approximately three publications per year, and the trend is an increase in the annual number of publications.

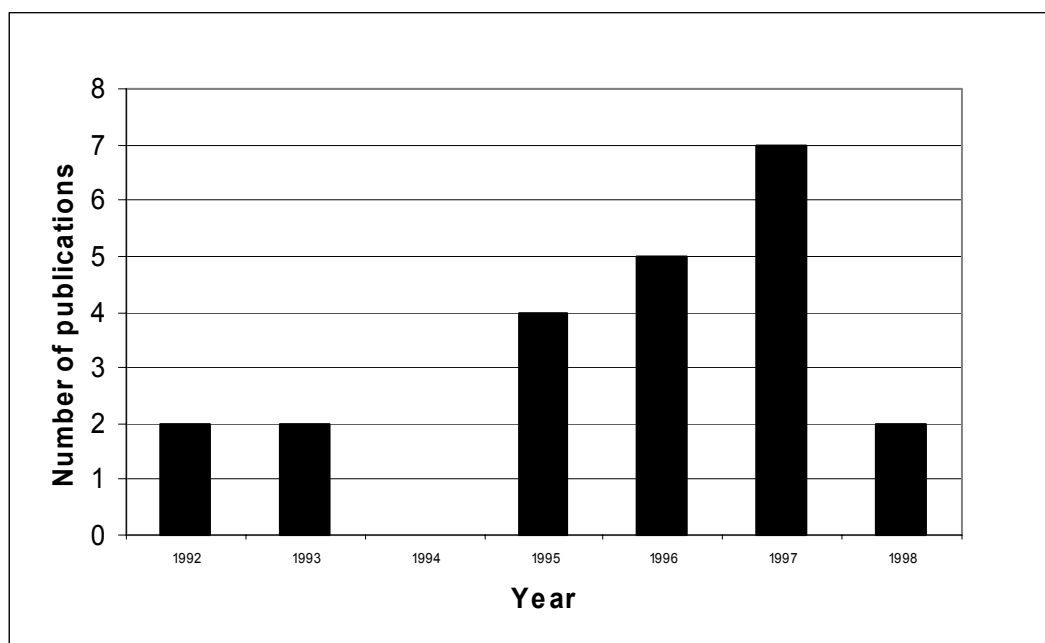


Figure 7. Annual output from Shaheed Beheshti University of Medical Science, Tehran

The research areas, as deduced from the papers published by the main authors, are focused on studies of hormones and their action as well as on renal transplantation (Table 20). The

research topics also include studies of effects of sulphur mustard and evaluation of protective means against toxin poisoning.

Table 20. Main authors and their areas of research^a

Name	Research area
Ghazi, A	Effects and treatment of iodine deficiency; thyroid hormone and RTH ^c syndrome
Azizi, F	Hormones; effects of sulphur mustard or iodine deficiency or methimazole; brucellosis, thyroid gland FSH ^c , LH ^c , testosterone, prolactin, TSH ^c , thyroxine, triiodothyronine
Nafarabadi, M	Effects and treatment of iodine deficiency; effects of sulphur mustard
Roshanzamir, F	Effects of sulphur mustard; protection against T-2 toxin poisoning
Yazdanapanah, H	Fusarium mycotoxins; protection against T-2 toxin poisoning
Kimiagar, M	Effects and treatment of iodine deficiency
Khazali, H ^b	Hormones, animals (dromedaries, camels, rams); LH ^c , GH ^c
Amiransari, B	Renal transplantation
Bassiri, A	Renal transplantation
Gol, S	Renal transplantation
Simforoosh, N	Renal transplantation

^aAuthors with two or more publications

^bOne additional publication from Tarbiat Modarres University, Tehran

^cThe abbreviations used in the Table are: RTH - Resistance to thyroid hormone; FSH – follicle-stimulating hormone; LH – luteinizing hormone; TSH - thyroid-stimulating hormone; GH - growth hormone.

3.3.4.7 *Tarbiat Modarres University, Tehran*

During the period 1992-98 there have been 14 published papers from the Tarbiat Modarres University, Tehran. The average number of published papers per year has been two, but the trend is a decrease in this number (Figure 8).

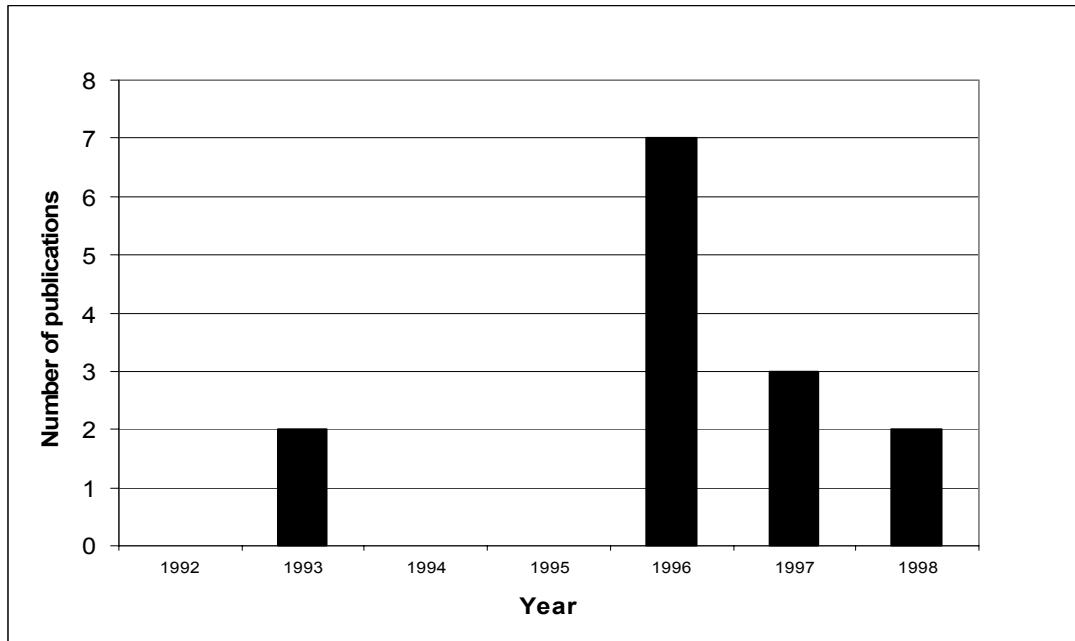


Figure 8. Annual output from Tarbiat Modarres University, Tehran

As deduced from the papers published by the main authors, there seems to be four major research areas at the Tarbiat Modarres University (Table 21). Firstly, several of the authors are involved in work on plant viruses. They also have collaborative work with researchers at the College of Agriculture, Isfahan University of Technology, Isfahan, and the Plant Pests and Diseases Research Institute, Tehran. The second area of research is focused on studies of hormones and immunomodulators such as cytokines. These authors seem to have a connection to researchers at the Shaheed Beheshti University of Medical Sciences, Tehran. The third area is directed to research issues in connection with receptors and receptor functions, and involves collaborative work with the Medical Faculty, University of Tehran, Tehran, and Shaheed Beheshti University of Medical Sciences, Tehran. Lastly, the fourth area of research concerns production of single cell protein and fermentation. The research topics also include studies of effects of sulphur mustard and Staphylococcal enterotoxin B.

Table 21. Main authors and their areas of research. Authors with two or more publications

Name	Research area
Ahounmanesh, A ^a	Tomato mosaic virus; watermelon chlorotic stunt virus; cucumber mosaic virus
Hajimorad, M ^b	Alfalfa mosaic virus; cucumber mosaic virus; tomato yellow leaf curl geminivirus; peanut stunt cucumovirus
Fazlali, Y	Cucumber mosaic virus
Karimi, AR	Cucumber mosaic cucumovirus
Ebtekar, M	Immunomodulators; cytokines; effects of sulphur mustard; Staphylococcal enterotoxin B
Khazali, H ^c	Hormones, animals (dromedaries, camels, rams); Luteinizing hormone, growth hormone, testosterone
Motamedi, F ^d	Dopaminergic receptors, bombesin brain receptor, tetrodotoxin and Medial Septal Area and memory or long-term potentiation
Rashidy-Pour, A ^e	Bombesin brain receptor, tetrodotoxin and Medial Septal Area and memory or long-term potentiation
Shojaosadati, SA	Single-cell protein production; ethanol fermentation

^aAdditional publications from Isfahan University of Technology, Isfahan, and Plant Pests and Diseases Research Institute, Tehran

^bAdditional publications from and Plant Pests and Diseases Research Institute, Tehran

^cAdditional publications from Shaheed Beheshti University of Medical Sciences, Tehran

^dAdditional publications from Medical Faculty, University of Tehran, Tehran, and Shaheed Beheshti University of Medical Sciences, Tehran

^eAdditional publications from Shaheed Beheshti University of Medical Sciences, Tehran

3.3.5 Fungal toxin publications

From all identified research centres in the Canadian study and in this study there were in total 34 published papers on fungal toxins during the years 1970-98 (Figure 9). The average annual numbers of publications for the first and second ten-year periods were 1.5 and 1, respectively. During the last nine years studied, the average has been 1.0. The majority of publications, more than 60 % of all published papers, occurred between 1975 and 1982.

As for the earlier time period, 1970-92, the research during the last seven years included studies of *Fusarium* mycotoxins and aflatoxins (Table 22).

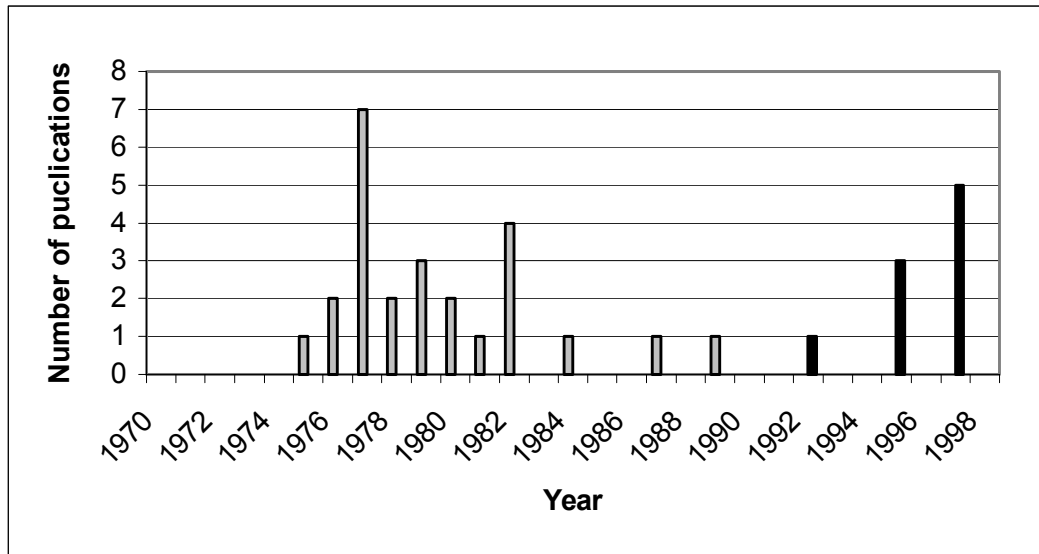


Figure 9. Iranian fungal toxin publications

Table 22. Fungal toxin research and involved universities and research institutes

Toxin or Fungus	University	Number of publications (publication year)
<i>Fusarium</i> mycotoxins, occurrence and protection	Islamic Azad University, Tehran	4 (1995, 1997)
	Shaheed Beheshti University, Tehran	
Aflatoxin B1, biological adducts and biotransformation	Tarbiat Modarres University, Tehran	4 (1992, 1995, 1997)
<i>Verticillium</i> phytotoxin, characterization	Plant Pest and Diseases Research Laboratory, Zarghan	1 (1995)

3.3.6 Brucellosis publications

During the time period 1970-98, there have been 50 published papers on *Brucella* or brucellosis (Figure 10). The majority of publications appear during three time periods: 1972-75 with 13 publications, 1980-88 with 24 publications, and 1995-97 with eight publications. There have been no published papers between 1991 and 1994. There is no obvious decrease in the number of publications between 1979 and 1992, as found for total Iranian publications on biological and toxin research (Figure 1). This could be a reflection of the epidemiological situation in Iran, resulting in high priority of research on specific subjects.

The research on *Brucella* and brucellosis are focused on occurrence in animals like sheep, horses or dogs and prophylactic treatment (vaccination), as seen in Table 23. There are also published papers describing studies of human brucellosis.

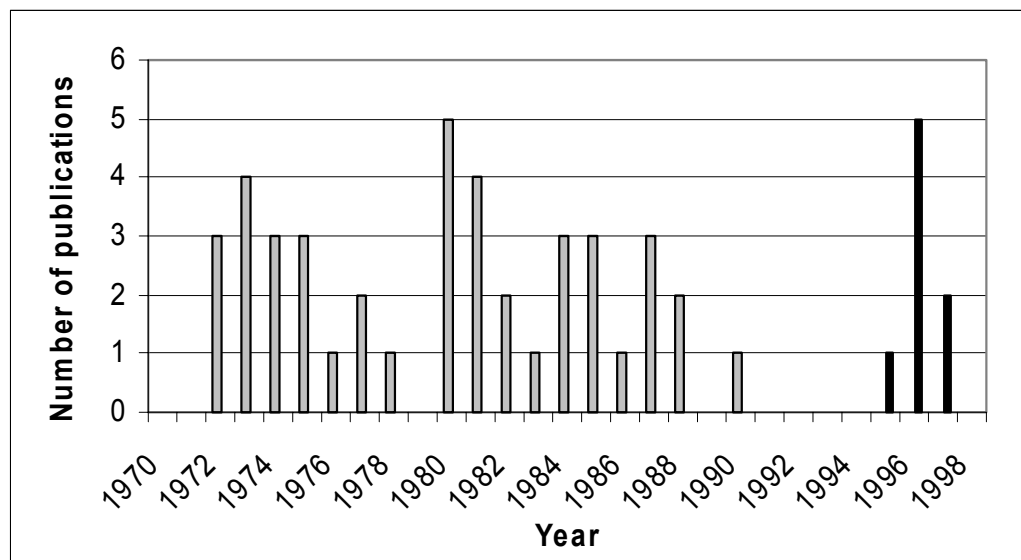


Figure 10. Iranian publications on brucellosis

Table 23. Brucellosis research and involved universities and research institutes

Toxin or Fungus	University	Number of publications (publication years)
Brucellosis, occurrence and vaccination, animals	Urmia University, Urmia.	5 (1995, 1996, 1997)
	Razi Vaccine and Serum Research Institute, Tehran.	
	University of Tehran, Tehran.	
	Ferdowsi Mashhad University, Mashhad.	
	Islamic Azad University of Tabriz, Tabriz.	
Brucellosis, human	Shaheed Beheshti University of Medical Sciences, Tehran.	3 (1996, 1997)
	Babol School of Medicine, Babol	
	Alzahra Hospital, Isfahan	

3.3.7 Anthrax publications

Since 1970 there have been 13 Iranian publications on anthrax research (Figure 11). Ten of these were published during the time period from 1973 to 1985. Between 1986 and 1992 there have been no publications in this area of research.

The publications during the last seven years studied are scattered in time and describe work on meningial or intestinal anthrax in man. This could reflect a correlation to incidences of anthrax in Iran. The research institutions publishing this research were Tehran/Iran University of Medical Sciences and Razi Vaccine and Serum Research Institute, both located in Tehran.

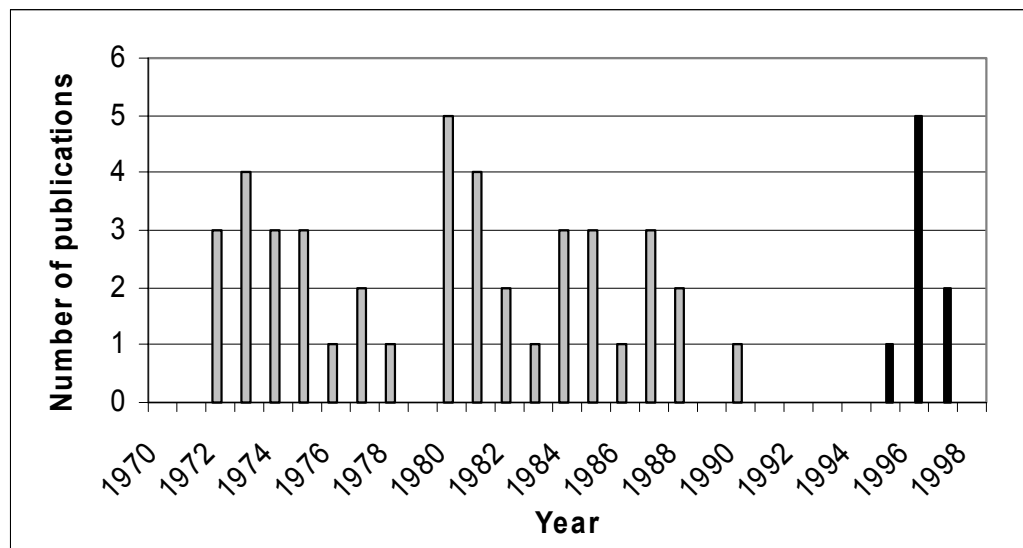


Figure 11. Iranian anthrax research

3.3.8 Neurotoxin publications

Since 1970 and up to 1998 there have been in total 28 published Iranian papers on neurotoxin research (Table 24). There are low annual numbers of publications. However, the trend is a slight increase.

The only paper published 1992-98 on botulinum toxin concerned an outbreak of food-borne botulism. The only publication 1970-92 also dealt with an outbreak of botulism poisoning. During the earlier period three publications dealt with vaccination against tetanus toxin. Between 1992 and 1998, three papers described work in this field and an additional three papers dealt with tetanus in humans. The published work on tetrodotoxin only involved tetrodotoxin as a tool to study neurotransmission. The described work on scorpion and snake toxins dealt with treatment of poisoning and neurological effects, respectively.

Table 24. Neurotoxin research and involved universities and research institutes

Toxin	University (1992-98)	Number of publications	
		1970-92	1992-98
Botulinum toxin A	Pasteur Institute, Tehran	1	1
Tetanus toxin	Razi State Serum and Vaccine Institute, Tehran	3	6
	Shiraz University of Medical Sciences, Shiraz		
	Ferdowsi University of Mashhad, Mashhad		
Saxitoxin	-	2	0
Tetrodotoxin	Tarbiat Modarres University, Tehran	2	3
	Tehran/Iran University of Medical Sciences, Tehran		
Scorpion/Snake toxins	Razi Institute, Tehran	5	2
	Khorasan University of Medical Sciences, Mashhad		
Other neurotoxins	Urmia University, Urmia	0	3
	Mashhad University of Medical Sciences, Mashhad		
	Tehran/Iran University of Medical Sciences, Tehran		
	Total number	13	15

3.3.9 Summary and conclusions

During the six years between 1992 and 1998 there has been a significant increase in the number of Iranian published papers in the microbial pathogen and toxin research field. This is probably a reflection of the governmental promotion of science and technology, which has resulted in a rapid growth of this area since 1989. The effect of the governmental support can also be seen in an increased number of universities and research institutes involved in biological and toxin research during the time period 1992-98 as compared to the years 1970-92 (Tables 8 and 9).

Of the research facilities identified in the Canadian case study, the majority showed a decrease in publication rate during the years 1979 to 1989. Exceptions to this are Institute of Biochemistry and Biophysics (University of Tehran), Faculty/College of Agriculture (University of Tehran), School of Public Health, Razi State Vaccine and Serum Institute, and Plant Pests Disease Research Laboratory. All these facilities are located in Tehran.

The papers published by these institutes describe work either in the agricultural field (plant and animal diseases, toxins associated with agricultural products) or in the public health field (epidemiology, infectious diseases, vaccines and treatment).

A comparison of main authors from the different research facilities in the Canadian study and this study shows differences. Several of the earlier authors are no longer involved in biological and toxin research, as deduced from the present database search. Some of them seem to have moved abroad or left for other Iranian research locations (according to a name-based search in the PubMed database).

Among research facilities that have continued to publish after 1991, some apparent changes in research direction can be noted. For seven facilities²⁹⁹ no publications were found on subjects such as aflatoxins, ricin, brucellosis, Q-fever, *Yersinia*, tularemia, cholera, anthrax, foot-and-mouth disease, typhoid fever, sulphur mustard and mustard gas in 1992-98. The College of Agriculture, Isfahan University, had no publications on aflatoxin or mycotoxins in 1992-98, but other fungal and viral plant diseases. Since these eight research facilities continued to publish their research on other subjects in English, it is less likely that research in areas of expertise would be published in lesser journals rather than international journals (in English) after 1991. This indicates that the aforementioned topics were of lesser priority, abandoned, or not published openly after 1991.

The research involving potential BW agents seems to have decreased after peak periods between approximately 1976-80 for fungal toxins, 1973-88 for brucellosis research, and 1973-84 for anthrax (Figures 9, 10 and 11). Some scattered publications can be seen that appear to be associated with natural outbreaks or incidences of disease. A supplementary database search in PubMed (NCBI, National Library of Medicine) shows a similar pattern (Figure 12). It is apparent from Figure 12 that BW agents research shows a decline after 1979. At the time when publications in biological and toxin research start to increase, after approximately 1990, there is no concomitant increase in the number of publications on BW agents research.

²⁹⁹Faculty/School of Medicine (University of Tehran), School of Public Health (Tehran University of Medical Sciences), the Pasteur Institute, Faculty of Veterinary Medicine (University of Tehran), Institute of Biochemistry and Biophysics (University of Tehran), School/Faculty of Medicine, (Isfahan University), and Mashad Medical Sciences University.

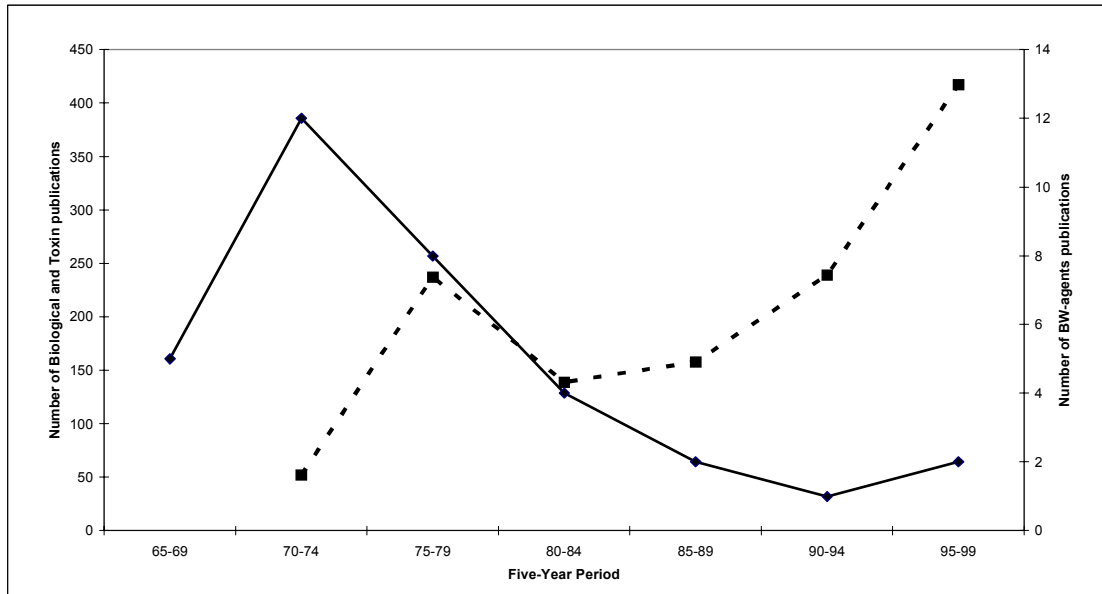


Figure 12. Iranian research publications on potential BW agents, and biological and toxin research between 1965 and 1999. The PubMed database was searched using key words selected to cover plague, anthrax, tularemia, *Rickettsia* and *Brucella*.

4 Discussion

4.1 Discussion of report findings

Various allegations have been made, mainly by the US, about Iran concerning CBW. Careful analysis of these allegations shows that they in general focus on capabilities and possibilities to produce agents. They go as far as to point out perhaps two facilities but give no further details. The US assessment is that in ten years the military may be able to deliver BW. This statement has not been modified as the years pass. From this can be seen that the language chosen is not that specific and mostly point to a possible BW capability. What information these allegations are based on and how the final allegations are arrived at, is never disclosed. Most other Western governments agree in general with the US assessments, even if their statements are not presented in the same manner.

Iranian opposition groups have presented reports supporting the view that there are ongoing WMD programmes. It can be discussed if this information is independent or based on previously published US information. There is very limited information pointing to specific organisations, type of agents worked on, stockpiles or weapons for delivery. (Information searches during the course of the present study, using such specific details in the most recent allegations, have not yielded any additional information.) The claims often focus on that Iran has ambitions and capabilities to develop BW or CW. This kind of statements can be true for many states that have sufficient technological infrastructure and required general know-how. It should also be borne in mind that most information on potential CBW programmes comes from two or three intelligence sources and thus cannot be checked for accuracy.

Proliferation of sensitive knowledge from former BW states is an issue of concern. There have been reports of increasing co-operation and exchanges of scientists in the biotechnology area between Russia and Iran during the last years. From the review of openly available information these exchanges appear to deal with legitimate commercial and scientific activities. However, these agreements on co-operation could of course be a cover for more BW-related activities, but there is nothing to support this in open publications.

Iran's arms control policies have been remarkably consistent and represent a rational response (as seen through Iranian eyes) to the security situation in which that country finds itself. It can also be noted that Iran has played a very active role in the CBW disarmament fora. Tehran has paid particular attention to what it regards as discriminatory policies of Western countries when they restrict access to dual-use technologies, including in the biological area. Iran has repeatedly suggested that such discriminatory supplier's groups (like the

Australia Group³⁰⁰) be abolished and that, in their place, the international verification mechanisms associated with multilateral treaties, like the BTWC and CWC, be strengthened. Iran has also placed great emphasis on the security guarantees that are often associated with these treaties, both positive and negative, and has called for negotiations to make such assurances legally binding.

The views of Iran on BW are in line with those of many other States Parties belonging to the NAM. In some respects, Iran is advocating a radical and hard line view with limited support in the NAM when they demand that the Australia Group export controls must be abolished. Iran supports the BTWC yet has not worked for a strong control mechanism but rather attempted to weaken it, favouring voluntary declarations and visits. Some of Iran's other negotiating positions on lists of agents and equipment, thresholds, including the word "use" in the BTWC, and during the terminated Protocol negotiations were more aimed at prolonging the negotiations than being constructive. The demand to define terms in Article I of the BTWC was even more serious as it would have meant redefining and limiting the scope of the Convention, and a discussion or negotiation on this would be detrimental for the Convention.

Iran has not openly declared or admitted the presence of a biodefence programme. Iran, in its only response under the CBMs of the BTWC, in 1998 neither answered yes or no if there is a biodefence programme. However, it is most probable that Iran has such a programme, due to its situation close to Iraq that for many years conveyed to the world that it had a well-developed BW programme. In this context, and due to the allegations of offensive BW activities, it should be in the interest of Iran to openly declare any biodefence programme. If this is not done, the suspicions will linger that there is something to hide in this area. Promoting transparency and to build confidence in the area of biodefence and its compliance with the BTWC should be made a priority for Iran.

In 1995, the Iranian R&D infrastructure was judged as poor but the government has sought to remedy this by promoting R&D programmes and exchanges with foreign countries, as well as the development of the biotechnology industry. A broad review has been carried out concerning the research and development base in Iran on microbial pathogens and toxins as seen from articles journals published in English. This review was compared and modelled after a previous Canadian study. During the period 1992-98 there was a clear increase in the number of publications partly due to that the whole biotechnology area has been given government priority for its development.

³⁰⁰The Australia Group is an informal group of Western countries that regularly meet to harmonize their national legislation on export controls concerning biological agents, toxins and chemical precursors as well as production equipment of dual use nature that could be misused. The group also exchange information on the proliferation of BW and CW.

One such example is the establishment of the National Research Centre of Genetic Engineering and Biotechnology. The numbers of universities and research organisations that perform research in this area have also increased. After the revolution 1979 there was a decrease in the numbers of publications. Due to the low number of publications dealing with specific BW agents, it is difficult to show any significant trends. This research decreases after 1979, and in the 1990s, there is no increase in the number of publications on BW agents in comparison with the notable increase in overall publications.

It should also be pointed out that no scientific work published in farsi or other non-English languages were included and thus, the volume of such work is not known. However, it is known that conferences on bioterrorism and protection against BW have taken place in Iran but nothing was found published in English. From the study it can be seen that a fair number of research institutes are involved and they cover a broad range of research topics. It can also be concluded that this research base and topics are what could be expected for a country like Iran.

In line with the Iranian governmental policy to further develop the biotechnology industry, self-sufficiency has been promoted for pharmaceuticals, including vaccines, and that at the 1990s this goal had very nearly been achieved. The review carried out of the Iranian vaccine industry identified the two main producers for human vaccines, the Razi Vaccine and Serum Institute and the Pasteur Institute, and nine producers of veterinary vaccines. The total production capacity of the Iranian vaccine industry is substantial and the number of different vaccines produced has increased in recent years. In conclusion, Iran has a domestic vaccine industry that produces enough vaccines to cover the country's needs for human and veterinary vaccines, both in terms of volumes and endemic diseases targeted. At least some, if not most, of the equipment for vaccine production can probably be manufactured in the country. Both volumes and the types of vaccines have been expanded in recent years as a result of the policy of achieving self-sufficiency in the country. Iran is also actively co-operating with a number of other countries to improve its know-how, including process technology, and the production facilities.

In preparing to carry out this study, the then current literature on Iran and WMD was reviewed. On the issue of biological capabilities, the information was found to be very scant, addressing the intentions of Iran rather than the scientific and technical resources relevant to the BW issue. This study shows that Iran, like many countries, has a material resource base that would enable an offensive BW programme if deemed politically necessary or desirable.

At the out-set of this study, it was not expected that searches in various open sources for information on Iranian science and technology would yield much information. On the contrary, the information allowed for satisfactory description of the vaccine production and biomedical research in the country.

The unexpected amount of information allowed for descriptions of general trends in the selected areas of Iranian research, but not an in-depth analysis of individual research papers. An advantage when collecting information in these areas was that the sources and their information were primarily targeted at an audience different from the intelligence community.

In summary, the publicly available information used in this report to describe various aspects of Iranian research, development, industry and technology status points to legitimate activities, i.e. activities of peaceful nature and purpose. Information from Iranian actions during disarmament negotiations and in BTWC declarations, or the lack thereof, provides adequate material for proliferation analysis, as is seen here.

4.2 Discussion on open source information and allegations of offensive programmes

Before entering upon a discussion on actual allegations of BW programmes, it is beneficial to take a look at the information used in such a discussion. In principle, there are at least three main sources of specific, publicly available information regarding allegations made against Iran: (a) Official government statements or publications, (b) news reports or other publications, and (c) personal communications. Most, if not all, government statements or publications on Iranian capabilities and intentions are, to some extent, ambiguous. This is often deliberate, partly in order to protect intelligence sources and methods. However, one can generally be quite certain that all such statements or publications are legally correct to the best knowledge of those who prepared them. In other words, they are correct and based on the best information, including that which is classified, available to the state. Most news reports are of mixed value because their provenance may be uncertain or unknown.

Open source information can give a picture of a state's emphasis on CBW-related R&D and equipment, the possible size of CBW defence programmes, other CBW defence-related areas (at least in the West), as well as arms control policies. Open source information can point in two main directions: The apparent existence of a programme and the apparent non-existence of a programme. In both cases, the image based on open sources may be true or false. Outside observers should be able to form a reasonable opinion of Iran's capabilities and intentions with respect to BW by systematically reviewing both the general parameters involved in conducting such an assessment, as outlined here, and by considering a sufficiently large amount of specific information. Occasionally, US intelligence officials have said that approximately 95 % of all information obtained by their agencies is from open

sources (i.e., it is unclassified and publicly available).³⁰¹ It is also clear that intelligence assessment both within countries and between countries have differed.

A problem is of course to obtain information about the intent of a state. It is likely that most of the information, or at least the most crucial information is classified. Furthermore, the publicly available open source information on policies and views is not always reliable. In fact, it may be desirable to disseminate false and incomplete information to obscure the real intent on an issue. While one can never be certain of the nature and meaning of information that one does not have access to, it is hoped that readers have been given a reasonably good understanding of what is known about Iranian BW capabilities, and that they will find that this exercise provides a useful analytical framework with which to judge proliferation allegations generally.

Iran's intents in the CBW area have sometimes been analysed based on Iranian views on export control. Iran has clearly and publicly opposed informal export control arrangements, such as the Australia Group, which have been used to deny Iran and other countries access to materiel, equipment and technology, including dual-use items, which could be used in the production of chemical, biological or nuclear weapons, as well as ballistic missiles.³⁰² Iran has clearly made efforts to circumvent such arrangements, partly for reasons unrelated to any possible desire to acquire these weapons, but rather out of national prestige and a desire for technological and economic self-sufficiency.

All denials due to export control regulations by Western governments are confidential and the numbers or details of the type of equipment denied are in most cases not in publicly available material. Thus, such information is not available for analysis. The elaborate and some times complex ways equipment is obtained may not be normal for perfectly legitimate procurements. To this can be added the political dimension, where Western governments in statements express the importance of export control systems to limit the proliferation of WMD, and Iranian statements to the effect that these regimes

³⁰¹ Commission on the Roles and Capabilities of the United States Intelligence Community, *Preparing for the 21st Century: An Appraisal of U.S. Intelligence*, 1 March 1996, p. 88, URL<http://www.oss.net/dynamaster/file_archive/020827/4f12cfe42362dad90bf4d7cc87849263/Exec3.htm>.

³⁰²Iran has consistently expressed opposition to informal export control arrangements at multilateral fora, including the Conference on Disarmament, the Ad Hoc group while it was still engaged in negotiating a legally-binding instrument to strengthen the 1972 Biological and Toxin Weapons Convention (BTWC) and at the Organisation for the Prohibition of Chemical Weapons (OPCW). See, for example, "Statement by H. E. Dr. Amir H. Zamaninia, Director-General for International Political Affairs, Ministry of Foreign Affairs of the Islamic Republic of Iran, Before the Seventh Session of the Conference of States Parties to the Chemical Weapons Convention", The Hague, Netherlands, 7-11 October 2002.

are discriminatory and limiting on Iran's peaceful development in specific areas.

The difficulty in the BW area is that almost all equipment with the exception of means of delivery and weapons are of dual-use nature. The question is what the material base is used for. It can then be concluded that a potential BW or CW capability is not enough to constitute a threat. Information on and analysis of the material base is essential to enable an assessment of any potential BW or CW programmes or related activities in a state. It is against this background that Western countries have imposed export control regimes to prevent that equipment or agents will be used for activities prohibited by the Conventions. As the criteria used to deny or limit export of equipment are not open there are allegations that these regimes are discriminatory and used to favour Western interests. Frequently "rogue states" is used as a term for "proliferators". A consequence of this is that states can end up on the list of "proliferator states" for a number of reasons including political. A proliferator designation is usually connected with a state trying to procure equipment which is controlled through export control regimes. In order to do this these states use a complex set of cover companies in different parts of the world. Thus, one way proliferators are identified by analysts is that they use very complex systems for procurement, which would not be required or efficient if the procurement was legitimate.

Official statements by bodies such as the OPCW, or during official CWC or BTWC negotiations also do not exclude the possibility that Iran is violating the treaties. This is mainly due to differing views on what is required to demonstrate treaty compliance, and the impossibility of proving a negative (i.e., the absence of an offensive BW or CW programmes). There are differing views on the meaning of "verification" and how much is sufficient to demonstrate treaty compliance with a "high degree" of confidence. Thus, in the absence of proof of non-compliance, discussions on treaty verification always involve a subjective element. While it is true that CWC verification provisions are among the most intrusive of any multilateral arms control and disarmament regime, the most stringent measure – a challenge inspection – has never been invoked by any State Party. All doubts regarding Iranian compliance with the CWC have been expressed outside the framework of the OPCW. This implies either that the basis for such allegations is weak and subject to multiple interpretation, or that the countries involved are unwilling to divulge intelligence sources and methods in a multilateral framework in order to convince other members, some of whom would almost certainly view the issue with scepticism.

There is at times a tendency to treat biological, chemical and nuclear weapons as one and the same entity (e.g. as WMD), and intents in the CBW area risk being confused with intents regarding nuclear weapons. Possible Iranian interest in acquiring a nuclear weapon capability or stockpile, is not proof that the country intends to pursue offensive chemical or biological weapon

programmes. In considering what, if any, linkages may exist between Iranian policies regarding these weapon systems, one should consider a number of other elements, including Iran's military doctrine and internal policy documentation. A great deal of time and effort has been spent analysing various countries' military doctrines over the years, with mixed results. Unless reliable documentation openly describes the conditions under which a banned or restricted weapon system is to be used, one usually must rely on a close reading of the text and infer possible meanings of selected phraseology, or the lack thereof. Analysing documentation related to military doctrine may prove problematic in view of that the state in question realises that such analyses are routinely carried out by other countries, and since internal documentation is unlikely to be made public. States generally do not make internal policy documentation publicly available until or unless they are rendered historical curiosities.

Any potential clandestine weapon programme would be highly compartmentalized and highly secret. These are the lessons learned from the Soviet and Iraqi WMD programmes. At least some of those involved in CWC implementation, for example, would likely not be privy to possible Iranian treaty violations. Likewise, regular Iranian armed forces may be largely unaware of aspects of some weapon programmes, as was apparently the case with the Indian military and its chemical weapon stockpile prior to that country declaring it to the OPCW following entry-into-force of the CWC. One should also note that if a programme, with the possible exception of a nuclear weapon programme, is so secret that the country's own armed forces are largely unaware of its existence, it would be difficult to argue that the weapon system is integrated to any significant degree in the country's military doctrine and operations. In such cases, the weapon system may serve more a strategic or political purpose at some future date following a decision to make the programme public. Usually the discussion is focused on a military capability. If, on the other hand, a capability would only be required for carrying out terrorist activities the facilities and equipment required would be of a much smaller scale and extremely difficult to detect. Alternatively, the programme may be driven by internal institutional reasons more or less autonomous or unrelated to outside factors.

What could the motives be, hypothetically, for Iran to acquire and develop a biological warfare capability? As the possession of BW is prohibited, this can not be openly declared or presented in a military doctrine to give greater prestige in the region. To have BW can have a political and strategic value for Iran. Weapons of mass destruction can help to create a balance between the Islamic world and Israel. One way for Iran to become a regional military power that cannot be neglected could be to acquire and develop WMD including BW. The strategies to prevent proliferation of WMD implemented by the West can be said to have slowed the rate of progress of the WMD programmes in the region, but have so far had limited success. The possession

of WMD that the West seeks to prevent Iran from acquiring, can give Iran a better negotiating position with the EU and the US as long as both firmly believe Iran's BW ambitions. Comparisons can be made with the North Korean nuclear programme and its deals with the USA. BW are banned, hence no one is entitled to possess or use them, and therefore no state can officially threaten to use them, or set out strategies for their use in a military doctrine. In the area of BW it is well known that if states that possess them do not openly declare this, it will anyway convey a threat and instil a form of deterrence. This could be achieved by not officially declaring possession but giving unclear hints and making ambiguous statements.

Prior to the US intervention in Iraq in March 2003, any Iranian potential attempts to acquire WMD were probably largely to balance Iraq's capabilities and to be able to retaliate against Iraq. The statements and actions by the Iranian government that could be taken to be indicative of its views and intentions regarding CBW are often ambiguous. Conditional statements, such as regards CW as inhumane and inhibitions to use them unless forced to by Iraq, point both to that there may indeed exist a CW programme, but also that the Iranians were only considering starting a programme if Iraq used or threatened to use CW. Iran has legitimate security concerns, foremost of which were Iraq. As long as Iran could not match Iraq or US conventional strength in the region, it would probably not abandon unconventional or asymmetric warfare or even terrorism. The protection of any potential WMD programmes so that nothing is disclosed that can indicate their location or activities would be most essential for Iran.

The potential threat posed by biological and chemical weapons or agents worldwide, including from terrorists, has attracted increasing attention in the past few years, for example in the media, not least after 11 September 2001 and the anthrax letters in the US. It is frequently stated that the threat from WMD has increased. Less attention has been given to what we actually mean by using the term "threat from biological or chemical weapons". How a threat is perceived will depend on many factors like the political, economical, social or cultural situation, etc. Every state has the right to defend itself, but its aim to do so may be perceived as a threat by other countries. For example, Iranian leaders often underline the necessity for their country to have a strong defence. Although this wish is perfectly legitimate, Iranian armament is viewed with apprehension by the US, and includes suspicions of acquiring CBW. There are no in-depth studies of how states acquire a BW or CW capability and what the driving forces are.

The information from open sources has to be viewed from at least two angles, i.e. the impression a state wishes to give of itself, and the impression of it formed by other states. To put it in another way, it is on one hand a question of how a state perceives the threat from another state, but also the impression one state wants to convey to neighbouring states. Of course, the originator of the information is important too. A good example of the latter is when a state leaks

information on its tests of new long-range missiles. What effect does this type of information have on our perception of the threat posed by that state if there is also information on BW or CW capabilities? The information might be true or false but there is a reason why such information becomes public. A state can have an interest in giving the impression that they have prohibited WMD, through ambiguous statements or by not denying allegations. In this case, a state does not disclose its possession, yet it achieves a stronger position in the region if neighbouring states perceive a threat, even if, in reality, this capability does not exist. Iraq's infamous CBW programmes could be a possible example of such a strategy. The impression formed in the West of the Iraqi CBW capabilities prior to the US intervention, have so far not been substantiated.

What generally is meant by "threat" in connection with BW or CW is a military threat and the existence of an offensive military capacity. If, instead, only agents are produced on a large scale and stored, the threat perception could be different. Drawing the line between defensive programmes or activities and offensive activities is often difficult in the area of BW or CW and this is especially true in the research area. Is research of offensive aspects permitted for defence purposes? Offensive research is not explicitly mentioned in the general prohibition clauses in the CWC or BTWC, but it is implicitly prohibited since development, production and stockpiling of CBW could not take place without any research at some point in time. In these treaties, the intent behind an activity is important due to the dual-use nature of the chemical and biological areas. This could be illustrated by the hypothetical case of a country possessing a secret mobilisation capacity to on short notice produce large amounts of agents, but only if required.

Open source information cannot unambiguously answer the question whether or not a state has offensive BCW programmes. As this type of activity is prohibited by international treaties there will never be any official confirmation. Time has shown that almost the only way to obtain this kind of information is through defectors, "whistle blowers", that have been part of the programme. Defectors can, however, be used to give false information, which has to be taken into account when assessing their stories. Open sources are also used by intelligence organisations to "leak" information on a specific topic to give the general public and/or politicians information in order to influence decisions or media attention, etc. The origin of the information and where it is published has always to be taken into account. This said, open source information can in many cases provide useful information for the discussion on the possible existence of CBW programmes. Open sources will also contain the information that a state wishes to communicate about its policy and actions in relation to biological and chemical warfare. There is a risk that pre-existing views on states' BW or CW activities influence the judgement of information, i.e. leading to selection of information that supports this view and disregarding information not supporting it.

The way forward would be increased transparency on CBW defence programmes, continuing promoting effective implementation of the CWC and further work to strengthen the BTWC, primarily with effective control mechanisms. The Arms Control and Regional Security (ACRS) talks could be revived and Iran could be invited to separate talks on arms control and regional security in the Gulf. A WMD-free zone could be created in the Middle East, which could be a central goal for a regional security regime. Such a WMD-free zone should include special verification provisions for intrusive and reciprocal regional inspections, including challenge inspections. These should adhere to international regimes when it comes to WMD.³⁰³

The US has tried to isolate Iran and in 1995 legislation was passed that made trade for US business illegal. This law was extended in 2001 for five more years. In 2002 the EU initiated negotiations on trade agreements between Iran and the EU. Iran is though far from an isolated country in international relations. Its ten major trade partners 2002 included, besides neighbouring countries, Germany, Japan, Italy, India, China, the Ukraine and the US.³⁰⁴ South Korea, France, and Russia are among the eight major originators of imports to Iran.³⁰⁵ Iran has relations with many countries in the Middle East, Africa and the West, as exemplified by the vaccine production survey in this report. Yet another conclusion of this study can be the need to more actively engage Iran from the EU, the US and other Western countries, in wide areas of activities including trade but also R&D. A policy in this direction, or at least verbal indications, could diminish the need for Iran to turn to countries like Russia and China. This would give better insight into Iran, contribute to mutual confidence and give a better position to influence their policies, including Iran's perceived need for WMD. Co-operation and engagement could be more fruitful than the present isolationistic policies employed by the US.

³⁰³ Jones, P., *Towards a regional security regime for the Middle East: Issues and options* (SIPRI: Stockholm, 1998).

³⁰⁴ "Ten Iranian Trade Partners in 2002", *Hamshahri* (Persian Morning Daily), 2 June 2003

³⁰⁵ "Iran trade 2002", CIA Factbook, URL<[#Econ](http://www.odci.gov/cia/publications/factbook/geos/ir.html), accessed 21 January 2004.

List of biotechnology and vaccine production facilities in Iran

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Asaban Ltd Co.

Address: No. 97, Larestan Ave. Motahhari Ave., Tehran [1]

Telephone: (98-21) 899463 [1]

Produces vaccines for cattle and small ruminants, but no further details were available [1]. The production also includes vitamins, e.g. for animal feed, barbital, pharmaceutical preparations in general for veterinary use and for reducing cholesterol levels, as well as cough syrup and corydalis tablets.

CinnaGen Inc.

Address: No. 10, Babak Alley, Bimeh 4 St., Ekbatan, Tehran, Iran [2].

Telephone: +98 (21) 466 6203/4 Fax: +98 (21) 466 4991 [2].

Directing Manager: Hamid Mobtaker

Homepage: <http://www.iran-export.com/exporter/company/cinnagen/index.htm>

Information about this company has been obtained from its Internet homepage, accessed in May 1999 [2]. CinnaGen was founded in 1992 with the aim to manufacture biological products used in research, diagnostics and industry. The company claims to be the only Iranian producer of biological reagents. Its production includes manufacturing recombinant Taq DNA Polymerase, T4 DNA Ligase, Pst I, and various immunological reagents. CinnaGen offers training workshops and videotapes in biotechnology. The company seeks joint ventures to expand their production, increase our technical know-how for the production of other biological products and to establish branches outside Iran. The production capacity is such that large quantities "can be available upon request" and the company can also supply neighbouring countries with its products.

Damloran Pharmaceutical Co.

Other name: Dam Loran

Address: 7, Bistoon St., Jahad Sq., Dr. Fatemi Ave.; P.O. Box 14155-3333; Tehran [3]

Telephone: +98 21 885 69 22 & 885 69 07 [3]

Fax: +98 21 65 13 25 [3]

Tlx: 212710 DVPL-IR [3]

E-mail: DLRVETCO@neda.net.ir [3]

Internet homepage: <http://www.neda.net/dlrvetco/>, apparently from 1996, accessed in May 1999 [3].

Number of employees: In 1996, the staff totalled 220, of which 10% were specialists in pharmacology and chemistry as well as in the veterinary, engineering, financial and commercial fields [3].

Dam Loran was established in 1984 and production started 1989 [3,4]. The facility is government-owned and was originally planned to make 13 veterinary pharmaceutical products in sachet, bolus and liquid formulations using imported raw ingredients [4]. The homepage (apparently from 1996) lists 25 products for anthelmintic, antibacterial or antiseptic use in addition to some vitamins [3]. Dam Loran was established by the Iranian Pharmaceutical Development and Investment Co. (IPDIC), which is owned by Darou Pakhsh, the major producer of veterinary products in Iran, and the Bank of Industry and Mine [4]. Darou Pakhsh was the major shareholder in Dam Loran [4], and the company was planned to join Darou Pakhsh, SS Razak Labs and Science Labs, but no further details were available [4].

In 1996, the company had a facility of 14 000 m² with “advanced machinery” [3]. There were also laboratories for chemistry and microbiology to control the process of production, finished products and for pharmaceutical quality assurance [3]. According to the company homepage the analytical methods conform to British, American and other international standards [3].

Darou Pakhsh Co.

Other name(s): Darou Pakhsh drug MFG. Factory Co. [5]

Address: Kilometer 18, Karaj Freeway, Darou Pakhsh Street, P.O. Box 11365-7388, Tehran [6]

Telephone: +98(21) 6026476 [6]

Fax: +98(21) 6026475, 6026476 [6]

Tlx: 214123 DPFT IR [6]

Email: dpakhsh@irnet.net.ir [6]

Internet pages: <http://www.sofi.ch/investments/iran.htm>, <http://www.iran-export.com/exporter/ch9/ch9-1.htm>

Number of employees: 2000 [6]

Established: 1956 [6]

Probably identical to the company below although the addresses are different.

Daru Pakhsh Co.

Address: No. 254, Opp. Laleh Park, Northern Kargar Ave., Tehran IR-14186 [1]

Telephone: (98-21) 922087, 61301-05 [1]

Owner: The Iranian Social Security Organisation since 1992 [7]; controlled and managed by the Ministry of Health (1982) [8]. Government-owned (1987) [9].

Registered Company Number: 924513 [1]

Internet page: <http://www.iran-export.com/exporter/company/darou/index.htm> [6]

This company manufactures a wide range of products listed in a business database, and also acts as a wholesaler, distributor, exporter and importer of e.g. industrial and commercial machinery and equipment, mechanical handling and hospital equipment, electrical and electronic products, computers, office machinery and furniture, and military equipment [1]. Among its own products are insecticides, vaccines for cattle and small ruminants, and unspecified sera and vaccines [1].

After the Islamic Revolution in 1979, Daru Pakhsh constructed a new section for the production of veterinary preparations that had previously been carried out alongside human pharmaceuticals [10].

In 1982, this company produced anthelmintics and was one of the two principal manufacturers of veterinary pharmaceuticals in Iran [10]. (Note that at the time, 80% of the country's requirements for veterinary pharmaceuticals were imported [10].) It manufactured 47 preparations and planned to increase this to 154 products in total, which, at that time, would be more than any other Iranian Company [8]. Daru Pakhsh imported a range of human pharmaceuticals, veterinary pharmaceuticals and other healthcare products although this was expected to decrease since the import of finished products was being taken over by the Iranian Pharmaceutical Institute [8].

Daru Pakhsh was to import all vaccines and biological sera for 1982-83 [8]. In the same year, the company was rapidly expanding, both by increasing its production, storage and distribution facilities, as well as adding new areas of activity and increasing the capacity for production of veterinary pharmaceuticals [8,10,11]. The company had obtained manufacturing approval from the Committee for Supervision of Veterinary Medicines to begin production of three new products and a new plant for veterinary products was being built in Brujerd, Lorestan [10]. The new facility was planned to start production in 1985, and then the company expected to increase its share of the Iranian veterinary products market to almost 50% [10].

In 1993, a medical complex, constructed jointly by the social welfare organization and the Daru Pakhsh, was opened in Brujerd, Lorestan [12], possibly the very same facility described above. It is said to be among the most modern medicine factories in the Middle East, and its production is planned to meet 10% of the country's needs. The production capacity is estimated to 1.2 billion tablets, 250 million capsules, 30 million bottles of syrups, 12 million

bottles of oral drops, 130 million liquid ampoules and 10 million dry antibiotics [12]. It is not clear whether veterinary pharmaceuticals are produced at this facility but it is possible [10].

In 1987, Daru Paksh supervised two other companies, Pharma Chimie and Eram Laboratories, as well as running the national Pharmaceutical Research Centre [9].

In 1988 local production of veterinary pharmaceuticals by Daru Pakhsh and Razak included antibiotics and various animal feed supplements, e.g. vitamins [4]. The company was the biggest pharmaceutical manufacturers in Iran, March 1989-March 1990, with sales of 235 million dollars and 235 products [13]. The company describes itself as “the biggest producer, distributor, importer and exporter of the manufactured medicine and pharmaceutical raw materials with the largest R&D department in Islamic Republic of Iran” [6].

Institute for Research on Livestock's and Production of Biologic Products

Location: In the city of Marand in East Azarbaijan province [14]

The institute is active in production of different kinds of vaccines and anti-parasite drugs [14]. The construction of this institute started in 1991 and it was inaugurated by Rafsanjani on June 6, 1995 [14].

Iranian Research Organization for Science and Technology, IROST

Headquarters: Tehran [15]

Technology park: The Asr-e-Enghelab Complex in the suburbs of Tehran [15]

Branches: In nine places throughout the country [15]

Affiliation: The Ministry of Culture and Higher Education of Iran [15]

Internet homepage: <http://www.irost.com/>, accessed Oct. 1999 [15]

History: The IROST was established in 1980 as an independent organization affiliated to the Ministry of Culture and Higher Education with the major aim of encouraging and developing R&D activities as well as promoting the scientific and technological standards at a national level. IROST has gradually developed to a leading R&D centre, and is now one of the largest and most important R&D organization in Iran. The support of IROST is apparently both technical and financial [15].

Agencies: There are nine regional branches and a technology park, summarized in Table 1. They are mainly focused on the development of scientific and technological potentials in the country, while taking into account the socio-economic aspect they are expected to address [15]. The decentralization is said to help IROST to firmly establish its leading role in promotion of scientific and technical level [15].

IROST co-sponsored the first Iranian Congress of Biotechnology, held in Tehran, in 1985 [16]. At the Congress, it was announced that the biotechnology division has prepared the Persian Type Culture Collection, which has been approved by the World Federation of Culture Collections [16]. The collection reportedly contained 600 bacterial and fungal strains [16], or 340 bacterial strains, 123 fungi, 26 yeast and 7 viruses [17]. Freeze-dried cultures of bacteria and fungi will be supplied to Iranian research organizations and pharmaceutical

Table 6. The structure of Iranian Research Organization for Science and Technology (IROST)^a

Location (Province)	Agency	Agency Divisions and Institutes
Isfahan	The Isfahan Research Centre	Mechanical Engineering Division
		Chemistry Division
		Electronic and Power Division
		Metallurgy Division
Khorasan	The Khorasan Research Centre	Mechanical Engineering
		Electronics and Medical Engineering
		Chemical Engineering and Material Science
		Agriculture and Food Technology
		Mechanical Engineering Division
Kerman	The Kerman Research Centre	Materials Engineering Division
		Chemistry and Chemical Engineering Division
		Electronic Division
		Mechanical Engineering Division
		Chemistry Industries Division
Fars	The Shiraz Research Centre	Electronics, Power and Telecommunication Division
		Agriculture Division
		Information System
		Mechanical Engineering Division
		Chemistry Division
East Azarbaijan	The Tabriz Research Centre	Electronic Division
		Veterinary Division
		Mechanical Engineering Division
Markazi	The Arak Research Centre	Mechanical Engineering Division

Location (Province)	Agency	Agency Divisions and Institutes
		Materials Engineering Division Chemical Industries Division Electronics and Computer Science Division Information System Mechanical Engineering Division Chemistry Division Electronic Division Veterinary Division Mechanical Engineering Division Agriculture and Natural Resource Division Chemistry and Food Industries Division Electronics Division Metallurgy Division Mechanical Engineering Division Chemistry Division Electronic Division Agriculture Division Textile Division
Gilan	The Gilan Research Centre	
Semnan	The Shahrood Research Centre	
Yazd	The Yazd Research Centre	
Tehran	Ast-e-Enghelab Complex (Technology park)	Electrical and Computer Engineering Institute (4 divisions, including Biomedical Engineering Division) Biotechnology Institute (4 divisions) Chemical Engineering & Chemistry Institutes (4 divisions) Mechanical Engineering and Energy Institute (5 divisions) Agriculture Institute (3 divisions)

Location (Province)	Agency	Agency Divisions and Institutes
		Materials and Metallurgy Engineering Institute (5 divisions)
		Technology Research and Studies Institute (3 divisions)

^aBased on information in the IROST internet page, accessed October 1999 [15].

companies, which are undertaking research in biotechnology and genetic engineering [16]. The Culture Collection has a staff of eleven people including the director Dr. Nazrin Moazami [17]. Among the products and services offered is training in pilot scale fermentation [17].

Iran Veterinary Pharmaceutical Co.

Address: No. 23 Arak Str., Sepahbod Qarani Ave., Tehran [1]

Telephone: (98-21) 892533 [1]

This company manufactures vaccines for cattle and small ruminants, as well as veterinary pharmaceuticals and animal feed supplements [1].

Jahad Razi

Other name: Jahad-e-Razi Co. [5]

Address: No. 46, Rashtchi Alley, First of Southern Kargar Ave., Tehran [1]; P.O. Box 13145/1511, Tehran [18]

Telephone: +98-21-922941, 934071 [1,5,18]

Fax: (+9821) 936148, 922931 [5,18]

Managing director: B. Bahramian [18]

This company manufactures, among other products, pharmaceutical preparations, vaccines for cattle and small ruminants, vaccines for poultry (both inactivated and live), vaccines and sera (not further specified), horse serum and fetal calf serum [1,5,18].

NASSR Veterinary Pharmaceuticals

Location: Mashad City, north-eastern Iran [19]

In 1992, a veterinary pharmaceutical manufacturing plant was being set up by NASSR Veterinary Pharmaceuticals in Mashad City, north-eastern Iran. The plant would be fully operational 18 months later, and manufacture around 25 veterinary injectable products including antibiotics, vitamins and minerals. It is expected to have an annual production capacity of some 28 million units. Imported machinery and equipment for the plant has costed around \$12 million [19].

National Research Centre of Genetic Engineering and Biotechnology (NRCGEB)

Address: No. 15, Shahid Abbas Shafiei Alley, Qods St., Enghelab Ave., Tehran [1]

Telephone: (98-21) 6419738-9 [1]

Internet page: <http://www.nrcgeb.ac.ir/Main.htm>, accessed May 1999 [20]

Number of employees: Over 75 full-time staff members work in the research, administration and service departments [20]. In addition, a number of scientists from universities and educational centres in Iran and abroad co-operate with the Centre in research projects and educational workshops [20].

This centre performs research, testing and development [1]. It was established in 1988 under the supervision of the Ministry of Culture and Higher Education, with the aim to perform basic and applied research in bioscience, medicine, agriculture, pharmacology and biotechnology [20]. This also includes the development of modern techniques in genetic engineering, molecular biology and biotechnology [20].

The NRCGEB has laboratories, a library, a computer centre with the Bio-informatic National Network, and is planning to expand [20]. In a first step, a 60 000 m² facility with up-to-date facilities for research and education is being constructed on a 15 hectare site 16 km west of Tehran [20]. A second phase includes more research facilities but also auxiliary services such as a mosque, etc. [20].

The NRCGEB holds workshops on various topics in molecular biology, genetic engineering, as well as large-scale protein purification and in vitro cytotoxicity and genotoxicity [20]. The NRCGEB has published sells a number of Farsi language books and English language course notes from workshops held at the Centre [20].

Pasteur Institute of Iran

Address: Avenue Pasteur, Tehran [21], 69 Pasteur Avenue, 13164 Tehran [22]

Telephone: 669871-4 [21]

Affiliated to: The Ministry of Health (1987) [9]; the Health and Medical Education Ministry (Vezerat-e Behdasht, Darman va Amoozesh Pezeshki) [23].

Manufacture of vaccines: BCG Freeze-dried [21,24], Cholera vaccine [21,24], Sheep brain rabies vaccine [24], Vaccine TAB, Anti-typhoparatyphoidique [24]

Described in 1987 as a research and production institute, mainly for vaccine [9].

A new type of rabies vaccine, said to have greater efficacy, is manufactured at the Pasteur Institute in Tehran starting in 1994 [25]. The institute had a WHO Collaborating Centre for Reference and Research on Rabies within the network of VPH¹, related the WHO collaborating centres in 1994 [22]. There is apparently a (Research & Production) Rabies Department [22].

The Pasteur Institute has been working with Cuba's Biotech Institute on a hepatitis B vaccine since 1996 [26]. There has been technology transfer to this institute, and notably 50 Iranian biotechnology experts were being trained in Cuba at the beginning of 1999. They were

¹ Veterinary Public Health

supposed to return to Iran, and to take over the operation of the Hesarak vaccine plant (near Karaj) when it has been completed [26]. The Pasteur institute in co-operation with the Cuban Centre for Biotechnology and Genetic Engineering built the vaccine plant [27].

The institute is in close co-operation with the Paris Pasteur Institute, and sends some of its personnel to France for academic purposes [28]. According to Morteza Azartoush, the head of Iran Pasteur Institute, they also have scientific co-operation with research centres in the US, Canada and Belgium [28].

The Iranian declaration of 1998 (for the year 1997) to the UN within the Confidence Building Measures of the Biological and Toxin weapons Convention includes three vaccine production facilities at the Pasteur Institute, as follows:

- BCG Vaccine Production for tuberculosis vaccine;
- Typhoid Vaccine Production for vaccine against typhoid fever;
- Cholera Vaccine Production for cholera vaccine [29].

Plant Pests and Diseases Research Institute

Address: Evin, Tehran, Iran [30]

Scientists from this institute co-authored abstracts with the following titles, at the Seventh International Congress of Plant Pathology, Edinburgh, Scotland (1998):

- Introductory study on distribution of walnut anthracnose in Iran [30];
- New records of a species of phytophthora as a causal agent of pepper wilting in Iran [31];
- Laboratory assessment on comparative susceptibility of potato tubers of some advanced wild clones (phureja) to fusarium dry rot (f. Solani and f. Sulphureum) [32].

Razak

In 1982, Razak was one of the large veterinary pharmaceutical manufacturers [10]. (Note that at the time 80% of the country's requirements for veterinary pharmaceuticals were imported [10].)

In 1988 the local production of veterinary pharmaceuticals by Daru Pakhsh and Razak included oxytetracycline bolus, albendazole, lincomycin, kitasamycin [4]. In 1988 Razak Pharmaceutical Laboratories added several veterinary preparations to its product range, then totalling 19 veterinary products [33]. Among the new products are neomycin powder, erythromycin powder, sulphaquinoxaline and diaveridine solution, oxytetracycline, chloramphenicol, pyrantel tartrate, and multivitamins with electrolytes, minerals, trace elements and amino acids [4,33].

This company ranked No. 11 among pharmaceutical manufacturers in Iran, March 1989-March 1990, with sales of 45.9 million dollars and 53 products [13].

In 1992, Razak (formerly Pfizer) was among the state-owned pharmaceutical companies privatized by the Iranian government. At the time, the company manufactured 56 products including human and veterinary medicines and its annual sales were approximately \$46.5 millions [34].

Razi Vaccine and Serum Research Institute

Other names: Razi State Serum Institute, Razi Vaccination Research Centre

Address: P. O. Box 11365/1558, Tehran [21]

E-mail: modir@dcf.ir

Director: Dr. Ali Akbar Mohammadi (1994) [35]

Affiliations: Attached to the Ministry of Agriculture (1987) [9], The Construction Jihad Ministry (1994) [35].

Internet homepages: <http://www.netiran.com/Frame-Html/WhosWho/newsmedia-index.html>,
<http://www2.nas.edu/labcode/3282.html>

The Razi Vaccine and Serum Research Institute produces about 30 different vaccines both for human and veterinary use. A summary of the types and amounts of human vaccines produced is found in Table 2 in Chapter 3.2.2, and the corresponding data for veterinary vaccines is presented in Table 4 in Chapter 3.2.3.

In 1985 the Razi Institute produced 24.0 million doses of human vaccine against diphtheria, tetanus, pertussis, measles and polio as well as animal and bird vaccines [36]. In July 1986, the institute was one of the main producers of human and veterinary vaccines in Iran [37,38], with a production capacity of 24.6 million doses of veterinary vaccines and 90.1 million doses of poultry vaccines [38]. In November 1987 it became the largest vaccine producer in Iran and produced over 132 million doses of vaccine and sera [39]. Of the total output of vaccines, 112 million doses were for poultry and 16.5 million doses for other animals [39]. In the following year the institute's production of livestock and poultry vaccines met the domestic demand [4].

The Razi Institute produced over 3.9 million doses human vaccines as well as sera in December 1987 [40]. At that time, the Razi Institute succeeded in manufacturing vaccines against mumps and rubella in volumes meeting the domestic demand [41]. The institute also supplied vaccines against polio and measles [40,41], and in 1993, the production of polio vaccine reached 10 million doses [42].

In 1994 the Razi Institute manufactured 21 human and veterinary vaccines in commercial quantities [43]. According to its director, 28 kinds of biological substances for various medical purposes were manufactured at the institute that year [35]. The institute also planned to export its polio vaccine, used by the Iranian Ministry of Health to inoculate all children less than five years of age in the country [43]. The director of the institute said it could increase its production to both meet domestic needs and provide neighbouring countries that are members

of the Economic Cooperation Organization² with vaccines [35]. The institute had ca. 1090 experts engaged in research work and it had recently opened a biotechnological section for improving the duration of vaccines and to reduce their side-effects [35].

In 1995, the institute produced 23 different animal vaccines, eight human vaccines, and four types of serum for poisoning treatment [44]. A leishmaniasis vaccine was developed by the Razi Vaccine and Serum Institute entered trials at four centres in Iran, and batches of the vaccine were sent to Sudan and Pakistan, for trials to be conducted under supervision of the WHO [45]. A triple vaccine against diphtheria, tetanus and whooping cough for oral administration was being finalized [44]. In June that year a production line for five new vaccines at the facility in Karaj was inaugurated [46]. At the same time a major project for breeding laboratory animals was started [46].

The Razi Institute was prepared to send 500 000 doses of lyophilized veterinary vaccines to Africa to support the UN Food and Agriculture organization's disease eradication campaigns in 1997 [47]. Already in 1986, after contacts between the Razi Institute and the Ministry of Health and Agriculture in Tanzania [37], the institute planned to establish a research and manufacturing institute there, called the Tanzanian Razi Institute, the following year [36]. Laboratory equipment and batches of animal and human vaccines was already sent to Tanzania. Some Tanzanian students were trained at the Iranian Razi Institute [36].

In 1997, Ali Akbar Mohammadi, head of Razi Research Institute, said that Iran is self-sufficient in polio vaccine, producing some 50 million doses annually, and of these some eight million doses are exported [42]. He also said that the production has increased five-fold compared with 1993 [42]. In 1997, the Razi Vaccine and Serum Institute (Tehran) was expected to start commercial production of a Newcastle disease vaccine as trial production of the vaccine was coming to an end [48].

The Iranian declaration of 1998 (for the year 1997) to the UN within the Confidence Building Measures of the Biological and Toxin weapons Convention includes the Razi Institute and its production, including 9 vaccines for humans, 18 veterinary vaccines and 5 poultry vaccines [29]. That year the Razi Institute reportedly produced 2.8 billion doses of vaccines, sera and antigens worth \$100 million [49]. The production in 1999 is forecast to rise to three billion doses [49]. The Institute exports to 19 Asian, African and European countries. A new leishmaniasis vaccine is being produced in 1999 [50].

Samen Serom Sazi Co.

Address: 17th Kilometer of Ghouchan Rd., P.O.Box 4996/91375, Mashhad 91375, Iran [18]

Telephone: (+9851) 620106-8 [18]

Fax: (+9851) 620105 [18]

Managing director: S.A. Kakhki [18]

² <http://www.ecosecretariat.org/>

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Appendix 1
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Manufacturer of large volume parenterals (injectable products) [18].

Shahid Ghazi Tabriz Serum Production Co.

Telephone: +98-21-8701854

Fax: +98-21-8701862

Producer of sera [5].

Shahed University

Address: Rahim Zadeh Alley, Next to Vali-e asr, Tehran [1]

Telephone: (98-21) 649765-6401065 [1]

Contact E-mail (305): shahedun@dc.i.iran.com [1]

Affiliation: Affiliated To Bonyad Shahid [1]

Supplier of biocatalytic and biotechnical processes [1].

Tamin Ehtiajate Dam (TAD)

Address: No. 55 Joybar Str. Fatemi Sq., Tehran [1]

Telephone: (98-21) 893347 [1]

This company produces veterinary preparations such as inactivated and live vaccines for poultry, and also vitamins, insecticides, disinfectants and similar products [1].

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- [1] The database "KOMPASS Middle East/Africa/Mediterr" version 1997/Apr was searched for "IRAN" and either of the terms "SINGLE CELL PROTEIN*", "VACCIN*", "BIOTECH*", "FERMENT*", "AGRICULTUR*", "VETERINAR*" or "BIOPESTICID*", April 1997.
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Iranian Research Facilities

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The following research facilities are ranked in decreasing order of the number of publications during 1972-98. For a full description of the key word based database searches performed, please see Chapter 3.3.2.

Faculty of Veterinary Medicine, University of Tehran, Tehran

The pattern of publications over time from the Faculty of Veterinary Medicine is shown in Figure 1. The time course of publications follows the same pattern as the time course for all biological and toxin publications during 1970-92. There is a constant annual number of publications between 1972 and 1981, no publications from 1982 to 1991, and an increased annual number from 1992.

During the time period 1970-92 the Faculty of Veterinary Medicine published research on industrial microbiology and food contamination. Some of the apparent research priorities included *Brucella melitensis*, foot-and-mouth disease, salmonellosis and influenza virus.

According to Table 1, there is an emphasis on animal health research during the period 1992-98, as deduced from published articles. During this period there seems to have been a specific interest for bacterial infectious diseases of animals.

There are no publications concerning brucellosis, foot-and-mouth disease, salmonellosis, influenza virus or tick-borne diseases. None of the 27 authors, except four, on the publications from 1970-92 in the aforementioned areas can be identified in the key word based database search for the time period 1992-98. Two of the four authors, as deduced from the published articles, are still present at the Faculty of Veterinary Medicine, one has moved to the Razi Serum and Vaccine Institute and one has moved to the Medical Science University, Tehran.

Only three of the main 1970-92 authors seem to have been affiliated with the Faculty of Veterinary Medicine during 1992-98 (Table 2).

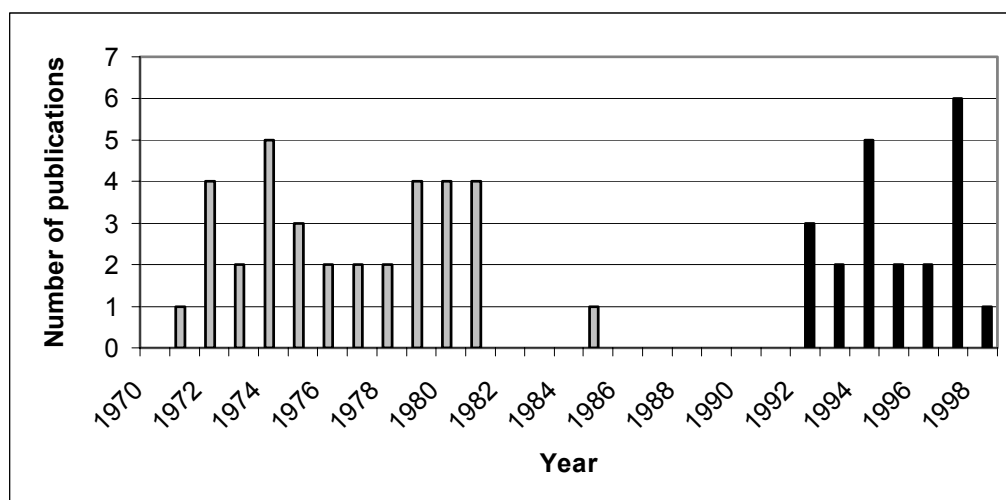


Figure 1. Annual publications from the Faculty of Veterinary Medicine, University of Tehran, Tehran

Table 1. Research priorities

Research	Number of publications
Antibiotics	1
Vaccine, coccidiosis	1
Animal disease	1
Glanders	1
Pneumonia-chronic	1
Mastitis (Staphylococci, <i>Pseudomonas</i>)	2
Carp, sterilization	1
Strangles-equine	1
Cholecystokinin, secretin, pentagastrin	1
<i>Cryptococcus neoformans</i>	1
<i>Moraxella spp.</i>	1
<i>Listeria spp.</i> (cultivation)	2
Trypanosoma	1
Animal production/Silage fermentation	2
Reproductive potential	1
Microbial flora	2
Dermaphytoses	1
TOTAL	21

Table 2. Main authors

Main authors 1970-92^a		Main authors 1992-98^b	
Name	In 1992-98 list	Name	In 1970-92 list
Gharagozlou, MJ	Yes	Khosravi, AR	No
Hosseinioun, M	No	Atyabi, N	No
Keyhani, M	No	Genigeorgis, C	No
Nadalian, M	No	Razavilar, V	Yes
Samadieh, B	No	Tadjbakhsh, H	Yes
Shimi, A	No		
Tabatabayi, AH	Yes		
Tadjebakhche, H	Yes		

^a Authors with three or more publications

^b Authors with two or more publications

School of Veterinary Medicine, Shiraz University, Shiraz

During the years 1970 to 1998 the School of Veterinary Medicine, Shiraz University, published 41 papers (Figure 2). The average annual number of publication during the first ten-year period was 0.5, for the second period 1.3 and for the last nine years 2.3. Thus, there is an increase in the annual number of published papers.

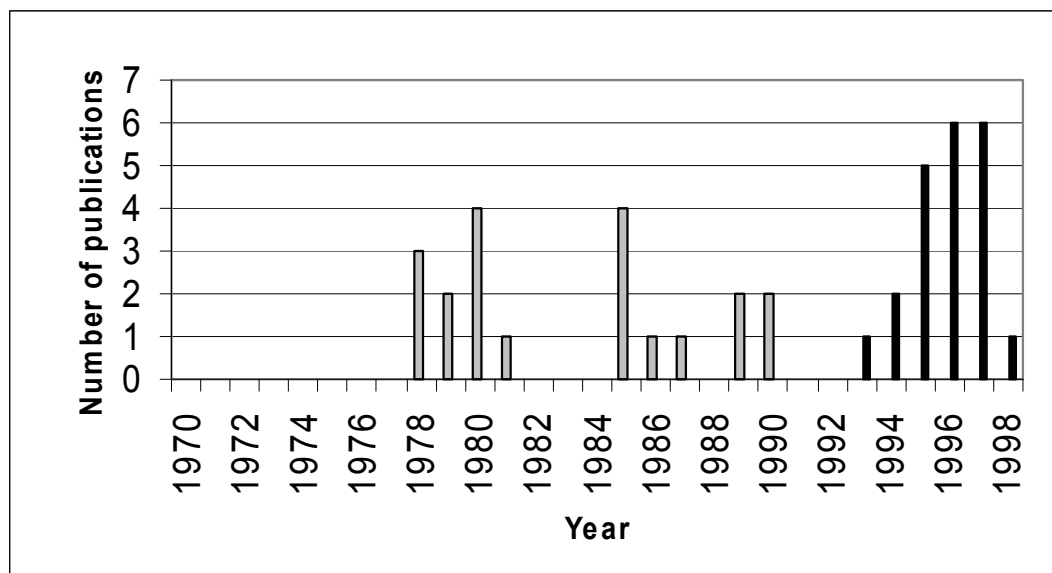


Figure 2. Annual number of publications from the School of Veterinary Medicine, Shiraz University, Shiraz.

Table 3. Research priorities 1992-98

Research	Number of publications
Antibiotic resistance, microbial flora	6
Antibacterial treatment	2
Immunology and immunization, fish	3
Experimental bacterial meningitis, calf	1
Actinobacillosis	1
<i>Ehrlichia canis</i> , dogs	1
Nocardial pyothorax, cats	1
<i>Sarcocystis</i> infection, sheep	1
Lymphadenitis, sheep	1
Besnoitosis, goats	1
Kala-azar, <i>Leishmania</i>	1
Protein localization	1
Poisoning, oleander	1
TOTAL	21

The nature of the work reported during 1970 and 1992 dealt with applied veterinary problems such as brucellosis. Other published work was concerned with pesticide applications. During the recent years the main focus of the research have been on antibiotics, antibiotic resistance, treatment of infections of animals, and immunisation (Table 3).

None of the two major authors 1970-92 are found in the 1992-98 list and only one out of the seven major authors 1992-98 are present on publications from the earlier period (Table 4). Two out of twelve authors, P. Hooshmand Rad and H. Mohammed, from the earlier period appears as authors on recent publications from Razi Vaccine and Serum Research Institute, Tehran.

Table 4. Main authors

Main authors 1970-92		Main authors 1992-98	
Name	In 1992-98 list	Name	In 1970-92 list
Muhammed, SI	No	Nazer, AHK	Yes
Tadayon, RA	No	Akhlaghi, M	No
		Oryan, A	No
		Rezakhani, A	No
		Gaur, SNS	No
		Haghkhah, M	No
		Khodakaram, A	No

Department of Medicine, Shiraz University, Shiraz

The Department of Medicine, Shiraz University, published 40 papers during the years 1970-92. The majority (60%) of the papers were published between 1978 and 1980. There were only one to two annual publications from 1981 up to 1991. There were no publications during the time period 1992-98. None of the most frequent authors during the years 1970-92 appear in the 1992-98 list (Table 5). Taken together, these facts indicate a major change in the areas of research.

The research priorities at the Department of Medicine during 1970-92 included *Brucella melitensis*, anthrax, typhoid fever, curare, scorpion venom, thyroliberin and prolactin. None of the authors (in total 19) on publications concerning anthrax, brucellosis, *Yersinia*, enteric fever or mustard gas are found in the 1992-98 list. Two authors, P. Khajehdehi and A. Kharazmi, who published work on typhoid fever have during recent years published work from Shiraz University of Medical Science and Pasteur Institute, respectively.

Table 5. Main authors

Main authors 1970-92	
Name	In 1992-98 list
Azadeh, B	No
Dar, MS	No
Dutz, W	No
Kohout, E	No
Zirvi, KA	No

Tehran/Iran University of Medical Sciences

Publications from Tehran or Iran University of Medical Sciences, Tehran, also includes published papers from Sina Hospital (5 papers), Behcet's Unit, Rheumatology Research Centre (1 paper), Centre for Research and Training in Skin Diseases and Leprosy (5 papers), Shariati Hospital (13 papers), Childrens Medical Centre (3 papers), and Hashemi-Najad Medical Centre (1 paper). Together with Iran University of Medical Sciences (11 papers) the total number of published papers between 1992 and 1998 amounts to 39 papers. As can be seen in Figure 3 there is an increase in the annual number of publications.

As deduced from published papers of main authors there are two major research areas at the Tehran/Iran University of Medical Sciences (Table 6). These areas are focused on Behcet's disease (Rheumatology Research Centre, Behcet's Disease Unit, Shariati Hospital) and

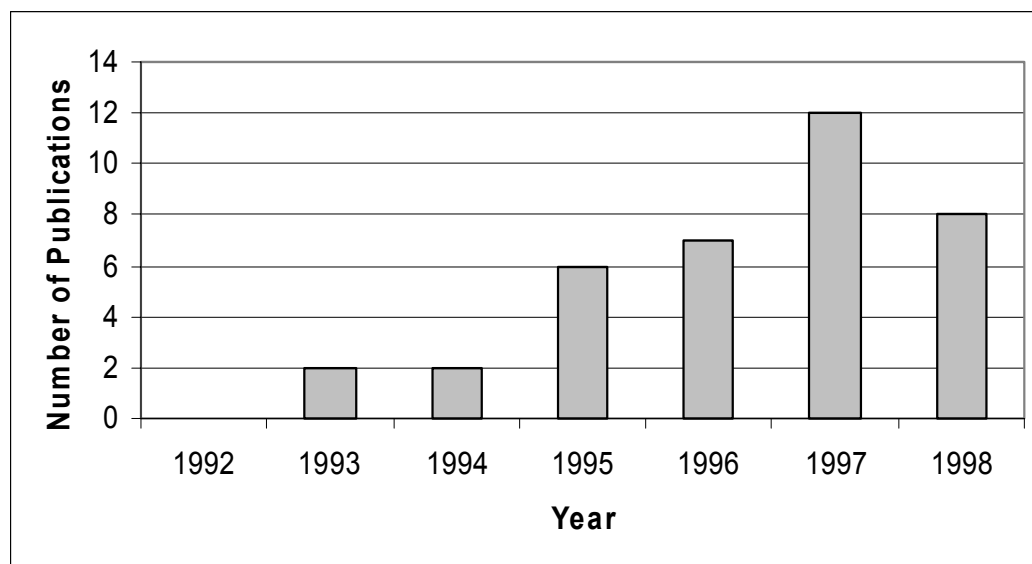


Figure 3. Annual output from Tehran/Iran University of Medical Science, Tehran

infections and treatment of infections or gastric ulcers caused by *Helicobacter pylori* (Digestive Diseases Research Centre, Shariati Hospital). Other research areas include structural biology and molecular modelling, different aspects of transplantation, and several infections and their treatment.

Table 6. Main authors and their research topics, Tehran/Iran University of Medical Sciences, Tehran.^a

Name	Research area
Akbarian, M	<i>Salmonella</i> , SLE ^b , Behcet's disease
Davatchi, F	<i>Salmonella</i> , SLE ^b , Behcet's disease
Shahram, F	<i>Salmonella</i> , SLE ^b , Behcet's disease
Chams, C	Behcet's disease
Gharibdoost, F	Behcet's disease
Nadji, A	Behcet's disease
Vakili, A	Behcet's disease
Mahmoudian, M	Structures, molecular modelling, quantitative structure-activity relationships (QSAR) Fungicides, Gs proteins, HIV inhibitors, cathepsin E Cyclosporine
Ghods, AJ	Transplantation, erythropoietin, Cyclosporin
Malekzadeh, R	<i>Helicobacter pylori</i> infections and treatment
Massarrat, S ^c	<i>Helicobacter pylori</i> infections and treatment
Alizadeh, BZ	<i>Helicobacter pylori</i> infections and treatment
Amini, M ^d	<i>Helicobacter pylori</i> infections and treatment, Effects of sulfur mustard
Dowlati, Y ^e	<i>Leishmania major</i> vaccine and treatment, melanoma, granuloma faciale
Rastegar, LA	Pseudomonas infections, <i>Salmonella typhi</i> treatment, bacterial peritonitis
Mehrsai, A	Bacteriuria, nocardiosis, infected stones and urease positive bacteria Transplantation

^aAuthors with three or more published papers.

^bSystemic lupus erythematosus.

^cTwo additional publications from Shiraz Medical School, Shiraz.

^dOne additional publication with Shaheed Beheshti University of Medical Sciences, Tehran.

^eTwo additional publications, from Bahar Medical Laboratory, Tehran, and Kerman University of Medical Sciences, Kerman.

School/Faculty of Medicine and Faculty of Pharmacology, Isfahan University, Isfahan

The School/Faculty of Medicine, Isfahan University, is located in the city of Isfahan, also spelled Esfahan. Since 1970 the school/faculty has published approximately 37 papers on biological and toxin research. The publications occur in two clusters, 1972-83 and 1989-98 (Figure 4), but none between 1984 and 1988. The trend is that there is an increase in the annual number of published papers.

Research priorities during 1970-92 included studies of aflatoxins, brucellosis, typhoid fever, prolactin and mustard gas effects. During the time period 1992-98 the main research areas have been studies of hormones and neurotransmitters, infections caused by fungi and *Leishmania* (Table 7). None of the authors publishing papers on brucellosis during the earlier period are present in the 1992-98 author list. Of the researchers working on mustard gas effects only one, A-Z. Momeni, are present in the 1992-98 list and seems to be involved in work on dermatophytoses and *Leishmania*.

As deduced from published papers of main authors there are two major research areas at the Tehran/Iran University of Medical Sciences (Table 6). These areas are focused on Behcet's disease (Rheumatology Research Centre, Behcet's Disease Unit, Shariati Hospital) and infections and treatment of infections or gastric ulcers caused by *Helicobacter pylori* (Digestive Diseases Research Centre, Shariati Hospital). Other research areas include structural biology and molecular modelling, different aspects of transplantation, and several infections and their treatment.

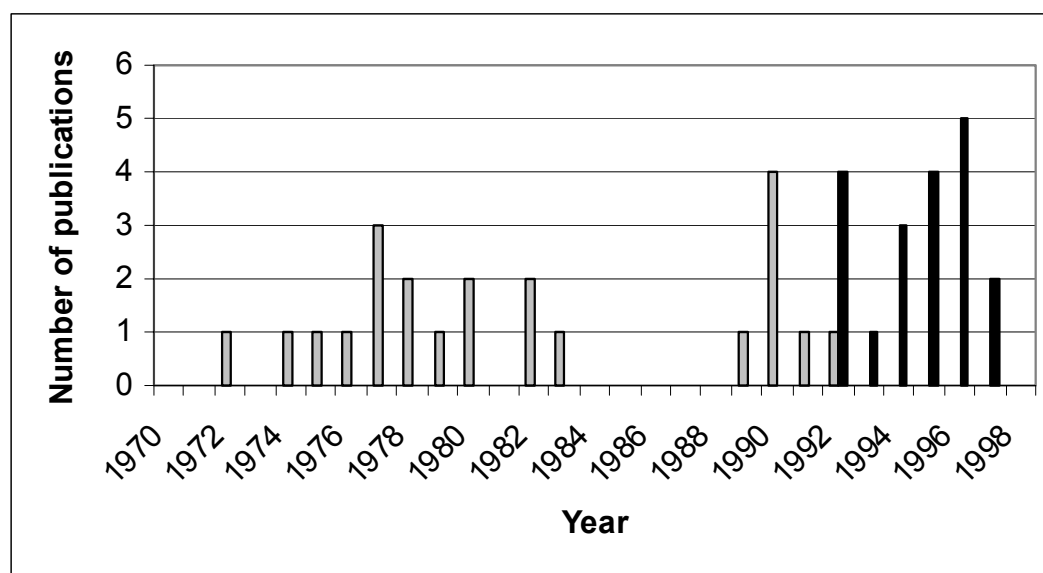


Figure 4. Annual number of publications from the School/Faculty of Medicine and Faculty of Pharmacy, Isfahan University.

Table 7. Research priorities 1992-98

Research	Number of publications
Dopamin and serotonin, synthesis and uptake	3
Steroid hormones, corticoid hormones	3
Dermatophytosis/Opportunistic fungi	4
Airborne fungi	1
<i>Leishmania</i> , leishmaniasis/treatment, diagnosis, incidence	6
Burn injuries, treatment	1
Myasthenia gravis, acetylcholine receptor antibodies	1
TOTAL	19

Table 8. Main authors 1970-98

Main authors 1970-92		Main authors 1992-98^a	
Name	In 1992-98 list	Name	In 1970-92 list
Emtiazi, G	No	Momeni, AZ	Yes
Feiz, J	No	Messripour, M	Yes
Ghafghazi, T	No	Aminjavaheri, M	Yes
Miralai, M	No	Chadeganipour, M	No
Sabbaghian, H	No	Ghahery, F	No
		Moshtaghie, AA	No
		Shadzi, S	No

^aAuthors with three or more publications

College of Agriculture, Isfahan University, Isfahan

The College of Agriculture, Isfahan University, has published 32 papers between the years 1970-98. The first publication appeared 1976, and up to 1980 twelve scientific papers were produced (on average three annual publications). During the period 1980-89 the average annual number of published papers went down, to 0.5, as it did for several universities and research institutes. Between 1992 and 1998 there have been 15 published papers, on average two annual publications (Figure 5).

During the years 1970-92 the main research topics emphasised fungal toxins such as aflatoxins. Of the 17 published papers during this time period 12 described work on aflatoxin or mycotoxins. During 1992-98 there have been no publications on these subjects. The majority of the published papers during the last seven years have a focus on fungal and viral plant diseases (Table 9).

Of the five most frequent authors 1970-92 only two, M. Bahar and D. Danesh, are still affiliated with the College of Agriculture (Table 10). The three missing in the 1992-98 list were all involved in work on aflatoxins. Of the authors, in total 17, on publications concerning mycotoxins or aflatoxin only two can be found in the 1992-98 database searches. Eight authors, as judged by their names, have a foreign origin. Three of the eight have a South African affiliation and one of these, A. Lubben, has been publishing work on aflatoxins since 1975 up to 1997. Of the authors during the years 1992-98 three are also present as authors on published papers from other universities (University of Tehran, Tarbiat Modarres University and Shiraz University).

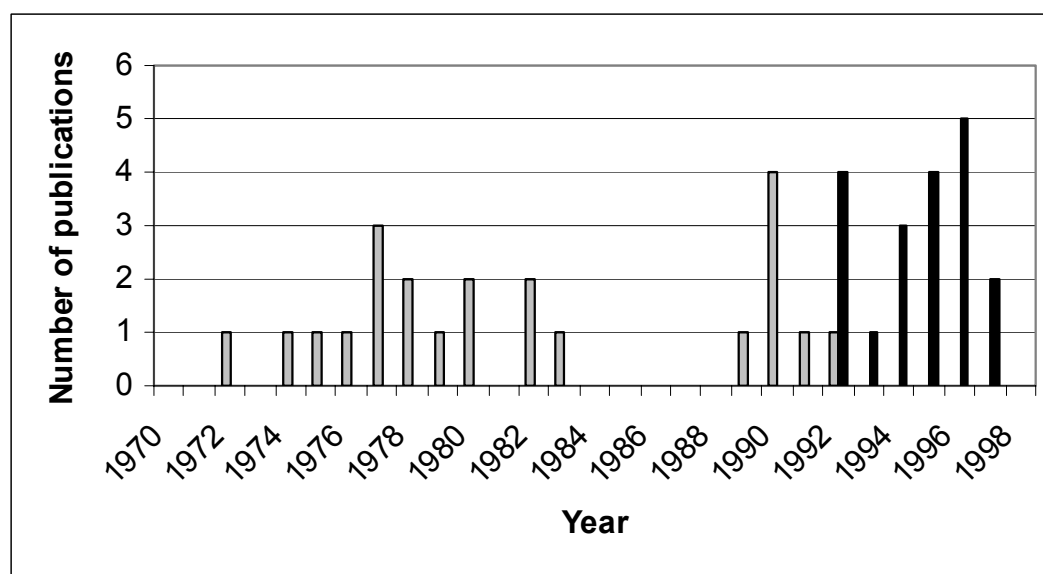


Figure 5. Annual number of publications from the College of Agriculture, Isfahan University.

Table 9. Research priorities 1992-98

Research	Number of publications
White cheese, recombined milk	1
Seed potato production	1
Corn common smut and other smuts	2
Sainfoin rust and root and crown rot	3
Downy mildew, plants	1
<i>Urocystis primulae</i> on <i>Primula macrocalyx</i>	1
<i>Erysiphaceae</i> , plants	1
<i>Tilletia</i> species on winter wheat	1
Cucumber mosaic virus	1
Tomato mosaic virus	2
Potato viruses	1
TOTAL	15

Table 10. Main authors 1970-98

Main authors 1970-92		Main authors 1992-98 ^a	
Name	In 1992-98 list	Name	In 1970-92 list
Bahar, M	Yes	Sharifnabi, B	No
Danesh, D	Yes	Ahoonmanesh, A	No
Emami, A	No	Bahar, M	Yes
Mojtahedi, H	No	Danesh, D	Yes
Suzangar, M	No	Ghobadi, C	No
		Nekui, A	No

^aAuthors with two or more publications

Mashhad Medical Sciences University, Mashhad

The first published paper from Mashhad Medical Sciences University, Mashhad, appeared in 1977. Since then this university has published 28 papers on biological and toxin research. During the periods 1977-82 and 1989-98 the average annual number of publications have been 1.2 and 1.1, respectively. There were no publications between 1983 and 1988 (Figure 6).

The research priorities between 1977 and 1992 were brucellosis and antibacterial chemotherapy. Also the published papers included work on sulphur mustard and aflatoxin. During 1992-98 work on epidemiology, immunodiagnosis and drug development has been described (Table 11). None of the authors on papers on the first and the two last topics is found in the 1992-98 database search (Table 12).

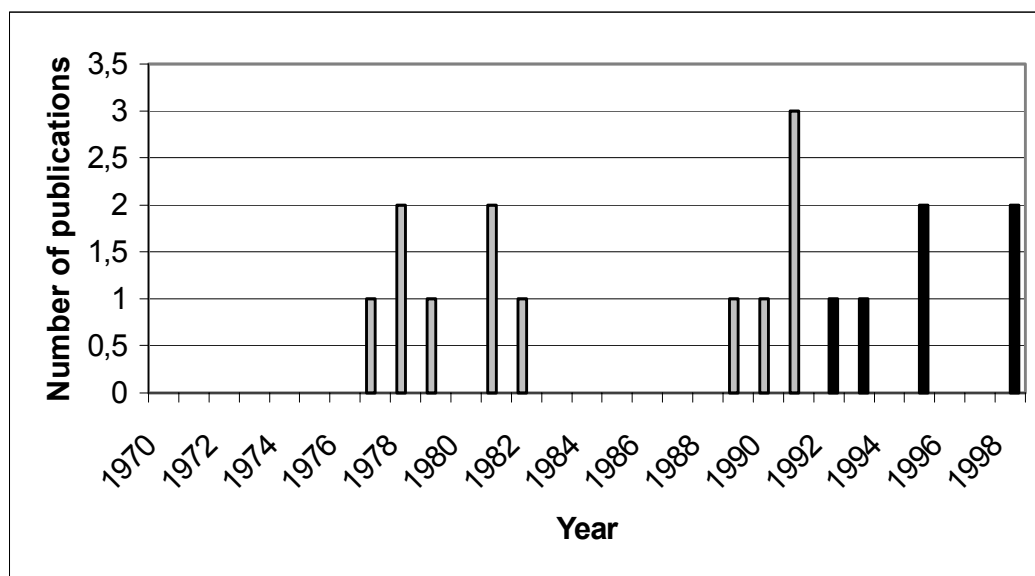


Figure 6. Annual number of publications from the Mashhad Medical Science University, Mashhad.

Table 11. Research priorities 1992-98

Research	Number of publications
HTLV-I ^a , seroepidemiology	1
Hydatidosis, immunodiagnostic test	1
<i>Tetrahymena pyriformis</i> , drug screening	1
Honey bee venom, collection and standardisation, as drug	1
Allergy, sCD23 and IgE	1
<i>Tuberculosis cystitis</i> , gastric neobladder	1
TOTAL	6

^a Human T-cell Lymphotropic Virus.

Table 12. Main authors 1970-98

Main authors 1970-92		Main authors 1992-98 ^a	
Name	In 1992-98 list	Name	In 1970-92 list
Al-Saadi, D	Yes	Farid, R	No
Kianmehr, H	No		

^a Authors with two or more publications

Institute of Biochemistry and Biophysics, University of Tehran, Tehran

The pattern of publications over time from Institute of Biochemistry and Biophysics is shown in Figure 7. Unlike most of the other laboratories there is no obvious decrease in annual publication number during the 1979-89 period. Furthermore, there is no obvious increase in publications from 1993 and further on.

During the time period 1970-92 the Institute of Biochemistry and Biophysics published research on enzymology, prostaglandins and bioregulators. As can be seen in Table 13 there is an emphasis on applied research, as deduced from published articles. No clear change in the direction of research can be observed compared to publications for the period of 1970-92. There was one publication concerning *Vibrio El Tor* (1974) and one on the effects of sulphur mustard (1990). None of the authors on these publications can be found in the list for the period 1992-98.

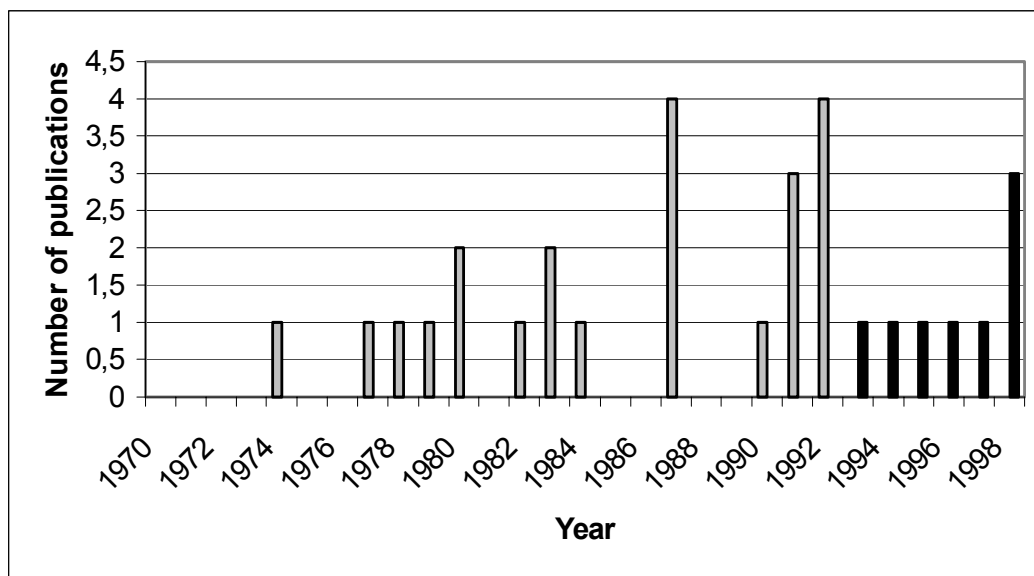


Figure 7. Annual publications from the Institute of Biochemistry and Biophysics, University of Tehran, Tehran

Table 13. Research priorities

Research	Number of publications
Alveolar macrophages, colony-stimulating factor (CSF)	1
Granulocyte-macrophage CSF, hyperthermia	1
Glucose oxidase	1
Genotoxicity	1
Citric acid production, <i>Aspergillus</i>	1
Immobilizing enzymes, biotransformation	1
Desorption, cellulolytic enzyme systems	1
Storage stability of liposomes	1
TOTAL	8

Only two of the main 1970-92 authors seem to have been affiliated with the Institute of Biochemistry and Biophysics during 1992-98 (Table 14). The author E. Keyhani seems, deduced from published articles, to have moved to Laboratory Life Sciences in Tehran.

Table 14. Main authors

Main authors 1970-92		Main authors 1992-98 ^a	
Name	In 1992-98 list	Name	In 1970-92 list
Djavadi, OL	No	Goliaei, B	Yes
Goliaei, B	Yes	Yazdanparast, R	No
Keyhani, E	No		
Rabbani, A	Yes		

^aAuthors with two or more publications

Department of Plant Protection, College of Agriculture, Shiraz University, Shiraz

Since 1970 the Department of Plant Protection, College of Agriculture, Shiraz University, has published 25 papers (Figure 8). During the first 10-year period, the average annual number of publications was 0.4, during the second period 1.0, and 1.1 during the last nine years of the studied period. Since the first paper was published in 1977 the output from the department seems to be rather constant over the years.

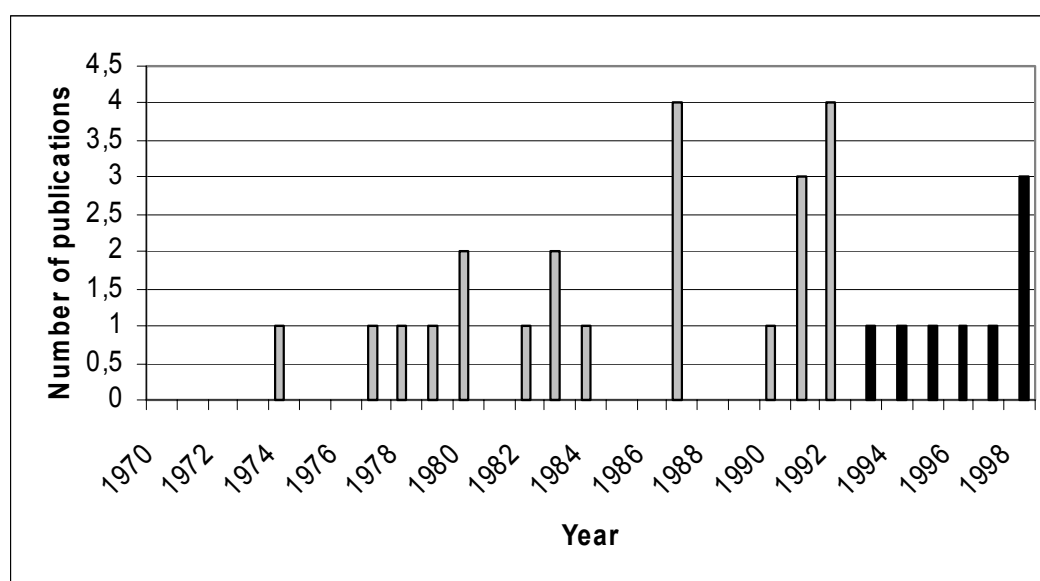


Figure 8. Annual number of publications from the Department of Plant Protection, College of Agriculture, Shiraz University

From 1977 to 1992 the research areas with high priority seems to have been plant viruses and rice pathogens. No major change in the research priorities appears to have taken place during the more recent years (Table 15). This is in accordance with the fact that the most frequent authors in 1992-98 also were the main authors during the years 1970-92 (Table 16).

The authors K. Izadpanah and Z. Banihashemi also appears as authors on published papers from Shiraz Plant Pests Disease Research Institute, Shiraz, and Fars Agricultural Research Centre, Shiraz University/College of Agriculture, Isfahan University, respectively.

Table 15. Research priorities 1992-98

Research	Number of publications
<i>Tenui</i> virus, wheat	1
Bean leaf roll virus, beans	1
Johnson grass chlorotic stripe mosaic virus	1
Bermudagrass etched-line virus	1
<i>Citrus tristeza</i> virus	1
<i>Leveillula taurica</i> , tomato and pepper	1
Disease, sugar-beet	1
<i>Uncinula necator</i>	1
Ice nucleation bacteria	1
TOTAL	9

Table 16. Major authors 1970-98

Main authors 1970-92		Main authors 1992-98	
Name	In 1992-98 list	Name	In 1970-92 list
Banihashemi, Z	Yes	Izadpanah, K	Yes
Fatemi, J	No	Banihashemi, Z	Yes
Izadpanah, K	Yes		
Rahimian, MK	No		

Department of Microbiology, Shiraz University, Shiraz

Since 1977 the Department of Microbiology and Immunology, Shiraz University, has published 21 papers. They appear in two clusters, 1977-81 and 1993-96, with scattered publications in between (Figure 9). This is in accordance with the pattern of annual number of publications seen for other universities and research institutes.

During 1977 to 1992 the main research topics were antibiotics, immunology and immunisation, and no major change has occurred in 1992-98 (Table 17).

Of the most frequent authors during 1970-92, only one, M. Kabiri, is present in the list of authors 1992-98 (Table 18). This author now seems to be affiliated with the Faculty of Chemistry, Tabriz University. The author S. Ardehali is present on publications from Tarbiat Modarres University and also Department of Microbiology, Shiraz University, but then in research areas not covered by the key words specified for the database search in the Canadian and present study.

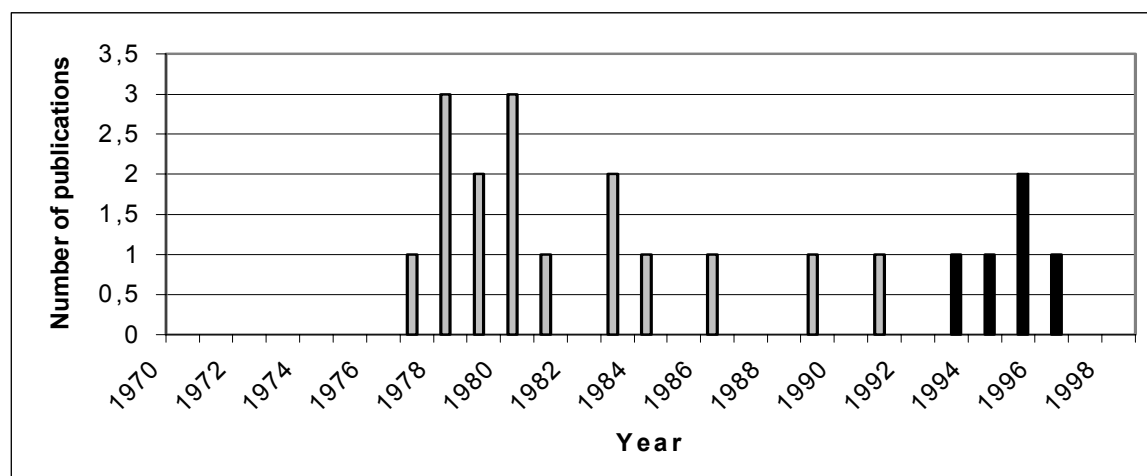


Figure 9. Annual number of publications from the Department Microbiology and Immunology, Shiraz University

Table 17. Research priorities 1992-98

Research	Number of publications
Immunology, IgE	1
Immunology, HLA ^a & Interleukins	2
Transplantation, Immunology	1
Leishmania, diagnosis	1
TOTAL	5

^aMajor histocompatibility complex

Table 18. Main authors 1970-98

Main authors 1970-92		Main authors 1992-98	
Name	In 1992-98 list	Name	In 1970-92 list
Ardehali, S	No	Ghaderi, AA	Yes
Behforouz, NC	No	Amirghofran, Z	No
Kabiri, M	Yes	Stanworth, DR	No
Kohanteb, J	No	Gaudernack, G	No
Rezai, HR	No	Motazedian, H	No

Faculty/College of Agriculture, University of Tehran, Tehran

During the time period 1970 to 1992 the Faculty of Agriculture published 21 research papers with no obvious drop in the number of publications between the years 1979 to 1991 (Figure 10). In fact, there was a slight increase in annual number of publications 1985 to 1990. Since 1992 there have been about one to three publications annually.

During 1970-92, the Faculty/College of Agriculture published research with focus on fungi, both pathogens for animals and pathogens for plants. Some of the apparent research priorities were *Aspergillus flavus*, brucellosis and *Pyricularia oryzae*. As can be seen in Table 19 there is an emphasis on plant diseases, and biotransformation and persistence of pesticides during 1992-98, as deduced from published articles. There was one publication about brucellosis in 1970-92 (authors: A. Eghtessad and A. Menari). No articles about brucellosis were published between 1992-98.

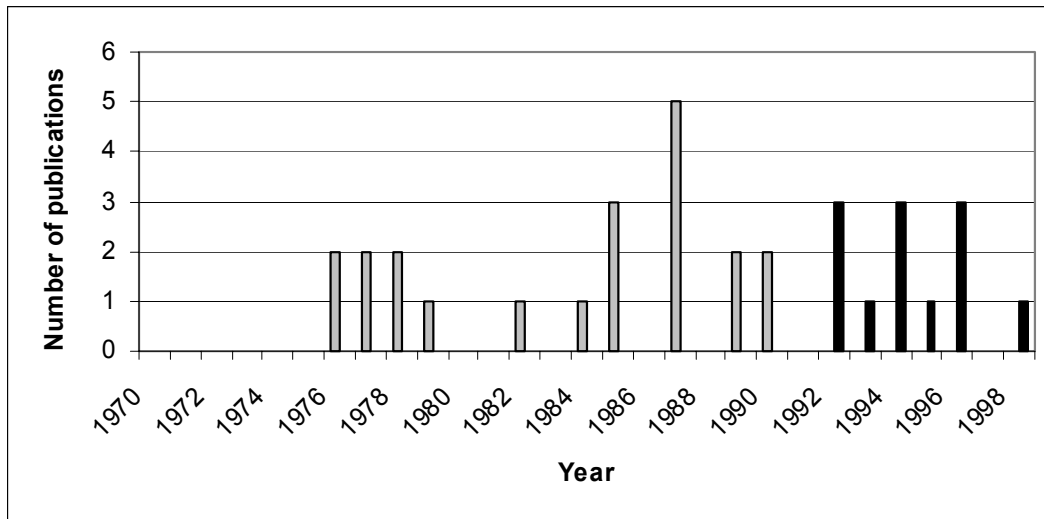


Figure 10. Annual publications from the Faculty/College of Agriculture, University of Tehran, Tehran

All four of the most frequent authors during the time period 1970-92 are still present as authors on publications from the Faculty/College of Agriculture (Table 20). Four of the authors on publications also appear as authors on publications from other universities or research centres (Agricultural Research Centre, Bushehr; College of Agriculture, Guilan University, Rasht; College of Agriculture, Esfahan University of Technology, Esfahan; and Plant Pests Diseases Research Institute, Tehran).

Table 19. Research priorities

Research	Number of publications
Fungicide, cucumber crown rot	1
Meristem culture (callus, root)	1
Safflower seed-borne disease	1
Rhizobium, lentils	1
<i>Pestalotiopsis spp.</i> , grey blight tea	1
Whole crop barley silage	1
Coliform bacteria, ripening of white cheese	1
<i>Trichoderma</i> , <i>Colletotrichum</i> , potatoe	1
Fire blight disease	1
Thiometon residues, cucumber	1
Diazinon residues, basins	1
Carbofuran, soil	2
TOTAL	13

Table 20. Main authors

Main authors 1970-92		Main authors 1992-98 ^a	
Name	In 1992-98 list	Name	In 1970-92 list
Charifi, Tehrani, TA	Yes	Talebi, K	No
Hedjaroude, GA	Yes		
Okhovat, M	Yes		
Zad, J	Yes		

^a Authors with two or more publications

Iranian National Blood Transfusion Service, Tehran

The Iranian National Blood Transfusion Service published 19 papers between 1976 and 1992 with more than 60% of the papers published 1978-79. There was only one publication, from the Blood Transfusion Organization, during the time period 1992 to 1998. It is not certain that Iranian National Blood Transfusion Service and Blood Transfusion Organization are the same. None of the main authors during 1970-92 are found in the 1992-98 list (Table 21). This together with the low number of publications, only one if any, suggests a major change in research activities. The main research topics during the 1970-92 period included Hepatitis B and tetanus vaccine.

Table 21. Main authors

Main authors 1970-92		Main authors 1992-98	
Name	In 1992-98 list	Name	In 1970-92 list
Ala, F	No	Yosefirad, M	No
Anaraki, F	No		
Farzadegan, H	No		
Foroozanfar, N	No		
Harbour, C	No		
Shamszad, M	No		
Sharma, MK	No		

Department of Biology, Faculty of Science, University of Tehran, Tehran

During the time period 1970-92 the Department of Biology, Faculty of Science, University of Tehran, published 14 papers between the years 1977 and 1983. No publications could be identified for the time period 1992 to 1998 in accordance with the earlier investigation. One of the most frequent authors, F. Malekzadeh, appears on publications from Tehran University and Tehran Medical Sciences University (Table 22).

Table 22. Main authors

Main authors 1970-92 ^a		
Name	In 1992-98 list	Affiliation 1992-98
Ala, F	No	-
Malekzadeh, F	Yes	Tehran University, Faculty of Science, & Tehran Medical Sciences University, Faculty of Pharmacy
Mortazavi, MSM.	No	-
Rahbar, S	No	-

^aAuthors with two publications

Pharmaceutical Research Centre, Darou-Paksh Company, Tehran

The Pharmaceutical Research Centre, Darou-Paksh Company, Tehran, published ten papers during 1985 to 1990. The Daru Paksh is also a major Iranian biotech company (see Appendix 1). All but one of the ten papers were published 1985 and 1989-90. Three of the most frequent authors 1970-92 are the authors of the only publication during 1992-98 (Table 23). The authors S. Amini and M. Mahmoudian have during the recent years published work from the Pasteur Institute and Tehran University of Medical Science, respectively.

The research during 1970-92 covered topics such as *Salmonella typhi*, *Bacillus cereus*, insulin, growth hormone, and antibacterial and antifungal chemotherapy. The only publication between 1992 and 1998 dealt with gentamycin-induced nephrotoxicity.

Table 23. Main authors

Main authors 1970-92		Main authors 1992-98	
Name	In 1992-98 list	Name	In 1970-92 list
Akhtar, KF	No	Samadian, T	No
Amini, S	Yes	Dehpour, AR	No
Eshgi, L	No	Amini, S	Yes
Khoyi, MA	No	Nouhnejad, P	Yes
Mahmoudian, M	Yes		
Nouhnejade, P	Yes		
Rezaei, E	No		
Salehian, P	No		

Abbreviations

The following are abbreviations used more than once and not found in the Oxford Advanced Learner's Dictionary of Current English, Sixth Edition, 2000, Oxford University Press.

ACDA	Arms Control and Disarmament Agency
ACRS	Arms Control and Regional Security
BTWC	Biological and Toxin Weapons Convention
BW	Biological weapon(s)
CBMs	The Confidence-Building Measures of the BTWC
CBW	Chemical and biological weapon(s)
CW	Chemical weapon(s)
CWC	Chemical Weapons Convention
ECO	Economic Cooperation Organization
NAM	Non-Aligned Movement
NPT	Non-Proliferation Treaty
NRCGEB	National Research Center for Genetic Engineering and Biotechnology
OPCW	Organisation for the Prohibition of Chemical Weapons
PrepCom	Preparatory Commission (to the OPCW)
R&D	Research and development
UNMOVIC	United Nations Monitoring, Verification and Inspection Commission
UNSCOM	United Nations Special Commission on Iraq
VEREX	Ad Hoc Group of Governmental Experts to Identify and Examine Potential Verification Measures from a Scientific and Technical Standpoint
WMD	Weapons of mass destruction