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BLOOD TRANSFUSION SERVICES IN IRAN

BLOOD TRANSFUSION SERVICES IN IRAN. A centralized, state-funded organization was established in 1974 for the recruitment of safe, voluntary, non-remunerated blood donors and the subsequent collection, testing, processing, and distribution of blood and blood products to hospitals. The project was initiated and founded by Dr. Fereydoun Ala and established by a parliamentary act. It was originally administered through a High Council, under the aegis of the Empress Farah Pahlavi, as the Iranian National Blood Transfusion Service (INBTS), or *Sāzemān-e Melli-e Enteqāl-e Khun-e Irān*. The title of the organization was altered in 1981 by the Islamic Republic of Iran to Iranian Blood Transfusion Organization (IBTO), or *Sāzemān-e Enteqāl-e Khun-e Irān*, with the Ministry of Health in charge of its overall administration.

Medical context. Although Ebn al-Nafis al-Demašqi (1210 or 1211-1288) had already described the pulmonary blood circulation in the 13th century (Haddad and Khairallah, Fancy), it was not until William Harvey (1578-1657) first described the systemic blood circulation in 1616 that a scientific basis for the direct transfusion of blood into the circulation was established (Hoff and Guillem). The general application of blood transfusion in medical practice had to await the brilliant work of the Nobel Prize-winning Austrian scientist Karl Landsteiner (1868-1943), who in 1900 discovered that there were different kinds of human blood, and that the agglutination and destruction of red cells occurred if the wrong types of blood were mixed. Thus, the scientific rationale

for safe transfusion followed the discovery of the three main human blood groups of the A, B, O system and, two years later, of the AB blood group. In the 1930s, this crucial discovery was complemented by the description of the complex Rhesus blood system by Landsteiner and Alexander S. Wiener (1907-67), which is of so much importance when foetal and maternal incompatibility occurs, causing hemolytic disease of the new-born (Rosenfield).

During World War I (1914-18), the life-saving use of blood transfusion in the gravest emergencies had to be carried out by "vein-to-vein" transfusion between donor and recipient, because blood soon coagulated and could not be stored. The uses of sodium citrate solutions to prevent blood clotting and of the nutrient dextrose to allow for blood storage were introduced soon after and made it possible to keep blood refrigerated for up to 21 days (Loutit and Mollison).

It was only during and after World War II (1939-45) that blood transfusion received the tremendous impetus which forged modern services. The great pioneers of these—primarily in Europe: Alfred Hässig (1921-99) in Switzerland, Harry Nevanlinna in Finland, Erik Freiesleben in Denmark, Jean-Pierre Soulier (1915-2003) in France, and J. J. van Loghem (d. 2005) in the Netherlands—were responsible for creating the exemplary centers of excellence which were to serve as models for the rest of the world. The cardinal contribution of the United States of America at the time, through Edwin J. Cohn (1892-1953) at Harvard in 1940, was the initiation of the industrial science of cold-ethanol fractionation of human plasma into many vital, highly specific and stable "medications," such as albumin, immune globulin, and anti-hemophilic factor VIII concentrates, which later developed into a multi-billion dollar global industry.

A parallel development of the 1960s was the so-called "Component Therapy": the use of disposable multiple polyvinyl chloride (PVC) blood bags, instead of glass bottles, allowed for the separation and concentration of the different blood cells within a sterile, closed system. Thus, a specific and economic use of donor blood, this precious human resource, became possible, because red cells could be employed for anemia, platelets for patients bleeding for lack of these haemostatic cells, and white cells for certain immune deficiencies.

Early history. Very basic emergency blood services had been in existence in Iran for some three decades before the establishment of the INBTS in 1974.

However, without exception, blood for transfusion, whether in private hospital practice or in government and university hospitals, was procured through disreputable dealers. Professional blood sellers exploited the poorest sectors of society, who were prey to malnutrition, anemia, and other diseases, as well as drug addiction. This was also true of the transfusion services of the Red Lion and Sun Society, the Iranian affiliate of the International Red Cross, currently called the Red Crescent Society. Even the military hospitals de facto bribed soldiers—though never officers—to give blood by granting them 72 hours' leave to allow for their recovery. In addition, advances in modern science, laboratory technology, and proper compatibility testing had as yet made little impact upon the rudimentary, fragmented, unsafe, corrupt, and grossly commercialized blood services available at the time. Increasing population density and rapid advances in hospital surgery and medicine, together with the growing expectations of both the expanding middle class and highly trained medical practitioners, revealed the glaring dangers and profound inadequacies of the blood services, and set the scene for fundamental reforms in this vital sector of the public health infrastructure.

Donor blood and transfusions services. It was Dr. Fereydoun Ala who first conceived the plan for establishing a modern, centralized service for blood transfusion to meet the rapidly increasing demand for blood from safe, voluntary donors in the entire country. In 1965 Dr. Ala accepted the position of assistant professor at the Tehran University Pahlavi Hospital (present-day Imam Khomeini Hospital Complex; see FACULTIES OF THE UNIVERSITY OF TEHRAN v. Faculty of Medicine). He had qualified in medicine at Edinburgh University and completed his post-graduate training in Internal Medicine and Hematology in London and Edinburgh, becoming the first Iranian appointed a Fellow of the Royal College of Physicians. With the help of a grant from the Wellcome Trust, Dr. Ala was able to establish in Iran the first clinical hematology department with its own fully equipped, modern diagnostic laboratories.

Even more so than surgeons, hematologists have to rely heavily upon various cellular and plasmatic components of blood for the optimal treatment of patients who are suffering from leukemias, lymphomas, hemolytic anemias, and inherited bleeding disorders such as hemophilia. Yet, in the late 1960s, the only available blood was untested, whole blood obtained by professional blood sellers and preserved in glass bottles, washed and re-sterilized by the Pasteur Institute of Iran (IPI; see Institut Pasteur). These gross inadequacies were the

spur and the germinal seed that led Dr. Ala to plan the creation of national blood services. His project would take the rampant commercialism and the artisanal activities (see Blood Letting) which passed for blood banking out of the market place and bring them into the realm of altruism, medicine and science, and research and teaching.

While in Europe, and to some extent in the United States of America, the exigencies of World War II had fostered the establishment of regular, voluntary blood donation as a well-accepted, altruistic principle, giving blood for strangers was an entirely alien concept in Iran. The general expectation was that some government agency should provide blood—as in the United Arab Emirates, where at that time blood was imported from abroad—or that those with sufficient means would have to buy blood in the free market, with all the potential dangers this entailed. But without donor blood there could be no national transfusion service, however well equipped and generously funded the transfusion service might be. While one could learn, import, and adopt any or all of the technologies associated with testing and processing blood from abroad, the organization of blood donation was a process that could only be researched, planned, and implemented in Iran. If the Iranian society wanted safe, reliable blood for transfusion, it was the society itself which had to donate blood. It was therefore necessary to explain to the public that we were all individually responsible for each other's welfare and that we had a civic, humane duty towards our less fortunate fellow human beings (for the irreplaceable role of altruism in successful public health policies, see Titmuss). Persuading the public, particularly the middle and upper echelons of society, that they must voluntarily donate the "gift of life" anonymously to their fellow Iranians was a formidable task, calling for a veritable social revolution. Potentially, the creation of the tradition and motivation for voluntary blood donation could be taken as a surrogate for a grassroots democratic movement that fostered a burgeoning sense of civic responsibility.

Organizing the INBTS. In 1972, Dr. Ala proposed the creation of an independent agency, which would bring together under a single administration all the disparate, fragmented, hospital-based activities whereby each hospital had been forced to fend for itself, merely in order to provide for the day's surgical list, with scant regard for the next day or the future. A major public information campaign was initiated, employing every means of communication—mass media, posters, films, television programs, and lectures—to capture the attention of every sector of society: religious

leaders, trade unions, civil servants, teachers, university students, the Boy Scouts, the bazaar, and the upper middle classes. The information campaign set out the grave dangers of the current blood transfusion services and the needs of modern medicine and surgery, while motivating the public and allaying fears of giving blood at regular intervals.

It was the conviction of Dr. Ala that the independence and stability of the political platform underpinning such an organization would determine its success, rather than impressive technology and a large budget alone. It was essential for the new organization to be independent in order to better associate with and serve everyone. This was not an easy concept to convey to the Ministry of Health, the Red Lion and Sun Society, and Tehran University, all of whom felt it was they who should have exclusive control of such a putative organization, even though none of them had an existing plan or set of proposals on how such a vital public service could be created.

The first step was to obtain parliamentary approval for the creation of a national service as a legal entity with a dedicated annual budget. The advice and support of Dr. Shoja Sheikh (Šojāʿ Šeyḵ-al-Eslāmzāda), an orthopedic surgeon soon to be appointed Minister of Health and Welfare, and of Dr. Khodadad Farmanfarmaian, the head of the Plan Organization (*Sāzemān-e barnāma*), were crucial to complete this step. Once Empress Farah Pahlavi had accepted the patronage of the new organization, a High Council of relevant, influential individuals was appointed. Among its members were General Dr. Abdolkarim Ayadi, the head of the Armed Forces Medical Services, Dr. Abdol-Hossein Sami'i, the Minister of Science and Higher Education, and Dr. Sheikh. A strong and beautiful emblem, still employed by the IBTO today and representing the circulation of blood in abstract form, was designed by the German artist Karl Schlamminger and accepted by members of the Council (Figure 1, Figure 2).

The fledgling INBTS was granted start-up funding of 800,000 tomans (about 100,000 USD in 1972) by the Plan Organization. The recently vacated building of the Tehran Clinic on Avenue Villa (now Ostad Nejatollahi Street) was rented from the public-spirited Mrs. Firuzgar, and major alterations were put in hand. This had to be a clean-cut and modern space (Figure 3) quite unlike the tawdry buildings used for this purpose in the past. It had to appear welcoming and hygienic, without being too coldly clinical, for it was essential to attract and inspire the confidence of fastidious middle-class donors.

While myriad items of the latest automated technical equipment had to be ordered in this gestation phase, the cardinal focus of attention was the recruitment and further training of highly qualified members of staff—the most crucial element of the project. Bursaries were organized for the senior-most members of the scientific cadre, most of whom were already faculty members of Tehran University, so that they could acquire the requisite further expertise from some of the most advanced centers in the world: Dr. Behrouz Nikbin traveled to Belgium and Denmark to learn tissue-typing for the future organ transplantation program; Dr. Irandokht Shoa'i (Irāndokt Šoʿāʿi) went to Paris to study blood coagulation and hemostasis testing; Dr. A. Mass'oud (Masʿud) received training in clinical immunology in France; and Dr. Nooshin Foroozanfar (Nušin Foruzānfar) was sent to London to study immunology. Dr. Akhtar-Zandi, a U.S.- trained biochemist, was apprenticed to the Scottish Plasma Fractionation Centre in Edinburgh to learn the techniques of protein separation, both by the classical Cohn method, but also through large-scale chromatography. Ms. Mesbah-Karimi went to the American Red Cross Laboratories in Washington, D.C. to gain experience in cryobiology. Dr. Khosrow Majidi, who had trained in hospital administration in both the United Kingdom and the United States and was a staff member of the Tehran University School of Public Health, joined the INBTS as Director of Administration and later was appointed Deputy Director of the INBTS. Ms. Pari Mo'men, an experienced social worker, took on the fundamental task of organizing public education and motivation campaigns. She was in charge of the recruitment of voluntary blood donors, as well as the organization of mobile blood collection teams, and had the all-important responsibility of selecting and training the young donor attendants and recruiters who would be the front-line troops by whom the public would judge the fledgling service. A year later, Dr. H. Farzadegan, a U.S.-trained virologist, and Dr. Rezvan, a UK-graduate in biochemistry who was to head the Quality Assurance section, joined the scientific staff. A British management consultant, whose experience lay in marketing, was hired to plan a public information and donor recruitment program.

The demand for donor blood. It was estimated in 1973 that approximately 100,000 units of blood were being used in Tehran every year. At that time the population of the capital was about 4 million people, served by a total of roughly 12,000 acute hospital beds. Some 8 units of blood were used for each hospital bed annually. On the other hand the provinces, taken as a whole, were estimated to use only some 100,000 units of blood per annum. Tehran,

with no more than 12 percent of the total population, was using about 50 percent of the blood resources available for the entire country (Ala, 1976, p. 2). If fractionation of plasma was to be introduced, the average minimal needs would lie between 10 and 15 units per bed, per year, and about 30 to 50 blood donations per 1,000 inhabitants would be required every year. In consequence, a more realistic target to cover the future needs of Tehran alone would be between 150,000 to 200,000 blood units per year. Moreover, planning for future needs had to take into account the rapidly growing population, the widening coverage of national medical insurance schemes, industrialization, and the increasing availability and sophistication of surgery and medicine. All of these factors were putting escalating pressure upon an infrastructural service such as national blood transfusion.

Mobile blood donor sessions. After several pilot studies to sound out public attitudes towards voluntary donation among different segments of society, the INBTS launched its first mobile blood donor sessions wherever there were large numbers of people gathered for a common purpose, be it employment, sport, worship, or study: government ministries, university faculties, or factories, as well as the Boy Scouts and the National Railways Organization.

The first step of each session was for the INBTS director to visit the relevant minister or chief executive of the target establishment to obtain his support and to set a date. On the appointed day, one or several modular blood collection teams, depending upon the estimated number of potential donors, arrived, armed with all the items of equipment required. The director would deliver an introductory talk about the virtues of giving blood and how safe it was. This was followed by a brief promotional film, initially purchased from the International Red Cross or the American Association of Blood Banks and later replaced with Iranian films by Dariush Mehrjui, the famous film director. (Mehrjui's full-length film *Dāyera-ye Mina,* released in the United States with the title *The Cycle*, depicts the exploitation of paid donors; see Cinema iv.). The session equipment had already been set out with 10 or 12 beds covered in crisp white sheets, and impeccably uniformed donor attendants (Figure 4), selected for their pleasant manner, were standing by. Volunteers were interviewed, and their blood pressure and hemoglobin level were determined to ensure they were fit to donate 450 milliliters of blood. Donors were each given a tiny dose of local anesthetic before venepuncture. It was a matter of considerable importance that the venepuncture should be an agreeable experience, since otherwise donors might never come again.

As an alternative mode of blood collection, two self-contained, air-conditioned, six-bed trailers and their tractors were purchased from France and the United States, and these were later complemented by similar trailers manufactured in Iran. They were stationed in Tehran's busiest locations and proved to be a great success, each collecting blood from between 100 and 150 walk-in donors every day.

The ultimate objective was to recruit volunteers who would become repeat or established donors, returning at regular intervals to give blood again and again, as these were the safest donors. Usually some 5-8 percent of the donors failed to meet the minimal criteria and were turned down as ineligible, and this enhanced the public reputation of the INBTS for integrity. In order to provide an incentive for repeated donation, biochemical screening tests for blood urea, cholesterol, blood sugar, and liver function were carried out for all donors, aside from the testing of hemoglobin levels and screening for hepatitis B; the INBTS implemented in Iran the first testing for the recently described "Australian Antigen" (Blumberg et al.). In short, giving blood functioned as a clinical "check-up," particularly attractive to a public with a fair share of hypochondriacs. These policies stood in stark contrast to those adopted by all other countries in the region. They still employed professional donors or relied, as in Syria, on young men who were coerced into giving blood in order to obtain a driver's license or to graduate from university. It was unlikely that these individuals would ever offer to give blood again.

From the outset the INBTS adopted the use of disposable, multiple PVC blood bags as a standard, replacing the old-fashioned, reusable glass bottles of the past. This allowed the Service to introduce Blood Component Therapy to the medical profession, a novelty especially for the surgeons who were obsessively fixated on "fresh" whole blood.

Merger of the INBTS with the transfusion services of the Armed Forces and the Red Lion and Sun Society. In Iran the armed forces (see Army V. Pahlavi Period) inhabited a separate world: they wore different outfits, lived in separate enclaves, and had their own sports and entertainment facilities, as well as terms of employment. They also had their own medical facilities and transfusion service. It became clear that merging military and civil transfusion services would provide manifold advantages for both. The public image of the armed forces would be enhanced, since they would be seen as contributing to the common good and being at one with the rest of the population. The merger would be particularly appropriate, because the military blood services were

inadequate and mediocre in the extreme, unable to cope in potential cases of conflict or national emergencies. Besides, voluntary blood donation was completely unknown to the armed forces, just as it had been to the civilian population. Soldiers were ordered to “volunteer” and received a 72-hour leave as remuneration, confirming their mistaken conviction that giving blood was detrimental to health.

It was accordingly put to Mohammad-Reza Shah that a merger would be wise for both political and logistic reasons. Dr. Ala proposed that the INBTS should be allowed to conduct blood collection sessions among military personnel throughout the country and to be responsible for the testing, processing, and distribution of blood products to all hospitals, whether military or civil. This highly radical policy proposal could only be implemented with the personal support of the commander-in-chief of the armed forces, that is, the shah himself, since it marked a fundamental departure from convention and was, with the exception of Israel, unique in the region. The proposal was approved, and Colonel Dr. Eftekhari, the director of the Armed Forces Blood Service, joined the staff of the INBTS. By 1978, the armed forces contributed some 12 percent of the 200,000 units of blood collected by INBTS. In addition, it was agreed that the Red Lion and Sun Society would also cease providing its own blood services, and would be formally superseded by the INBTS.

As the first rumblings of the impending Islamic Revolution were being felt late in 1978, an entirely new donor recruitment campaign with a strong Islamic theme was initiated. Its posters were bearing quotations of Imam Jaʿfar Ṣādeq (ca. 702-765) and other Muslim luminaries relevant to donation (*iṯār*). A film showed Ayatollah Noori (Nuri) donating his blood in Qom. The campaign also highlighted religious traditions (hadith) claiming that giving blood rejuvenated the body.

Transfusion science and technology at the INBTS. (1) Blood group serology and virology screening. Blood grouping, rhesus factor typing and even minor blood group antigen screening were carried out using two Groupamatic-360 automated machines, newly developed in France in the mid-1970s (Essick and Ala). Hepatitis B surface antigen screening was conducted by hemagglutination inhibition and radioimmunoassay (RIA). A Special Serology section was established to identify abnormal red cell antibodies in patients; this service helped hospital blood banks unable to find compatible blood, and initiated an antenatal screening service for obstetricians.

(2) Cellular blood components. Some 90 percent of whole blood units were centrifuged to produce partially packed red cells so that fresh plasma could be salvaged for fractionation. On average, some 100 platelet concentrates, mainly utilized by hematologists and oncologists, were prepared daily for issue.

(3) Frozen blood. An air-separator unit was purchased to produce liquid nitrogen for the cryo-preservation of rare units of red cells. The frozen blood supported the kidney transplant program and made it possible to maintain a sera archive for the virology and tissue-typing sections.

(4) A high-yield cryoprecipitated factor VIII (FVIII) concentrate was produced to treat patients suffering from hemophilia A. In addition, it was anticipated that a plasma fractionation section for the manufacture of a cryo-aluminium hydroxide FVIII concentrate would be commissioned.

(5) Plasma fractionation. Dr. John Watt, the director of the Scottish National Blood Transfusion Service Protein Fractionation Centre in Edinburgh, had helped the INBTS with obtaining the equipment for a plant for the production of human albumin, polyvalent immunoglobulin, coagulant Factor VIII, and a triple prothrombin complex (coagulant Factors II, IX and X) for the treatment of hemophilia B. This plant was a pilot project, and had an annual processing capacity of 10,000 kg of plasma. As reported to the Joint Congress of the International Society of Hematology (I.S.H.) and the International Society of Blood Transfusion (I.S.B.T.) in Paris, in July 1978, the INBTS, in collaboration with the Pasteur Institute of Iran, was the only center outside France where, thanks to Dr. Akhtar-Zandi, a hyper-immune intramuscular anti-rabies immune-globulin was produced. Shortly before the Islamic Revolution in 1979, experts from the UK headquarters of the Boston chemical engineering company of Stone and Webster who were already in Iran working for the National Iranian Oil Company (NIOC), were also given the task of drawing up the first plans for a new plant with an annual processing capacity of 100,000 kg of plasma.

(6) Transplant immunology. Dr. Nikbin of the INBTS introduced tissue-typing and the matching of donor and recipient to Iran, and these technologies provided the scientific support for the first kidney transplantation service. Dr. Nikbin collaborated with Dr. Behrouz Boroumand at the National Dialysis and Transplant Committee, and their work received funding from the Ministry of Health and Social Welfare. In the 1970s it was estimated that every year over 1,500 patients in terminal kidney failure would require transplants.

(7) Clinical immunology. The first immunology laboratory in Iran was conceived as a service to clinicians, but the laboratory also carried out research on the prevalence of hepatitis B; the acquired immune defects of professional blood donors; the application of specific lymphocytic transfer factors in cutaneous Leishmaniasis (*sālak*); alpha heavy-chain disease in intestinal lymphoma; and the experimental production of leucocytic interferon by the method of Kari Cantell, initially intended for the treatment of viral dendritic ulcers, a common cause of blindness in Iran.

Blood transfusion medicine. A most important component of the transfusion cycle was raising the very poor standards of clinical transfusion practice in Iran. There was little use in obtaining the blood from safe, voluntary donors and in screening and processing it while applying meticulous quality assurance criteria, if the resulting blood product was merely misused or wasted "downstream." It required an extensive teaching and training campaign among doctors, nurses, and laboratory technicians to foster the use of modern compatibility testing and antibody screening in hospital laboratories, to provide and implement proper guidelines and indications for safe blood transfusions, particularly among surgeons, and to familiarize clinicians with the use of blood components and plasma fractions. It was, in short, a demanding, long-term task.

Regional blood transfusion centers. As a national service, the INBTS could not confine its activities to the capital alone. A regional strategy was developed whereby a limited number of large, high-quality regional centers would be established over the next five years, affiliated wherever possible with the regional university. It was argued that creating myriad small centers all over the country, as the Red Lion and Sun Service had done, would lead to mediocrity, duplication, and difficulty in maintaining high standards. The first such center was created in Shiraz, close to the Nemazee Hospital (Figure 5), and was soon followed in rapid succession by centers in Hamadān, Sari, Mashad, and Ahvāz. The latter three centers were constructed as prefabricated buildings, in the interests of speed and flexibility.

Blood bag manufacture. The Islamic Revolution of 1979 interrupted the construction of a plant for the manufacture of PVC disposables, such as catheters, bags for intravenous solutions, and blood bags, near Rasht on the Caspian coast. This project was a joint-venture collaboration of the INBTS with the U.S. firm Delka, the Ministry of Health, and the Industrial and Mining Development Bank.

Computer software design. The INBTS recruited Stefan Palffy to design software for a national database management system that would comprise the data of the blood donor panel, the blood screening and processing, and the blood issue to hospitals, as well as financial and management data. Palffy was a systems analyst already employed in designing software for the ambitious National Library project in Tehran.

The IBTO from 1981 to the present. The essential services, standards and integrity of the INBTS survived the profound social and political upheaval of the Islamic Revolution of 1979 remarkably well, while a number of other promising institutions, such as the Environmental Protection Agency or the Center for Cellular and Molecular Biology at Tehran University either foundered or became stultified. However, the progress, the long-term planning, and the intellectual ferment of the pre-revolutionary years were lost in the initial years after the Revolution, since most of the senior cadre, both administrative and scientific, were either dismissed or resigned. The technical staff lapsed into an artisanal state, and a succession of incompetent and unqualified political appointees took up the direction of the Service. The implementation of plans for a new headquarters building and plasma fractionation center in western Tehran were abandoned, as was the project for manufacturing plastic bags and other disposables. Despite these detrimental effects of the chaotic aftermath of the Revolution, the well-established culture of quality of this people's service, now called the Iranian Blood Transfusion Organization (IBTO), and the sheer utility and relevance of the service at a time when conflict in Kurdistan, followed by the protracted war with Iraq (see IRAQ vii. IRAN-IRAQ WAR) necessitated the survival of these vital services and ensured their continued support by both the government and the public.

The ensuing years saw an explosive population increase, particularly in urban centers. The population of Tehran grew from some 4 million to over 12 million, while the overall national population increased from approximately 40 million to over 70 million. Correspondingly, blood needs and voluntary blood donation grew exponentially and reached more than 1.7 million units in 2007, or some 25 units per 1000 people (Abolghasemi et al., p. 85, fig. 1). At present, 92 percent of the donors are men. HIV and hepatitis C testing was introduced in 1989 and 1996, respectively. HTLV (Human T-lymphotropic virus) screening became mandatory in the province of Khorasan in 1995. Since 2003 the IBTO has implemented the Quality Assurance System of the Paul-

Ehrlich-Institut which provides proficiency testing exercises for laboratory technology.

The growth in blood needs and voluntary donations was accompanied by an enormous expansion in the numbers of provincial or regional centers from 1985 onwards, culminating in 2008 in the creation of some 200 centers throughout the country. In 2008, the IBTO was effectively awarded university status, since the scientific staff received academic posts and were permitted to take on M.Sc. and Ph.D. students for supervision.

Following an initial period of decline and disorganization after the Islamic Revolution of 1979, the IBTO has progressively improved in quality, diversity, and academic potential. It is now without question, the most progressive, well developed, and extensive blood service in the eastern Mediterranean region.

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