RELIGION AND MEDICINE IN IRAN: FROM RELATIONSHIP TO DISSOCIATION

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In Islamic medicine, the link between religion and medicine is explicit in the very word *tebb*, which in Arabic means healing, treating, sorcery, magic, spellbinding. This term derives from the root *tbb* with three forms of vocalization: in particular (1) *tabib* is one who is learned about any matter, hence *tabib* is a skilled person in any science or craft, including medicine; and (2) *tebb* is the practice of medicine.[1] With regard to the first meaning, *tabib*, much was assigned to supernatural skills in medical treatments but also in various other matters such as philosophy, the transmutation of metals (or alchemy), etc. According to an anonymous Persian author, the *tabib* or physician is a person who calms and reassures the mind of a patient.[2] For another author, 'Aqili, *tebb* meant disposition, spellbinding and skilfulness in sciences and techniques in general, and in the jargon of physicians, it consisted of knowledge of the human body in health and illness.[3] In a medieval source, the eighth branch of science (*fann*) is *hekmat*, which is divided into theoretical (*nazari*) and practical (*'amali*). The theoretical *hekmat* is subdivided in three: divinity, which is the superior science, mathematics, the middle science, and natural science, the inferior science.[4]

The supernatural dimension of medicine was fully rooted in Iran before Islam. After being imprisoned by Goshtâsp-Shâh in Balkh,[5] at the instigation of his enemies, Zoroaster (*c.* 600 B.C.) was released only when he succeeded in healing by magic and prayer the beloved black horse of Goshtâsp-Shâh, which had fallen ill.[6] In a passage of the *Vendidad*, one of the surviving texts of the *Zandavesta*, three kinds of medicine were distinguished: medicine by the knife (surgery), medicine by herbs, and medicine by divine words; and the best medicine was, according to the *Vendidad*, healing by divine words.[7] The Zoroastrian clerics were called *magis* or *mogh*, which means magicians. They counted among themselves medical *magis* who treated illness by drugs or surgery and priestly *magis* who were considered the ablest because they could heal without the intervention of drugs or the knife.[8]

All of these divisions, at different periods of history, constituted the theoretical foundation of the religion–medicine relationship and the close association of religious establishment and medical practice.[9] The involvement of the religious class in the medical profession in Iran was similar to what occurred in medieval Europe,[10] but it was not as institutionalized as it was in Europe.[11] The loose relationship between the religious establishment and medical practice is better illustrated in the history of hospitals in the Islamic countries. Unlike European

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countries, where many hospices were constructed and supported by the Church, in Iran hospitals belonged to the secular power. Nonetheless, as in any other traditional society, medieval Persian medicine was characterized by its supernatural or religious dimension.

Towards the end of the nineteenth century, however, the relationship between religion and medicine grew weaker in the sense that medicine became increasingly an independent corps of knowledge free of supernatural connotations. This dissociation can be seen in both theoretical and institutional levels as epitomized in the case of Boqrât ol-Hokamâ: in 1903, Mehdi Malek-Afzali,[12] a cleric-doctor who had studied religious science with Ayatollâh Brujerdi[13] and medicine with Hâj Mirzâ Mohammad Bâqer in Ispahan, went to Tehran to study modern medicine at the Department of Medicine at the Polytechnic School of Dâr ol-Fonun, established in 1851. While studying at the Medical School, he practised traditional medicine in order to earn his living. In 1907, he took his honours degree and received the modern title of Doctor and the honorific and traditional one of Boqrât ol-Hokamâ (the Hippocrates of physicians).[14] In the same year, at the climax of the constitutionalist movement, he left Tehran and went to Neyshâbour in Eastern Iran where he practised medicine until his death in 1965. In one manuscript, dated 1942, he focused on the damaging effects of the consumption of meat and alcohol. In the first chapter, referring to contemporary European scientists and physiologists, he provided a medical analysis to show that the consumption of meat by human beings was harmful and caused premature death.[15] In the second chapter, by referring both to modern medicine and *hadiths* (Traditions from the Prophet and the Imams), he highlights the toxicity of alcohol.[16] Echoing both modern and traditional knowledge, Boqrât ol-Hokamâ did not oppose bloodletting and cupping, which he considered useful for eliminating spoiled blood, but he opposed the unhygienic instruments used for these practices.[17] Boqrât ol-Hokamâ is one amongst many, at the threshold of the century, who, with a background in both traditional and modern medicine, either simultaneously followed medical and religious careers, or, instead of continuing with their clerical positions, put aside their cloak and opted for studying modern medicine. Another example is Dr Nosratollâh Kâzemi, born in 1908, who chose to pursue medicine instead of becoming a mullah, as he had intended.[18]

How can we explain this change — the secularization of medicine — occurring in the second part of the nineteenth century, at a time when the influence of the religious establishment was growing in the political and social spheres?[19] Was it merely the impact of the introduction of modern medicine, which became increasingly fashionable among the élite? Was it a result of the current political movement led by scholars or politicians, such as Seyyed Jamâlod-din Afghâni[20] in Iran and Mohammad ‘Abdu in Egypt, who saw the solution to the backwardness of the Islamic countries in the adoption of Western science and technology along with the revival of the Caliphate?[21] Or was it because of the budding interest and confidence in the efficiency of anatomical-clinical medicine in lieu of humoral

medicine? Through a theoretical and historical survey of the religion–medicine relationship in Iran I will argue in this paper that the change in this relationship was the result of the institutional and theoretical modernization of medicine, as well as the evolution of the socio-political role of the Shiite establishment.

What is known as "Islamic medicine" was not drawn from the Koran, since the Koran provides no specific section on medical knowledge although it does include remarks of a very general nature dispersed over different verses. Islamic medicine, in the classic sense, was in fact founded in the school of translators or "House of Science" established in Baghdad under the Caliph Ma'mûn (813–17). Christian translators such as Hunain b. Eshaq translated Galen and Hippocrates into Arabic. These basic texts were further elaborated throughout several centuries of Islamic expansion into the non-Arabic countries. The medical literature attributed to the Prophet or to the Imams, was in fact a mixture of folk medicine, astrology, aphrodisiac lore, tropical dietetics and personal hygiene, embroidered with Galenic concepts and terminology. Under the first Caliphs, 'Omar, Abubakr, 'Othmân and 'Ali, who reigned for about thirty years after the death of the Prophet (632), the primitive and nomadic culture of Arabian desert still prevailed. But with the consolidation of the Caliphate under the Umayads (661–750) and then the 'Abbasids (750–1250), it became essential to incorporate the political system as well as the sciences of the conquered countries.[22] To this end, theoretical and institutional instruments, which we will discuss in the following sections, were devised. But the original Koranic creed, mainly established during the first period of the rise of Islam, did not recognize the human understanding of the body as a corpus of medical knowledge in its own right. This creed, which was deeply embedded in Islamic culture, was later enshrined in classical Islamic medicine. "All human medicine is made subservient to the tenets of religion and to the world of nature which reflects directly the wisdom of the Creator who is also the Supreme Curer, one of His Names being al-Shâfi [curer]."[23] The subordination of the human intellect to the tenets of religion left a profound mark on the history of Greco-Islamic medicine, which will be examined in the following sections.

THEORETICAL FOUNDATIONS OF THE RELIGION–MEDICINE RELATIONSHIP

The intellectual link between religion and medicine was of two kinds. The first was related to the fact that the human intellect was held to believe in supernatural causes, which covered magic, astrology and religion. The second form of the religion–medicine relationship in Iran was elaborated with the aim of assimilating Aristotelian and Galenic theories into the Islamic religion.

The Persian or Arabic sources for this study consist of a wide range of religious texts in which medicine and religion overlap at different levels. Almost all medical books refer, to some extent, to faith healing and all treatises on prayers claim somehow to have healing effect. Some prayers (*ad'ia*) were written with the intention of curing different kinds of diseases, for instance, prayers for preserving

the body against, or for curing, cholera, or prayers for curing leprosy. Reciting specific prayers, "while putting some dust of a saint's tomb on the eyes, then eating it with water, cured any kind of diseases".[24] As Sâveji put it in his treatise, the majority of the *ad'ia* had a curing effect for all kinds of diseases.[25] Some books on pharmacopoeia mixed pharmacy and magic. For example the author of one treatise proposed a recipe to prepare different drugs used in an ordinary pharmacopoeia but these drugs were to be taken at specific astrological hours and on specific days of the week; or while taking the drug, the patient should recite such and such a verse or prayer.[26] The underlying theory of this connection between religion, astrology and medicine is that the object of medical knowledge, the body, was a reflection of the universe; each organ was related to one of the twelve [*sic*] planets embodying the four temperaments (heat, cold, dryness, wetness) according to the four seasons of the year.[27]

Mohammad Hâdi 'Aqili in the eighteenth century assumed that a drug was a substance from one of the three kingdoms (mineral, animal, vegetable) and each of these kingdoms was subject to the influence of the planets. Therefore, he argued, the medical properties of drugs depended on the temperaments of the planets. Likewise, as Pingree has put it, the prognosis of the course of the disease, according to iatromathematics, as one of the branches of Islamic astrology, depended on the motion, phases and contacts of the moon.[28] The bare bones of the traditional-Islamic medicine were the cosmology according to which matters, or *arkân* (pillars) of the universe and the human body alike, had four states of water, earth, air and fire which, together with their hot and cold qualities, constituted the humoral physiology of the body. Diseases were caused when an imbalance occurred in the proportion of these elements. All these theoretical devices were involved in the medico-religious discourse.

The hygienic codes usually conveyed a strong religious or magical character, so that for believers, they were considered as prayers; and although they were usually observed for their medical efficacy, they sometimes had entirely religious or magical explanations. Rubbing the skin in the bath was useful because it eliminated dirt, and thereby Satan ran away from the body.[29] Or, as hot mineral springs took their source from Hell, not only did they have no healing effect, but they were positively harmful to the body.[30] Conversely, sin was understood as a symbol of dirt while prayer was conceived as a cleanser, hence the religious connotation of *ghosl* or bathing.[31]

The questions of somatic and psychic diseases, or natural and supernatural causes of disease and healing, were discussed at different levels in both religious and medical texts. Although medical sources examine mainly natural and physical treatments and prayer books propose supernatural treatment for somatic diseases, in both sources healing had a religious or divine origin because diseases were caused by God and could not be known by doctors. Hence, the *hadith* of the fifth Imâm of the Shiites, Mohammad Baqer (677–732), claimed that if the *suras* (verses) *hamd* and *qol hovallâ* had no effect on a disease, nothing else and nobody

could cure it.[32] The author of *Meftâh al-shafâ* quoted the Prophet as saying that "if one does not ask healing from the Koran, he would never recover from illness".[33] Another *hadith* from the Prophet states that the Angel Gabriel taught him a prayer, the recitation of which seventy times while blowing on water collected from the April rains[34] dispensed with the need for any doctor and eliminated any diseases in organs, veins and bones, and even deleted all diseases recorded in the eternal (or divine) table (*Lawh-e mahfuz*).[35]

Therefore, according to the prayer books, the effects of divine or supernatural healing were taken for granted. How then did Islamic medico-religious discourse explain the many cases where sick believers died despite their prayers? The answer was that the person who prays must truly believe, in which case his prayer would certainly be accepted. Also, the curative power of prayers could be either apparent or invisible. In some cases sick people were fully conscious of the efficacy of the magic cure. In others, however, when the illness was apparently not cured, it was because the sick were not aware of the healing result, which for some reason remained concealed to them.[36] This illustrates how medico-religious discourse regulated the social order.

In addition to this religious or magical understanding, there were also two contradictory interpretations of cure by prayer. According to the first one, which can be considered as the forerunner of modern psychiatry, the physician, through the mental process and relying on the patient's belief, tried to cure the illness. There are many references to this method in traditional medicine. Avicenna recognized a direct relation between bodily illness and psychic problems.[37] This method was widespread to such an extent that Ibn Qayyim, for instance, thought that the knowledge of heart and spirits was a good basis for physical treatment and that the one who "has no such knowledge, even if he is skilful in the treatment of the constitution and the states of the physical body, is only half a physician".[38] Such theories are, or could provide, a rational explanation for magical or religious treatments of diseases.[39] Sâveji, for example, discussing the psychic causes of diseases, maintained that the movements of spirits, breath or psychic faculties, are outward and/or inward and in both cases are either sudden or progressive. If, for instance, the inward movement is swift, it produces fear and panic, and if it is slow, it results in depression. At the time of epidemic, as the majority of people are frightened, the spirits enter the body swiftly and because of the speedy movement, the outer body becomes cold and the inner body gets hot and produces boiling phlegm in the heart. Therefore, when cholera spreads out, those who are psychically weak are predisposed to it. Consequently, a basic treatment for those stricken by cholera is the psychic treatment to which this author devotes eleven pages of his *Dastur al-atebbâ* for the treatment of cholera.[40] Another religiously committed doctor alleged that fear was the cause of cholera and advised his patients to resort to religion in order to overcome their fear.[41] In all these cases, supernatural or spiritual treatments were employed by traditional doctors to cure physical diseases. In Shiite Islam, the cult of saints, as in medieval Europe, prevailed. Even

today, in many Iranian villages and towns there are shrines of the Imam-zâdehs (male or female descendants of one of the twelve Imams of the Shiites), which are believed to possess miraculous power. These Imam-zâdehs possess different degrees of healing power (according to the level of their kinship with the main Imams) for incurable diseases and still today constitute for many people the last resort when all medical treatment has failed. It is highly revealing that this healing function of religion or the saints was indirectly brought into question by one of the traditional, though modern-minded, doctors in the second part of the nineteenth century, who wrote a treatise on the establishment of the modern hospital. Although this author refers frequently to religious ethics as providing moral criteria for professional doctors, he assigned the healing effect not to the shrines but to the hospital. In a conceivably parabolic expression, this anonymous author maintains that the hospital was the place where the prayers (for curing diseases) were received favourably ("*mahall-e ejâbat-e do'â*"). By this he implied that the curing place was the hospital and not the shrines of the Imams or Imam-zâdehs. Then he provides a rational line of reasoning to explain why, how and in which spiritual condition, a prayer was granted. His argument can be summarized as follows. At the time of illness, the temperament is corrupted and the unity or harmony between soul and body is lost. The soul, which at the time of health was embedded in material pleasure, now puts an end to its attachment to the corrupted matter and increases its connection to the spiritual and incorporeal beings. If in this situation of purity the sick person prays, his wishes will come true. The prayer of the sick, in the words of our author, is said for the benediction of those who constructed the hospital (in this case, the state), but what the author left unsaid is that the sick pray also for their own cure. In other places, he complained that almsgiving was wasted during the feast of sacrifice, when it should go instead to the hospital for the benefit of the sick poor.[42] What is noteworthy here is that the author presents an entirely rational perception of the health–faith relation, which had been understood in purely magical terms for many centuries. This illustrates the budding intellectual process of separation between religion and medicine.

The second form of intellectual link between religion and medicine was introduced by Islamic scholars in order to reconcile religion with secular or non-Islamic sciences. As the Koran, according to Islamic religion, covered every aspect of knowledge, there was no need for the sciences. This idea took shape at the early stage of Islam during the first century of Hegir (beginning in A.D. 622), under a political system originating in the regions of Arabia. However, as I have mentioned earlier, under the caliphates of Umeyads and Abbasids, a more cosmopolitan culture prevailed. In fact the Abbasids imitated the court of the Sasanid in Iran, overthrown by Islam, and also borrowed elements of Byzantine civilization. Under new conditions framing the movements of the sciences and arts within the heterogeneous parts of the vast Islamic lands, the cultural self-sufficiency of the Bedouins based only on the Koran could no longer be operational. In order to

remove this obstacle and acquire legitimacy for all branches of human knowledge within the Islamic community, the sciences were divided into the *'olum-e avâyel* (pre-Islamic sciences) such as philosophy, mathematics, medicine, music and so forth, and the *'olum-e avâkher* (Islamic sciences) like *hadith*, *shari'at*, or religious law and jurisprudence, commentary on the Koran, theology, etc.[43] This philosophical or doctrinal recognition of pre-Islamic sciences was largely underpinned by historical and socio-political experiences: even before Islam, the Middle East was the cross-roads for the circulation and transfer of knowledge between Eastern and Western countries. Embassies, missionaries, refugees, war prisoners and merchants or travellers all contributed to the passage of texts and knowledge.[44] The recognition by the Shiite Islam of the pre-Islamic religions, namely Zoroastrianism, Judaism and Christianity, as monotheistic religions and belonging to the same spiritual affiliation also helped to legitimize knowledge derived from these non-Islamic societies.

The division of the sciences into pre- and post-Islamic categories was spontaneously integrated into, and supported by, the medico-religious discourse. But at the same time, this implied that medicine was a secular and non-Islamic science, a situation that provided a pretext for, if not a hostile, at least an ambiguous attitude towards *avâyel* sciences. Thus Abu Hâmed Ghazzâli (1058–1112) declared that the study of science was to be shunned "because it leads to a loss of belief in the origin of the world and in the Creator".[45] Such doctrines gave rise from time to time to the indictment for apostasy or atheism being made against philosophers or physicians like Avicenna. How, then, could medicine be admitted as knowledge and be studied by the believers? The construction of a medico-religious discourse contributed to this reconciliation. Different aphorisms established an analogy between Hell and disease or between Paradise and health. As religion helped believers to avoid Hell and approach Paradise, so medicine could eliminate disease and preserve health. An anonymous author asserted that "people were saved from Hell thanks to the science of *shari'at* and from diseases by using the science of medicine".[46] This discourse also included the association of religion and medicine either by integrating religious sciences into the medical curriculum (for instance, the first of the ten moral and scientific qualities required for a physician was, according to 'Aqili writing in the eighteenth century, the science of jurisprudence and *hadith*)[47] or by incorporating medical knowledge into religion through the production of literature such as *Tebb al-nabi* (*Medicine of the Prophet*), *Tebb al-a'emma* (*Medicine of the Imams*), *Resâleh-ye zahabiyya* (*The book of gold*),[48] and *Zâd al-mosâferin* (*Provisions for the travellers*), or other works such as *Ketâb-e enqelâb-e ruh* (*Revolution of spirits in the body*),[49] where humoral medicine was associated with certain religious precepts.

At best, the sayings of the Prophet and the Imams were explained by humoral theories. Ibn Qayyim, for instance, justified the *hadith* of the Prophet with regard to fever, by referring to Galen and Razi.[50] Or in another place, he comments on different and contradictory *hadiths* of the Prophet and dismisses

as unsound and unconfirmed those according to which Mohammad did not believe in contagion.[51] At worst, humoral theories were attributed straight to the Prophets and the saints. Astarâbâdi, in reaction to the introduction of the theories of modern medicine, admonished the doctors who did not differentiate between bilious, phlegmatic, melancholic and sanguine temperaments, and held that the writings of physicians such as Sheikh ol-Ra'is (Avicenna) were inspired by these humoral principles of medicine, which were founded by the Prophet Edris and conveyed by other prophets until Mohammad perfected them.[52]

The *hadith* "*al-'elmo 'elmân: 'elm al-abdân va 'elm al-adyân*" ("science is twofold: science of body and science of religion"), attributed to the Prophet, was interpreted differently according to the religious or scientific penchant of doctors. Usually it was seen as proof that clerics were entitled to medical knowledge. For some, the fact that in this *hadith*, the term *badan* (body) comes before the term *din* (religion), indicated that the Prophet gave more importance to medical knowledge than to religious science and that he privileged the doctors over the clerics.[53]

The pattern of association of Islamic and non-Islamic, or local and foreign knowledge, continued in modern Iran. With the introduction of European sciences in the second half of the nineteenth century, the Iranian intellectuals, caught between modern science and traditional education, tended to associate them in a specific manner. This trend was obvious especially in the fields of social science and medicine. In hard sciences such as physics, mathematics and, to some extent, astronomy, the association between the modern and the traditional did not occur as much as in medicine. One can discern this difference by comparing manuals of medicine with those of physics, mathematics or astronomy produced for the curriculum of the *Dâr ol-fonun*, the polytechnic school established in the middle of the nineteenth century.[54] In medicine, however, the pattern of association did not survive because it increasingly based itself on microbiology, while in the humanities, modern sociology and anthropology were used to provide religious ideas with rational or "scientific" explanations.[55]

INSTITUTIONAL DEVICE

The institutional relationship between religion and medicine, which was mainly based on the control of education by clerics, played the major role in Islamizing the *avâyel* sciences. After the conquest of non-Arab countries, all the sciences that had been developed in these civilizations were translated from Greek, Syriac, Pahlavi Persian or Sanskrit into Arabic.[56] As enumerated in the *Nafâyes ol-fonun* (*The epitome of sciences*) of Amoli, the curriculum of (Islamic) scholars, covered all "sciences", including religion, mathematics, natural sciences, geometry, medicine, music, astronomy, history, literature, grammar, science of the interpretation of the Koran, magic, and arithmomancy or divination by means of numbers (*jafr*).[57] There was a dialectic interaction between institutional and theoretical aspects of the religion–medicine relationship.

The practice of medicine by clerics was not unusual in Iran. When a mullah of low education could not provide a proper medical treatment, he was still seen as reliable enough to write a specific prayer (*do'â*) for healing the illness. It was therefore not surprising to see that medical books were sometimes recommended to students of religion. In a note on the front page of a manuscript, *Zobdatol-Qavânin al 'Alâj* (*Compendium of the rules of treatment*), the owner dedicated and recommended it to the students of religious sciences (*talabeh-ye 'olum-e diniyeh*).[58] Conversely, those who specialized in non-religious sciences also had to study religious sciences, as did the doctor-to-be Mirzâ Ali, the translator of Grisoll's books in the second half of the nineteenth century. Hence, the association of natural sciences, astrology and religion in the curriculum was not only due to the Aristotelian worldview.[59] Religion provided scholars with a moral and cultural framework within which they could implement or apply their knowledge in social and professional life. This was mainly operated through Islamic jurisprudence (*feqh*), which was studied by all students, including medical ones. The *feqh* dealt not only with religious questions but also and more importantly with social, economic and political life.

THEORETICAL AND INSTITUTIONAL REFORM IN MEDICINE

As a result of the Islamization of education, any reform in this field had to take into account its intellectual resources — or even to employ them, especially in the absence of a colonial power that could replace them with its own, as happened in some other Islamic countries in the nineteenth century.

Reform in medical institutions started in Iran later than in other countries such as India, the Ottoman Empire, Tunisia and Egypt.[60] While India and North African countries had a continuous relationship with Europe during the eighteenth century, Iran, being in the throes of civil war, remained isolated from the network of economic and diplomatic connections with European countries. Correspondingly, acquaintance with modern sciences in Iran began systematically only with the establishment of the central power of the Qajars in the closing years of the eighteenth century. Moreover, the path of reform throughout the Qajar period (1797–1925) was quite erratic, especially in the first part of the nineteenth century. No special institution was set up for implementing modernization. The total number of students sent abroad to study Western science was fewer than ten during the first part of the nineteenth century, compared to Egypt where as many as 104 students were sent to Europe between 1826 and 1833.[61] The encounter with Western medicine occurred mainly through the presence of a handful of European physicians in Iran, as well as through occasional translations of European medicine into Persian. Abbas-Mirzâ (1789–1833), the heir apparent of the Qajar throne and governor of Azarbaijan, endeavoured to introduce modern sciences, not least because he attributed his defeat in the war against Russia to the lack of a modern army and also because the small population of the country resulted from high mortality. He asked his personal physician, the British doctor John Cormick, to

introduce vaccination against smallpox. The children in some villages within his jurisdiction were vaccinated but this was not attempted nationwide. Although Abbas Mirzâ played a key role in the introduction of modern medicine, he had no specific agenda for reform and was never willing to give the task of modernization to a European expert, as did, for instance, Mohammad-Ali-Pasha in Egypt.

In an *ad hoc* manner, however, some important medical texts were translated into Persian during the first part of the nineteenth century. One of the books of Paracelsus (1493–1542) was translated at least three times in three different versions. The first, in 1810, was from an Arabic translation, by an anonymous author who entitled it *tebb-e jadid-e kimiyâ'i* (*Modern medicine based on chemistry*).[62] It was again translated, probably in the 1820s, by Abdol-sabur Khu'i, with the title *Morakkabât-e jowhariyyeh* (*Compound medicine based on essence*). In his introduction, Khu'i explained the efficacy of chemical drugs and criticized the harmful effects of herbal medicine. This author also wrote, in 1827, *Resâleh-ye âbeleh-kubi* (*Treatise on vaccination*),[63] which was in fact a free translation of Cormick's *Smallpox inoculation and the need for its universal use*. A third translation of Paracelsus was made in 1836 by Mohammad Ali (Fâni) b. Mollâ Eskandar Shervâni, entitled *Kimiyâ'-e shafâ* (*Chemistry for healing*).[64]

The translation of Paracelsus was by no means a mere coincidence. In Europe Paracelsian iatrochemistry, which had been overshadowed by anatomy-based medicine as early as the seventeenth century, had been entirely refuted by the nineteenth century;[65] and no European doctor who wished to introduce Western medicine in the Qajar Iran would have recommended Paracelsus. The translations indicate, first of all, that Western medicine was assimilated by traditional doctors according to their own understanding, and secondly, that through the ideas of Paracelsus, some traditional doctors began questioning the very foundations of humoral theories. At the same time, medications based on the essence (*jowhar*) of the simple or component herbal drugs were imported. These new drugs threatened the market of local drugs partly thanks to their relative effectiveness and partly because the Europeans, who possessed dispensaries or practised medicine in Iran, distributed them free of charge in order to ingratiate themselves, and promote their cause. For instance, Dr Collins, a British ophthalmologist, visiting Iran in 1895–96, informs us that the British telegraph official, Sergeant Glover, who was responsible for the telegraph station in Abâdeh in Southern Iran, had opened a dispensary, which contained over three hundred different drugs and gained a local reputation for his skill in the extraction of teeth.[66]

Mirzâ Mohammad Taqi Shirâzi wrote in Arabic an essay against the introduction of Western drugs and the permission for their use in the marketplace, which he entitled *Resâleh-ye jowhariyyeh* (*Treatise on [against] essences*). Later, one of his pupils, Astarâbâdi, argued in his treatise on cholera that the essences of drugs, introduced by the Europeans, were harmful to the body for two reasons: "First of all because they were altered through their transformation from their natural

state to their essence; secondly because they were produced in a climate different from that of Iran and consequently they did not fit the temperaments of the local population."[67] Yet both Shirâzi, a high-ranking court doctor, and Astarâbâdi, a mullah-doctor of lesser importance, were in contact with the modern-educated doctors, whether Iranians or Europeans. Shirâzi, together with the French physician, Dr Tholozan, participated in the Health Councils, which had been established by order of the Shah at the onset of the 1860 cholera epidemic.[68]

On the other hand, traditional doctors took a pragmatic view of new drugs, perhaps because they continued to flow into the country along with other items of consumption from Europe. It is thus not surprising to see that, for instance, both Shirâzi and Astarâbâdi recommended certain European drugs such as Epsom salts (*namak-e farangi*), effervescent powder[69] and quinine.[70] It seems therefore that the importation of new drugs from Europe, or even their manufacture in Iran, threatened the local doctors and pharmacists more for economic and institutional reasons than from an ideological or theoretical point of view. When, at the end of the century, the German Schwerin, head of the pharmacy Department of the Dâr ol-fonun, opened a retail pharmacy in Tehran, he encountered violent public opposition.[71] That is why the modern apothecaries were usually limited to catering to the needs of European customers or a few educated Iranians. However, the traditional apothecaries (*'attâri*) remained strong and prosperous throughout the nineteenth century. Their influence was such that as late as 1939, when Charles Oberlin, dean of the Faculty of Medicine in the newly established Tehran University, created the chair of pharmacy, the curriculum included Galenic pharmacology, chemical pharmacology, simple herbal drugs, organic chemistry and biochemistry.[72]

In the middle of the nineteenth century, institutional reforms were initiated by Mirzâ Taqi-Khân Amir-Kabir, the reforming prime minister of Nâser od-Din-Shâh (ruled 1848–96), through the creation of a modern school of Dâr ol-fonun and a military hospital. In Qâjâr Iran, the modernization had a specific pattern. It did not simply mean the introduction of European methods and sciences. In its first stages, modernization was characterized more by institutional and organizational aspects than by conveying new ideas. In this sense, it was also aimed at the revival of traditional sciences, which had fallen into abeyance. As Dr Mirzâ Ali mentioned explicitly, Prince E'tezâd os-saltaneh, the (modern-minded) minister of science, had promoted (*ehyâ* = restored) both ancient and modern sciences.[73] Prince E'tezâd os-saltaneh[74] himself was an erudite man who left several books, including one on astrology where he refuted the very principles of the old astrology and described as superstition the custom of consulting the stars before undertaking a work. Yet E'tezâd os-saltaneh elaborated his argument against astrology by referring to both traditional and modern sciences.[75] In his book on the *Principles of physics*, Ali-Khan, professor of artillery at Dâr ol-fonun, pointed out that Nâserod-Din-Shâh was the propagator of modern and ancient sciences.[76]

The combination of modern and traditional is to be seen in almost all scientific

texts of this period in Iran. This intellectual process was sustained by a political power that planned to create a new regime of education in order to bring the educational system under its control. Accordingly, the establishment of a modern school meant the introduction of modern sciences as well as the reorganization of traditional education. As to education for adults, we do not have enough information. It seems that, except for perhaps a few universities in the Islamic world, higher education was available only through private tutorials, and students attended their teacher's lecture at his home. With the exception of those who were self-educated, the private tutorial was available only to the richest who could pay a professor. The reorganization or the revival of traditional sciences in the nineteenth century would therefore entail the creation of schools or universities where traditional education was public. This experience of reorganization or renovation of traditional education in nineteenth-century Iran reminds us of the transformation of techniques of disciplining scientific practitioners, which constituted the major characteristic of what was called by some scholars a second scientific revolution in Europe.[77]

To the extent that modernization implied promotion of the sciences, both modern European and traditional Iranian, the traditional doctors were called to take part in it. They were invited to publish their ideas about epidemics and to put together new prophylactic measures against them. In 1853, on the outbreak of cholera, Mahmud-Khân Kalântar, the mayor of Tehran, ordered physicians to write treatises on the prevention and cure of cholera.[78] The above-mentioned anonymous doctor who wrote a manifesto on public hospitals, advocated the creation of a hospital where doctors would acquire clinical experience, but he advised students of medicine to read traditional books like the *Canon* of Avicenna, *Kâmelos-sana'a* of Majusi, and so on.[79] The combination as well as the parallel practice of traditional and modern medicine in nineteenth-century Iran both illustrated and framed the process of institutional and intellectual transition of traditional medicine. Unlike North African countries and India, the revival or reorganization of traditional medicine in Qajar Iran was not a political reaction against European influence. This was mainly due to the fact that the introduction of modern science in nineteenth-century Iran was not identified or associated with colonial power.

Qajar Iran remained, over the course of the nineteenth century, outside the sphere of colonial expansionism, for different historical and geopolitical reasons. Firstly, because the major commercial relationship of Europe since the thirteenth century had focused on Mediterranean countries and Iran was not included in this longstanding economic network. Such a relationship was further impeded by the enduring hostilities between the Ottoman Empire and the Safavid Empire (1501–1722), as the Ottomans opposed any contact between Iran and Europe through their territory. Therefore, historically, European countries remained relatively uninterested in having a consistent commercial relationship with Iran. Secondly, Qajar Iran, being situated between the Russian and the British empires, acted as a buffer zone since they sought to avoid any direct territorial conflict. This necessarily led these powers to the compromise of keeping the Persian Empire

out of their colonial ambitions. Finally, the central state, rooted in, and identified with, the Old Persian monarchy, did not facilitate direct foreign influence or colonial domination. Conversely, both England and France increased their colonial expansion in North Africa and in the Indian subcontinent after their war industry and economic resources were released after the Battle of Waterloo (1815) and the Crimean War of 1854–55. Accordingly, although North African countries and India were acquainted with European sciences long before the Iranians, there the abrupt expansion of European colonialism created a political reaction within the community of scholars and populace alike against Western system of education. In Egypt, under Mohammad Ali, for instance, this opposition was a consequence of the repressive or discriminative manner of student recruitment.[80] In Iran, on the other hand, the scholars, notwithstanding their unfamiliarity with European science when it was first introduced in the nineteenth century, were not antipathetic to it and did not identify it with colonialism. They encountered modern medicine as neutral knowledge rather than as an instrument of colonial domination. This assisted the integration of modern medicine by traditional physicians in Iran.

THE SPLIT BETWEEN MEDICAL INSTITUTIONS AND RELIGIOUS ESTABLISHMENT

As we have seen, in medieval Iran and up to the end of the nineteenth century, the educational system was based on a holistic attitude to knowledge and science. Within such a system, most educated people, clerical or lay, studied medicine alongside other branches of scholastic sciences. Fakhr ul-Din Râzi (1149–1209), theologian, philosopher and physician, epitomizes this trend in education.[81] The division of sciences in the pre-Islamic and Islamic worlds was not a discriminative measure and aimed not at the excommunication of the non-Islamic sciences but at their assimilation and legitimization. Such a tendency to assimilate foreign sciences still prevailed when modern sciences were first introduced in the nineteenth century. The reaction of the scholars of this period toward modern medicine was therefore similar to the attitude of their fathers toward *avâyel* sciences in medieval times. Throughout the nineteenth century, we find this scientific interest illustrated in the translation of Aristotle (on hot and cold in animals) in 1801, Paracelsus (on spirits and essence, called chemistry of matters) in the 1810s, Cormick (on vaccination) in the 1820s, and Grisoll, Polak, Tholozan and other modern physicians (on anatomical-pathological medicine) in the 1880s and later. Accordingly, a process similar to the development of modern medicine in Europe occurred in nineteenth-century Iran.

Concurrently, there was a process of secularization of science, which kept the connection of religion and medicine quite loose. This process was twofold: despite the effort to reconcile *avâyel* sciences with Islam, the religious orthodoxy that had developed at different periods of Iranian history (for example, shi‘a orthodoxy under the Safavids) created or favoured the hostility of the religious establishment towards men of science. The second factor of secularization was the patronage of doctors by secular powers, which further loosened the control of the *ulema* (Shiite

clerics or mullahs) over medicine.

However, the primitive Koranic tenet that did not recognize the human intellect as a source of knowledge and the persistence of magico-religious medicine throughout the centuries implied the continuous interference of God and of supernatural forces in nature. Because of their religious commitment, physicians failed to focus on the force of nature at the cost of supernatural explanation. Several centuries of effort on the part of Islamic scholars to reconcile the *avâyel* science with religion occurred under the ideological pressure of Islam, reinforced from time to time by political factors. Secular knowledge was therefore held in check by religion. Discussing the origin of medical knowledge, Mohammad Hoseyn b. Mohammad Hâdi ʻAqili, the most important authority in the eighteenth century in Iran and in India, mentioned two major schools. The first believed in the God-inspired knowledge (*elhâmiya*); Hippocrates, Galen and other Greek poets, according to him, were the followers of this school. The second saw medical knowledge, like other sciences, as based on human intellect and the followers of this school were called deductivists (*estenbâtiya*); like Pythagoras, they acquired their science from experience. ʻAqili, citing the Koran verses: *va ʻallama âdam al-asmâ' kollahâ thom ʻarazahom ʻalâ al-malâ'ekat* ("God taught all names to Adam, then showed his creatures to the angels"), commented that the human being cannot understand medical science without being inspired by God.[82]

Such a genealogy of medical knowledge was not only a legitimization of medicine as a pre-Islamic science, but also, and more significantly, it constituted part of an ideologico-scientific discourse to the creation of which all branches, including mythology, astrology, magic and religion, since the pre-Islamic periods, had contributed. As long as medicine based its aetiology on the atmosphere and on the planets, it was conceivably in harmony with religion. But once medicine began to focus on the inner body, it disconnected the object of its study from the larger universe. Getting into the secrets of the body, known only by God, through anatomy, was a sacrilege, which could not be endorsed by religion. Consequently, by the nineteenth century, the medieval system, which was challenged by new social and political conditions as well as by the introduction of new theories of disease, could not operate as before. However, because of its Galenic background, traditional medicine in nineteenth-century Iran was not in clear-cut opposition to modern medicine but at different levels it shared certain concepts of modern science, not least because modern science itself developed through a natural evolution of Hippocratism and neo-Hippocratism. Even in the *Safineh-ye nuh* (*Noah's Ark*), a treatise on the 1892 epidemic characterized by its antagonism to modern medicine, one finds modern medical terminology. The contradictory elements or arguments of the treatises of Kani[83] or Astarâbâdi (*Safineh-ye nuh*) show that the theoretical or practical incoherence of traditional medicine in the nineteenth century was produced as a result of contact with modern medicine. Astarâbâdi, for example, criticized European medicine and drugs such as quinine because they were responsible, according to him, for new diseases;[84] but in the

following lines he prescribed quinine for the treatment of cholera.[85] Obviously Astarâbâdi did not oppose the use of the locally fabricated quinine; he was against the quinine imported from Europe — in the 1 May 1887 number of the journal *Echo de Perse*, published every fortnight since 1884, the quinine of Pelletier, Delondre and Levaillant was advertised as the best.[86] In another place, Astarâbâdi used modern terminology, such as *fisologia* (physiology) for the preservation of health and *atologia* (pathology) for the prevention of illness.[87] By making use of these terms for traditional concepts, Astarâbâdi attempted to import contemporary scientific concepts into traditional medicine in an effort to understand modern science which the author termed *'elm-e motekaffell*[88] — and to update traditional medicine. He believed that the cause of epidemics was sin while cholera was a punishment ordained by God. This implied that once epidemics occurred, the believer's religious duty was submission to God's will. Accordingly, he divided his treatise into two chapters. The first, *do'â* (prayer), provided the patients with special prayers that protected them against epidemic diseases. The second was *davâ*, medication, subdivided into two parts: preservation (*hefz*) of health and cure (*raf'*) of disease. To the extent that the latter implied that by curing disease the doctor intervened in God's will, it was in contradiction with the first chapter, *do'â*. This reveals the internalization, by traditional medicine, of the conflict between faith and science.

Astarâbâdi's use of the title *Safineh-ye nuh* for a medical treatise is very significant. By it he implied that his treatise resembled the ark of the Old Testament, able to preserve the human being from the deluge of cholera that modern medicine had failed to prevent. In this treatise, Astarâbâdi contends that the solution to the unprecedented epidemics is to revive fully the medicine of the Prophet and abandon modern theories. This view reflects the commitment of one mullah-doctor to religion, while the career of Boqrât ol-Hokamâ, described at the beginning of this article, illustrates the commitment of another mullah-doctor to medicine. In either case there was no all-encompassing dissociation between medicine and religion but rather a marked inclination towards one or the other, and this process gradually ended in the institutional separation of religion and medicine in the following decades.

The development of the Shiite establishment in nineteenth-century Iran created a situation favourable to the process of separation. In the nineteenth century the power of Shiite mullahs increased. This was due to two historical factors. First, after the downfall of the Safavid dynasty (1501–1722) which claimed religious legitimacy and controlled the *waqf* (legacy or religious endowments), the Shiite establishment became the masters of both religious legitimacy and the *waqf*.[89] Second, the civil wars in the eighteenth century further weakened the power of the state and provided the religious establishment with more opportunity to increase its autonomy. In nineteenth-century Iran, in addition to the control of the religious endowments by the mullahs, their alliance with the bazaar further enhanced their financial independence. The mullahs strengthened their power throughout the

nineteenth century to the extent that, despite the consolidation of the Qajar state, they were able to intrude in political affairs. Another factor during the nineteenth century that increased the clerical power was the fact that, in the absence of any lay institution, it was the only force able to organize the popular movement and, especially in the second part of the century, it became the only opposition party challenging the authority of the state. Almost the same reason was at the origin of the Islamization of the secular movement against the Pahlavis Shahs leading to the 1979 Revolution.[90]

As their political, social and economic influence increased, the Shiite clerics titled themselves ayatollah (the sign of God)[91] and revived the principle of *ejtehâd* (or the authority to derive new legal norms from the sacred law), which had been introduced around the fourteenth century but which had not been fully and systematically put into practice.[92] The principle of *ejtehâd* enhanced the juristic authority of the *mojtaheds*, high-ranking Shiite mullahs, allowing them to interpret the Koran and to apply the sacred law to everyday life; in other words, to ensure the relation between the community of believers and God in the absence of the Imam. This principle had far-reaching implications in social and political life. On the one hand, it increased the authority of the Mullahs, and on the other it opened divine law to human understanding and consequently to human intervention, unlike the traditionalist or orthodox version of the *shari'at*, according to which no human authority could devise any legal norms other than following what was explicitly transmitted through the Koran or *hadiths* (traditions). When modern medicine was first introduced in the nineteenth century, there were criticisms or hostile speeches against it here and there, but the religious establishment did not and could not excommunicate its study and practice. Because the Shiite mullahs had no institutional cohesion and hierarchy similar to what characterized the medieval European church, the *mojtaheds* were able to present different readings of the Koran and its application to social life. In the intellectual and organizational context in which it was first introduced in Iran, modern medicine enjoyed the implicit recognition of the Shiite establishment. This recognition, which became more explicit during the twentieth century, is illustrated in a recent *fatvâ* (religious injunction) issued by Ayatollâh Sâne'i, one of the moderate *mojtaheds*, allowing abortion (even though this is outlawed in Islam) not only when the mother's health is in danger but also when the family cannot afford another child or when there is overpopulation.[93] Even the Guardian Council, the Islamic Republic's constitutional overseeing body, which is dominated by the most conservative mullahs, has recently pronounced an edict allowing organ transplantation from dead or brain-dead people.[94] Modern medicine may be practised according to its scientific value, free from religious criteria. This is illustrated in the policy of the Islamic Republic to revive traditional medicine:[95] it can be practised, but only by doctors who have graduated from medical faculties where they have studied and fully integrated modern medicine.

The separation of religion and medicine towards the end of the nineteenth century was due to the evolution of the same factors that characterized and determined their relationship. As we have described, this relationship occurred theoretically and institutionally. In classical schools (*madrasa*), medicine was one of the general courses among grammar, mathematics, religion, etc. Even at the higher level studied by professional physicians it was still infused with supernatural concepts and elements of folk medicine. Concurrently, humoral theories were vulgarized through popular literature and culinary arts as well as religious education. After the creation of Dâr ol-fonun and the introduction of modern sciences, medicine became increasingly devoid of spiritual elements. Likewise, due to the specialization of sciences, the religious class could not accommodate them. With the institutional reforms and the professionalization of medicine the clerics who practised it had to choose whether to serve the secular state or to remain within the clerical establishment. The imposing social and professional label of "doctor", acquired by those who had gone through a long period of specialized studies and social relations in modern schools, was the most important factor in excluding others, including the mullahs, from the practice of medicine. In addition to these historical factors of an institutional nature, one should bear in mind that nineteenth-century Iran was gradually moving away from its medieval traditions, where medical practice principally hinged on faith, towards a society in which medicine relied increasingly on reason. This general and global evolution was, at different levels in different countries, fundamental in the separation between religion and medicine.

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4. Anonymous, *Fehrest-e rashahât al-fonun* (*Index of the branches of science*), St Petersburg, National Library, copy dated 1227/1812, not paginated.
5. Presently in Northern Afghanistan.
6. Zartosht-e Bahrâm Pazhdou, *Zarâtosht-Nâmeh* (*Book of Zoroaster*), St Petersburg, National Library, fols. 149–53.
7. James Darmesteter, *Le Zend Avesta*, cited by Abbas Naficy, *La médecine en Perse, des origines à nos jours* (Paris, 1933), 13. See also: Horst Fichtner, *Die medizin im Avesta* (Leipzig, 1924).
8. Fielding H. Garrison, "Persian medicine and medicine in Persia", *Bulletin of the Institute of the History of Medicine*, i (1933), 129–53, p. 144.
9. The question of whether theoretical or institutional factors underlay the religion–medicine relationship, lies outside the scope of this study. This question, with regard to medical reform in Iran, has been addressed in my article, "Theory and practice in nineteenth-century Persian medicine: intellectual and institutional reforms", *History of science*, xxviii (2000), 171–8.
10. See Danielle Jacquart, *Le milieu médical en France du XIIe au XVe siècle* (Geneva and Paris, 1981).
11. Joseph Ziegler, *Medicine and religion c. 1300: The case of Arnau de Vilanova* (Oxford, 1998), Introduction.
12. He was born in 1879 in Ardakân, near Yazd, into a clerical family. I am indebted to Mr Nezâmod-din Boqrât, the son of Dr Boqrât ol-Hokamâ, for this information as well as for providing a copy of his father's manuscript.
13. Hâj Aqâ Hoseyn Tabâtabâ'i (1875–1960), of the Tabâtabâ'i family, was born in Brujerd. After his elementary studies, he went to Ispahan to learn *fegh* (religious jurisprudence) and philosophy. He later became *marja'-e taqlid* (or the source of imitation), the first religious authority of Shi'a Law and lived in Qom. In addition to his books on religious sciences and logic, he also wrote a treatise on purgatives for the sick (*Monzajât-e mariz*). *Cf.* 'Ali-Akbar Dehkhodâ, *Loghatnâmeh* (Tehran 1998), iii.
14. The honorific titles were attributed by the princes or the state to high-ranking doctors before the reform of medical institutions in Iran. Usually these titles, such as *Malek ol-atebbâ* (Prince of the Physicians), *E'temâd ol-atebbâ* (Confidant of Physicians), *Seyf ol-atebbâ* (Sword of Physicians), *Soltân ol-hokamâ* (Sovereign of Doctors), *Sehhat ol-dowleh* (Health of the State), indicated official recognition by the state. Such titles established differentiation between official and non-official, genuine and quack doctors. I discussed this subject in a paper "Medicine and politics in Qâjâr Iran", presented at the Fourth European Conference on Iranian Studies, Paris, 6–10 September 1999.
15. This manuscript is untitled. Conceivably this anti-carnivorist argument of Boqrât ol-Hokamâ could have some origin in the Zoroastrian philosophy. Yazd, Central Iran, and Kerman, South-East, are two regions in Iran where the Zoroastrians are still concentrated and still have their temples. For some indications on the vegetarian philosophy of Zoroastrianism, *cf.* Laurence Ossipow, *La cuisine du corps et de l'âme* (Paris, 1997), 37ff.
16. The Library of Dr Boqrât ol-Hokamâ contained 330 volumes of Arabic and Persian manuscripts, bequeathed, according to his will, to the Library of Astân-e Qods (Mashhad), and 42 volumes of French printed books, including: *Guide-formulaire de thérapeutique* by V. Herzen (Paris, undated); *Thérapeutique clinique* by H. Huchard (Paris, 1909); and *Les agents physiques usuels, climato-thérapie, hydrothérapie,...* by A. Martinet *et al.* (Paris, 1909). These books have been donated by Nezâmod-din Boqrât, his son, to the Open University of Neyshâbur.
17. According to Nezâmod-din Boqrât, interviewed in June 1999, Neyshâbur.
18. *Cf.* Mohammad Mehdi Movahhedi, *Zendeginâmeh mashâhir-e rejâl-e pezeshki-ye mo'âser-e Iran* (Tehran, 1371/1992), 36–37. See also Mohammad Taqi Mir, *Pezeshkân-e nâmi-ye fârs*

(*Physicians of Fars*), 2nd edn (Shiraz, 1363/1984).

19. About the growing influence of the Shiite ulema in the nineteenth century see below, ref. 90.
20. Seyyed Jamâl od-Din Asadâbâdi, nicknamed Afghâni, was an Iranian born in Asad Abâd of Hamedan. For political reasons, particularly to avoid the persecution of the Qajar regime, he had requested Afghan nationality and chosen an Afghan name because at that time Afghanistan was under the protection of the Great Britain. For the biography of Afghâni, *cf.* Homa Nategh, *Seyyed Jamâlod-Din Asadâbâdi, dit Afghâni* (Paris, 1971). See also Nikki Keddie, *Sayyed Jamal ad-Din "al-Afghani": A political biography* (Berkeley and Los Angeles, 1972).
21. For this question *cf.* Sami Zubaida, *Islam, the people and the state: Political ideas and movements in the Middle East* (London and New York, 1993). See also A. Hourani, *Arabic thought in the Liberal Age 1798–1939* (Oxford, 1982).
22. For a comprehensive book on the shaping of Islamic civilization, see Ira M. Lapidus, *A history of Islamic societies* (Cambridge, 1991). For further reading see William L. Cleveland, *A history of the modern Middle East* (San Francisco and Oxford, 1994); Albert Hourani, *A history of the Arab people* (Cambridge, Mass., 1991); G. H. A. Juynboll (ed.), *Studies on the first century of Islamic society* (Carbondale, Ill., 1982).
23. Seyyed Hossein Nasr, Preface to the *Medicine of the Prophet* of Al-Jawziyya (ref. 1), p. xix.
24. See for example an anonymous treatise, annexed to the book written by Fakhr al-Hokamâ va Zobdat al-Attebâ Hâji Mirzâ Musâ Sâveji, *Dastur al-atebbâ fi 'alâj al-vabâ* (*Prescription of doctors for the treatment of epidemics*), lithograph (Tehran 1269/1852–53), Majles Library, 1–3. It seems that this annex is the second part of the Sâveji's book, hereafter: Sâveji, *ad'iya*.
25. *Ibid.*
26. Treatise on pharmacopoeia, Persian MSS, St Petersburg National Library, fols. 43–55.
27. Anonymous treatise on medicine, entitled in the catalogue as *Ketâb-e tebb*, St Petersburg, Library of the Oriental Institute, 10–11.
28. D. Pingree, "Astrology in Islamic Iran", in *Encyclopaedia Iranica*, ii, 869–71, p. 870.
29. Eitham Karim, *Resâleh-ye dallâkiyyeh*, St Petersburg National Library, fol. 23b.
30. *Ibid.*, fol. 7b.
31. Mohammad b. Majlesi Esfahani, *Hadiqat ol-mottaqin* (18th century). The date of writing is not mentioned but in the first folio there is a note saying "this book in the year of 1146/1734 was in the hands of Mohammad Ali" (Persian manuscript, Wellcome Trust Library).
32. Sâveji, *ad'iya*.
33. In Sâveji, *ad'iya*. The *Meftâh al-shafâ* (*Key of healing*) referred to by Sâveji is probably the same as that written by Mirzâ Mohammad Kâzm b. Mohammad Sâ'eb, copied in 1265/1848, as the content is very similar to the genre Zâd al-Mosâferin and the author is qualified as A'zam al-Ulema.
34. The rain that falls in *Nisân*, the first month of the Hebrew calendar corresponding roughly to April.
35. Sâveji, *ad'iya*.
36. Anonymous, Treatise on *ad'iya* (prayers), Persian manuscript, St Petersburg, Library of Oriental Institute, fol. 1.
37. M. Nadjmabadi, *Târikh-e tebb dar Iran pas az eslâm* (*History of medicine in Iran after Islam* (Tehran, 1366/1987), 593.
38. Ibn Qayyim, *op. cit.* (ref. 1), 108–9.
39. This rational interpretation of the soul–body relation, and the association of scientific and religious elements, is quite similar to what happened in eighteenth-century England, where, in the case of an amateur doctor, William Dyer of Bristol, treatment by electricity was based on the idea

that fire was the moving force of the universe. "Electrical healing revived the animal spirits and removed the obstructions to the vital life, in a process which clearly paralleled the spiritual awakening of the individual by grace." See Jonathan Barry, "Piety and the patient: Medicine and religion in 18th century Bristol", in Roy Porter (ed.), *Patients and practitioners: Lay perceptions of medicine in pre-industrial society* (Cambridge, 1985), 145–76.

40. Hâji Mirzâ Musâ Sâveji, *Dastur al-atebbâ*... (ref. 24), 22–32.
41. 'Ali b. Mohammad Ja'far Astarâbâdi, *Safineh-ye nuh* (*Noah's Ark*), written about 1310/1892, Library of Ayatollah Mar'ashi, Qom, Iran, fols. 5–7.
42. Anonymous Persian manuscript, whose catalogue title is *resâleh dar khosus-e ta'sis-e mariz-khâneh* (*Treatise on the establishment of the hospital*), Tehran, Majles Library, no. 550, pp. 10 and 28–29.
43. Allâmeh Shamsod-Din Mohammad b. Mahmud-e Amoli, *Nafâyes ol-Fonun fi 'arâyes ol-'oyun*, ed. by Hâj Mirzâ Abol-Hasan She'râni (3 vols, Tehran, 1337/1958), i, 16ff. See also Fehrest-e rashahât…, *op. cit.* (ref. 4).
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52. Astarabadi, *op. cit.* (ref. 41), fols. 2–3; see also the appendix to this chapter.
53. Abu-zin Kahhâl, *Sharâyet-e Jarrâhi* (*Conditions of surgery*), dated 1855, University of California at Los Angeles, MS 61(I), fol. 2.
54. See for example *Javâher ol-hekmat-e Naseri* (a translation of Dr Tholozan's lectures) and *Javâher ol-tashrih* (written by Dr Mirzâ Ali, educated at the Paris Medical Faculty and professor of medicine at Darol-fonun, lithograph, Tehran, 1887) for medicine and *Osul-e 'elm-e fizik* (written by 'Ali-Khan, professor of Artillery and Physics at that school, lithograph, Tehran, 1295/1878) and *Ketâb-e mostatâb-e falak al-sa'âdeh* (*The excellent book of the sphere of prosperity*), written by Prince 'Aliqol-Mierzâ against the practice of astrology, lithograph, Tehran, 1278/1861.
55. I want to refer here to the modern-minded Islamic scholars such as the late Ali Shari'ati, sociologist and religiously-committed modernist who was considered as the intellectual father of the 1979 (Islamic) Revolution, and Mehdi Bâzargân, the first modernist prime minister of Ayatollâ Khomeini.
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61. Naguib Bey Mahfouz, *op. cit.* (ref. 60), 24.
62. Anonymous, *Tebb-e jadid-e kimiyâ'i*, transl. from an Arabic text written by Sâleh b. Nasrollâ al-halabi in 1669. Persian manuscript, St Petersburg, Library of the Oriental Institute, C 1612.
63. 'Abdol-sabur Khu'i, *Ta'limnâmeh yâ Resâleh-ye âbeleh kubi*, lithograph (Tabriz, 1245/1829).
64. Mohammad Ali Fâni b. Mollâ Eskandar Shervâni, *Kimiyâ'-e shafâ*, 1252/1836, Persian manuscript, University of California at Los Angeles, MS 65.
65. Roy Porter, *The greatest benefit to mankind: A medical history of humanity from Antiquity to the present* (London, 1997), 210–11.
66. E. Treacher Collins, *In the Kingdom of the Shah* (London, 1896), 109; see also pp. 162, 276.
67. Astarâbâdi, *op. cit.* (ref. 41), fol. 3.
68. Mohammad Râzi Kani Fakhrol-atebbâ, *Meftâh ol-amân* (*Key of Safety*), 1279/1862–63, Tehran, National Library, p. 3.
69. *jush-e shirin* or bicarbonate of sodium.
70. *Cf. Safineh-ye Nuh* (ref. 41), fol. 7.
71. Sâdeq Sajjâdi, "Drugs", in *Encyclopedia Iranica*, vii, fasc. 5, p. 559.
72. *Ibid.*, 560.
73. Dr Mirzâ Ali Hamedâni, Preface of the Persian translation of Grisolle's *Traité des maladies nevreuses* (*amrâz-e asabâni* = nervous diseases), lithograph (Tehran, 1297/1880), 4.
74. Prince Aliqoli-Khan E 'tezâdos-saltaneh (1819–81) was appointed head of the Dâr ol-fonun in 1858 and a year later nominated as minister of sciences. The first and the largest group of students (42) was sent to Paris under his auspices as soon as he became head of the Dâr ol-fonun. He took over responsibilty for the telegraph and the printing-house (*châp-khâneh*), and published several journals. *Cf.* Mehdi Bâmdâd, *Sarh-e hâl-e rejâl-e Iran* (*Biography of Iranian politics* (Tehran, 1335/1956), iii, 442–8.
75. *Ketâb-e mostatâb-e falakos-sa'âdeh*, lithograph, Tehran, 1862.
76. Ali-Khân, *'osul-e 'elm-e fizik* (*Principles of physics*), lithograph, Tehran, 1295/1878, Introduction.
77. Jan Golinski, *Making natural knowledge: Constructivism and the history of science* (Cambridge, 1998), 69.
78. Aqâ Mirzâ Mohammad Tehrâni (untitled treatise on cholera), lithograph, 1269/1853, Tehran, Library of the Parliament.
79. Anonymous Persian manuscript, undated, written in the early 1850s, Majles Library, Tehran, 81 pages.
80. Khaled Fahmy, "Women, medicine, and power in nineteenth-century Egypt", in *Remaking women*, ed. by Lila Aby-Lughod (Princeton, 1998), 35–72, pp. 46–47.

81. Elgood, *A medical history of Persia* (ref. 45), 219–20.
82. Mohammad Hosein b. Mohammad Hâdi Aqili, *Kholâsat al-Hekmat* (*Summary of medicine*), written in 1782, lithograph edn (Bombay, 1261/1845), fol. 287.
83. Râzi Kani, *Meftâh ol-amân* (ref. 68).
84. Astarâbâdi, *op. cit.* (ref. 41), 6.
85. *Ibid.*, 13.
86. *Echo de Perse, Journal politique, littéraire et commercial*, no. 3, Troisième année, 1 May 1887. ("La meilleure QUININE est la Quinine des trois cachets de Pellier, Delondre et Levaillant. Dépôt à Téhéran, avenue de Lalézar, chez Mr. Le Dr. Morel.")
87. Astarâbâdi, *op. cit.* (ref. 41), 15–16.
88. Astarâbâdi, *Safineh-ye nuh* (ref. 41), fols. 6, 8.
89. *Cf.* S A. Arjomand, *The shadow of God and the hidden Imam: Religion, political order and societal change in Shiite Iran from the beginning to 1890* (Chicago, 1984).
90. On the growing political power of the Shiite clerics in the nineteenth and twentieth centuries see Hamid Algar, *Religion and the state in Iran: 1785–1906* (Berkeley, 1969); *idem*, "The oppositional role of the Ulama in twentieth-century Iran", in N. R. Keddie (ed.), *Scholars, saints and sufis* (Berkeley and Los Angeles, 1972); Said Amir Arjomand, *The turban for the crown: The Islamic Revolution in Iran* (Oxford and New York, 1988).
91. Nikki Keddi, "The roots of the Ulama's power in modern Iran", in Keddi (ed.), *Scholars, saints and sufis*.
92. Arjomand, *The turban for the crown* (ref. 90), 13.
93. *Los Angeles Times*, 29 December 2000, article of Robin Wright.
94. Reuters, Monday, 11 December 2000. The news was published first in several newspapers in Iran one week earlier. The parliament had approved organ transplantation in April 2000 but the law had to be endorsed by the Guardian Council before it could take effect. The Guardian Council (*showrâ-ye negahbân*), appointed by the "supreme guide", is the most powerful, although unpopular, organization which oversees other constitutional bodies such as the parliament, president, etc.
95. After the anti-Pahlavi movement led to the establishment of theocratic power in Iran in 1979, a series of conferences was organized where the benefits of the 'forgotten' traditional medicine were discussed and the proceedings were published as *majmu'eh ye maqâlât-e tebb-e sonnati dar Iran* (*Collection of articles on traditional medicine in Iran*) in 1982. Dr Velâyati, a paediatrician and the minister of foreign affairs, assisted by historians of medicine such as Najmâbâdi, edited some sources of traditional medicine such as *Khoffeh-ye Alâ'i* (*Boot of Alâ'i*), a summary of the *Zakhira-ye Khârazmshâhi* of Gorgâni.

NOTICES OF BOOKS

Squaring the Circle: The War between Hobbes and Wallis. Douglas M. Jesseph (The University of Chicago Press, Chicago and London, 1999). Pp. xiv + 419. $80 (hardcover), $28 (paperback).

Douglas Jesseph's study of Hobbes's mathematical writings turned, he says, into "a study of his [Hobbes] controversy with Wallis" (p. ix). Thomas Hobbes (1588–1679) fell in love with geometry during a sojourn on the Continent when he happened upon a copy of Euclid's *Elements* and began to work on some of the problems he found therein. By his own account Hobbes "corrected some principles of geometry [and] solved some most difficult problems which had been sought in vain..." (p. 3). Among these was the ancient problem of squaring the circle which was at that time being debated by the leading mathematicians of the day including Pell, Longomontanus and Wallis. John Wallis (1606–1703), Savilian Professor of Geometry at Oxford, was Hobbes's main, although by no means only, critic. *Squaring the circle* investigates the origins of the controversy between the two men and assesses their respective arguments.

The Logic of Affect. Paul Redding (Cornell University Press, Ithaca and London, 1999). Pp. x + 204. $37.50.

As Blaise Pascal famously wrote, "the heart has its reasons, which reason does not know" (p. 1), implying, says Redding, a "difference between the reasons of the heart and the reasons of the head" (p. 1). Redding uses Pascal's aphorism as a starting point for his examination of the influence of the German idealists such as Fichte, Schelling and Hegel on the great philosopher-psychologists, Sigmund Freud and William James. He concludes that "reason must navigate on a sea of biological and other natural forces that do not belong to it.... Affect is our most immediate awareness of the fact that we sail on such a sea" (p. 158).

Dealing with Drink — Alcohol and Social Policy: From Treatment to Management. Betsy Thom (Free Association Books, London and New York, 1999). Pp. xii + 266. £40/$55 (hardcover), £15.95/$25 (paperback).

Dealing with drink looks at the development of alcohol policy in the United Kingdom from 1950 in the context of social and political change. Thoms examines the emergence in the 1950s of the voluntary sector as an agent for 'dealing with drink' and its alliance with psychiatrists in the 1960s. This alliance resulted in the 'disease' approach to alcoholism and it was generally accepted that sufferers required specialist treatment. In the 1970s this consensus about alcoholism began to break down. By the end of the decade alcohol policy was no longer based on

the disease model. Instead, alcohol abuse was seen as a social problem that should be handled through intervention. Specialized treatment was only on the agenda for the most severe cases. By the 1990s comprehensive management of alcohol consumption was accepted as the only prospect for dealing with alcohol abuse. The comprehensive approach (which includes educating the public about the dangers of excessive alcohol consumption, providing models for dealing with alcohol-fuelled troublesome behaviour and, as a last resort, treatment programmes) continues to offer the best hope for 'dealing with drink'.

Louis Jurine: Chirurgien et Naturaliste (1751–1819). Edited by René Sigrist, Vincent Barras, Marc Ratcliff (Editions Médecine & Hygiène, Chêne-Bourg, 1999). Pp. 494.

This collection of essays includes contributions by Micheline Louis-Courvoisier, Colán Macarthur, Carole Huta, Eric Asselborn, Patrick Bungener and Albert Carozzi in addition to those by the editors. The Jurine family, originally from Lyons, had emigrated to Geneva in the early eighteenth century. Largely side-lined now by his contemporaries such as Corvisart and Laennec, Jurine was considered during his lifetime to be among the finest doctors on the Continent as well as a productive and energetic academic. In 1784 Jurine was appointed surgeon at the hospital in Geneva, a post which he held concurrently with the post of Professor of Zoology and Anatomy at the Geneva Academy. Jurine wrote widely on both surgery and natural history. He was well-respected in both disciplines and in 1812 shared, with the German doctor Albers, a 12,000-franc prize for their work on croup.

Dans les Règles du Plaisir ...; Théorie de la Différence dans le Discours Obscène Romanesque et Médical de l'Ancien Régime. Jean Mainil (Éditions Kimé, Paris, 1996). Pp. 274.

Under the ancien régime, social success, particularly success at court, demanded rigid conformity to the (often obscure) codes of speech and behaviour that governed even the most minute detail of social, personal and professional interactions. By examining erotic, romantic and medical texts of the seventeenth and eighteenth centuries, Mainil demonstrates how these codes changed men and women into completely different species.

The Foundations of Modern Science in the Middle Ages: Their Religious, Institutional, and Intellectual Context. Edward Grant (Cambridge University Press, Cambridge, 1996). Pp. xiv + 247. £15.95 (paperback)

Much paper and ink have been expended in the past hundred or so years in an only moderately successful effort to expunge the image of the Middle Ages as a period of intellectual stagnation. In the scientific disciplines not only were the Middle Ages seen as not having made a contribution but as having been an outright impediment

to scholarly achievement. Edward Grant argues that without the developments that took place during the Middle Ages the scientific revolution could not have occurred. Grant says that the translation of Greek and Arabic manuscripts into Latin, the development of the universities, the adjustments of Christianity to secular learning, and the transformation of Aristotle's natural philosophy, were essential preconditions for the later efflorescence in the sciences.

Industry They Created, 1865–1956. James W. Cortada (Princeton University Press, Princeton, 2000). Pp. xxii + 350. £14.50/$22.95.

Although computing histories have been around almost as long as the technology itself, there is very little in print on the developments that led to global computerization. In fact, when *Before the computer* was first published in 1993, it was the only book available on the early history of information technology. James Cortada, an executive consultant with IBM, shows that the computer is the result of an evolutionary process dating from the development of the telegraph in the 1840s.

Beriberi, White Rice and Vitamin B: A Disease, a Cause, and a Cure. Kenneth J. Carpenter (University of California Press, Berkeley, Los Angeles and London, 2000). Pp. xiv + 282. £24.95/$40.

When Western doctors first encountered beri-beri they hypothesized that it was a deficiency disease similar to scurvy. However, they were unable to identify what was lacking. In the 1880s and 1890s, when germ theory was explaining many diseases, the search for the guilty bacterium began, but the breakthrough came from neither laboratory nor clinic. It was the chance observation that chickens fed solely on white rice lost the use of their legs (one of the early symptoms of the condition in humans) that provided the crucial clue. But it was forty years before scientists isolated the missing nutrient, thiamine, which is required by the body in very minutes quantities — 1 part per million — to ensure the healthy functioning of the nervous system.

A Dictionary of Biology. Fourth edition (Oxford University Press, Oxford, 2000). Pp. 641. £8.99.

This new edition of the *Dictionary of biology* contains not just biological terms but terms from the related sciences — physics, chemistry and geology. Terms from newer branches of the discipline, such as molecular genetics and biotechnology, including genetic engineering, are included as are biographical entries for the pioneers in these fields. The *Dictionary* also provides chronologies of various developments, for example microscopy; illustrative line drawings; feature articles on a number of topics; and appendices containing taxonomic classification schemes for the plant and animal kingdoms as well as a geological time scale.

Hero Myths: A Reader. Ed. by Robert A. Segal (Blackwell, Oxford, 2000). Pp. x + 219. £50/$66.95 (hardcover), £15.99/$31.95 (paperback).

It is difficult to separate the historical from the mythical in the legends that have grown up around our heroes. Hero myths have been perpetuated to provide paradigms of exemplary conduct, in particular, military, political, religious or intellectual valour. For example, Christopher Columbus (before twentieth-century revisionism) symbolized the progress of Christian civilization while Galileo remains an important intellectual hero.

Inventing Ourselves Out of Jobs? America's Debate over Technological Unemployment 1929–1981. Amy Sue Bix (Johns Hopkins University Press, Baltimore and London, 2000). Pp. x + 376. £35.

The early twentieth-century explosion of mechanization raised the very worrying possibility that the human workforce would ultimately be replaced by machines. This concern, exacerbated by the Great Depression which had thrown millions out of work, became the subject of books, cartoons, films and radio programmes. The coming of the Second World War and the boom that followed in its wake were only temporary diversions from the issue.

Science in Translation: Movements of Knowledge Through Cultures and Time. Scott L. Montgomery (University of Chicago Press, Chicago and London, 2000). Pp. xii + 325. $28.

Translation has been enormously important in the development of science in many cultures — Greek, Roman, Syriac, Persian-Indian, Japanese and, of course, European. Montgomery examines the transmission, by translation, of scientific knowledge beginning with "the transfer of Greek astronomy to Rome" (p. 18) and observes the way in which each culture leaves its mark on science. He concludes that "the idea of scientific discourse as a universal form of expression is at the least problematic" (p. 273).

In the Shadow of the Bomb: Bethe, Oppenheimer, and the Moral Responsibility of the Scientist. S. S. Schweber (Princeton University Press, Princeton, 2000). Pp. xviii + 260. £15.95/$24.95.

Schweber studied at Princeton when Oppenheimer was the Director of the Institute for Advanced Studies there and, later, with Hans Bethe at Cornell as a post-doctoral fellow. Both Oppenheimer and Bethe faced a moral dilemma created by the immense power — in both senses — that the development of the A-bomb gave to them and their colleagues. Each had somehow to come to terms with the fact that he had helped to build a weapon capable of unprecedented mass destruction; each bomb was capable of killing several hundreds of thousands of people and maiming many more. *In the shadow of the bomb* examines the different ways in

which each of the physicists coped with having unleashed the terrible destructive power of the atom.

The Story of Spin. Sin-Itro Tomonaga (University of Chicago Press, Chicago and London, 1997). Pp. xii + 258. £39.95/$50.

"The existence of spin ... is the most subtle and ingenious design of Nature — without it the whole universe would collapse" (p. viii). Using a minimum of mathematics, Professor Tomonaga describes the search for the origin of the self-rotation of the atom, the phenomenon called 'spin'. The story, beginning with the elaboration of the theoretical framework of quantum mechanics and ending with the concept of isospin, the sibling of spin, includes the contributions of physicists including Arnold Sommerfeld, Paul Dirac, Werner Heisenberg and Enrico Fermi.

Historic Scientific Instruments of the Adler Planetarium & Astronomy Museum, i: *Western Astrolabes*. Roderick and Marjorie Webster (Adler Planetarium & Astronomy Museum, Chicago, 1998). Pp. xii + 179. $45.

The Adler Planetarium & Astronomy Museum in Chicago houses a collection of astrolabes that is the rival of any in the world. The astrolabe — a small portable model of the heavens — is an astonishingly versatile and accurate instrument that was used for time telling, surveying, casting horoscopes, star finding, demonstrating astronomical relationships, and solving positional problems. Apart from its historical significance, the astrolabe is a beautiful object in its own right.

The Expanded Quotable Einstein. Ed. by Alice Calaprice (Princeton University Press, Princeton, 2000). Pp. x + 456. £11.95/$18.95.

The expanded quotable Einstein is a reprint of Alice Calaprice's successful *The quotable Einstein* first published in 1996. This superbly referenced book contains some 550 of Einstein's most memorable sayings, including such milestones as "$E = MC^2$" (p. 225) and "As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality" (p. 240). This book is thoughtfully organized and well indexed, making it both a readable and useful reference book.

The Energy of Life: The Science of What Makes our Bodies Work. Guy Brown (Free Press, London, 2000). Pp. 288. $25.

An introduction to the science of 'bioenergetics', which studies the origins and flow of energy within the body. Brown looks at mental as well as physical energy, and at the effect of such invigorating activities as sport and sex. The key to acquiring more energy, it turns out, is to expend more of it. A detailed appendix on the history of the subject is also included.

A Visitor Within: The Science of Pregnancy. David Bainbridge (Weidenfeld & Nicolson, London, 2000). Pp. 292. £18.99.

A visitor within is a biological account of pregnancy within humans "written for people with little or no scientific training who would simply like to know how pregnancy actually works" (p. 6). David Bainbridge, a reproductive biologist, traces a single pregnancy from conception through to breastfeeding in five informative chapters. The book also contains an invaluable glossary explaining many of the technical terms used in the book.

Who Wrote the Book of Life? A History of the Genetic Code. Lily E. Kay (Stanford University Press, Stanford, CA, 2000). Pp. x + 441. £45.

Who wrote the Book of Life? provides a detailed and comprehensive history of DNA and genetics in the twentieth century. The book charts the exciting history of the discovery of DNA and emphasizes the importance of the work of Crick and Watson amongst others (although disappointingly it makes no reference to the work of Rosalind Franklin). It also shows how the discovery of the "Book of Life" (p. 1) has had far-reaching implications in modern society where terms such as 'Human Genome' and 'Genetic Engineering' are rarely out of newspaper headlines.

How the Web was Born. James Gillies and Robert Cailliau (Oxford University Press, Oxford, 2000). Pp. iv + 372. £8.99/$15.95.

For many the world wide web and internet are recent inventions. In fact the fundamental principles that have guided its development were first outlined in the 1960s. This book describes the origin and development of information telecommunication from this period up to the creation of the current global organization that oversees the world wide web. The authors have drawn upon their long-standing research interest in the field and their extensive contacts to produce an eye-witness account expanded by contributions from many of the people who created the internet.

The Sokal Hoax: The Sham that Shook the Academy. The Editors of *Lingua Franca* (University of Nebraska Press, Lincoln, 2000). Pp. vi + 271. $20.

In May 1996 the U.S. physicist Alan Sokal had an article published in the academic journal *Social text*. One of its central arguments was that no enlightened scientist could now maintain that the universe exists as an objective reality. Sokal hoped that the article would be rejected and exposed as a hoax. That it was published confirmed his suspicion that the American academic Left had become intellectually bankrupt. However, the debate that ensued in academic circles and the mainstream media brought the question to a far wider audience. This book collects the original article, Sokal's defence of his actions, *Social text*'s editorial response, and many articles published worldwide in the aftermath.

Autism in History: The Case of Hugh Blair of Borgue. Rab Houston and Uta Frith (Blackwell, Oxford, 2000). Pp. viii + 207. £13.99/$22.95.

Hugh Blair was a member of the eighteenth-century Scottish landed gentry who gained notoriety after his marriage was annulled on the grounds of his mental incapacity. However, this book argues that Hugh Blair was not the simpleton he was branded as at the time but instead the unfortunate sufferer of the condition of autism. The authors have been able to exploit the large documentary evidence surrounding the court case that has survived, and have constructed a clinical case to support their conclusion and to which they apply current theories of autism. This accessible book is the result of collaboration between a social historian and a cognitive scientist and opens the possibility of further historical-clinical approaches to reinterpreting the judgements and mores of past society.

Science, Women and Revolution in Russia. Ann Hibner Koblitz (Harwood Academic Publishers, Amsterdam, 2000). Pp. x + 211. £32.

This volume is part of a series established by Harwood Academic Publishers to provide a forum for the study of women scientists in response to increasing interest in women and/or gender in science. The book reflects on the circumstances present in Tsarist Russia of the mid-nineteenth century that led to an "amazing flowering of women's opportunities" far in advance of other seemingly more developed countries. Six thematic chapters discuss the period in general, the relationships between women scientists and their male counterparts, lifestyle issues, the impact of women scientists in the late Imperial period, Russian women scientists in a broader context, and an assessment of the legacy of a prominent mathematician, Sofia Kovalevskaia.

Mendeleyev's Dream: The Quest for the Elements. Paul Strathern (Hamish Hamilton, London, 2000). Pp 309. £12.99.

A popular history of chemistry in general, and of the quest for the elements in particular. It begins with the story of Dmitri Mendeleyev, who literally dreamed up the idea of the periodic table (the foundation of modern chemistry), and then backtracks to the early alchemists, Paracelsianism, and the scientific revolution.

Masons, Tricksters and Cartographers. David Turnbull (Harwood Academic Publishers, Amsterdam, 2000). Pp. viii + 263. £35.

In the introduction to this intriguing book the author describes it as "a reexamination of the supposed rational and planned character of technoscientific knowledge". Much of what appears to be ordered and methodical application of knowledge is in fact "messy, contingent, unplanned and irrational". The author illustrates the variety of knowledge and "knowledge spaces" (the assemblage of territory and knowledge sustained and created by social labour) that have existed by

reference to a wide range of communities, medieval cathedral builders and Micronesian navigators among others. In this way a de-centred or non-Westernized world-view is supported.

Instruments and Experimentation in the History of Chemistry. Ed. by Frederic L. Holmes and Trevor H. Levere (MIT Press, Cambridge, MA, 2000). Pp. viii + 415. £34.50.

Fourteen essays are presented, each approaching advances in chemistry by focusing on the roles that apparatus and experimental design have played rather than following the course of chemical theory. The essays are grouped under three sections: The Practice of Alchemy; From Hales to the Chemical Revolution; and The Nineteenth and Early Twentieth Centuries. Key themes include experimental precision and reproducibility, evolution of apparatus and construction methods, and instruments that led to the linking of two separate disciplines.

Homage to Gaia: The Life of an Independent Scientist. James Lovelock (Oxford University Press, Oxford, 2000). Pp. viii + 396. £19.99.

Homage to Gaia is the fascinating autobiography of James Lovelock, one of Britain's most outstanding and fascinating scientists. What makes Lovelock stand apart from other contemporary scientists is his decision to work independently, making his living by selling his inventions. This book describes his remarkable life. In the first four chapters Lovelock describes his childhood and experiences in medical research. Chapters 5 to 8 describe how he came to be an independent scientist: "Science was and is my passion and I wanted to be free to do it unfettered by direction from anyone, not even by the mild constraints of a university department or an institute of science" (pp. 1–2). Chapter 9 details his quest for Gaia and its significance in his life highlighting his strong commitment to green issues.

June 8, 2004: Venus in Transit. Eli Maor (Princeton University Press, Princeton, 2000). Pp. xiv + 186. $22.95/£14.50.

In 2004 Venus will cross the Sun's face for the first time since 1882, a momentous event for which astronomers and enthusiasts are already preparing. This book tells the story of the five Venus transits previously observed and of the attempts to record and study them. There were many anxious moments, near misses, and heroic failures: one researcher in 1769 was too emotionally overcome to record the beginning of the event properly, while another prepared for it for decades only to find his view obscured by clouds on the day. However, the phenomenon also brought about admirable co-operation between otherwise distrustful nations, and was of crucial importance in enabling astronomers accurately to measure the distance between the Sun and the Earth.

Prometheus Wired: The Hope for Democracy in the Age of Network Technology. Darin Barney (University of Chicago Press, Chicago, 2000). Pp. x + 340. £18.50.

Darin Barney's book challenges the common presumption that the advent of the internet and other network technologies will lead inexorably towards increased freedom and democracy for the common man. Rather, he suggests that it seems to accelerate the worst aspects of capitalism and social control. *Prometheus wired* examines the history of digital networks and refers to historical thinkers from Plato to Marx who have all previously pondered the relationship between technology and society. Contemporary issues are also examined, from privacy and surveillance to the chances of sovereignty surviving in the age of global networks.

Lost Words: Narratives of Language and the Brain 1825–1926. L. S. Jacyna (Princeton University Press, Princeton, 2000). Pp. viii + 241. £28.50.

An individual who is in all respects sane and healthy yet who has become unable to form spoken words came to be known, from the mid-nineteenth century onwards, as suffering from "aphasia". This book re-examines the medical theory of and writing on aphasia from 1825 to 1926 and critically assesses the scientific and clinical aspects of aphasia, as well as the cultural and political impact of the movement to describe the functions of the mind in terms of localized structures and areas of the brain. The book proceeds to examine the experiences of men and women suffering from aphasia, to ask to what extent their speechlessness affected their humanity in the eyes of society.

Paul Dirac: The Man and his Work. Ed. by Peter Goddard (Cambridge University Press, Cambridge, 1999). Pp. viii + 124. £15.95.

Although not as publicly-known a scientific figure as Albert Einstein or Stephen Hawking, Paul Adrien Maurice Dirac (1902–95) is considered among physicists as an equal of any of the greats. He was one of the founders of quantum theory and involved in many subsequent developments. This interesting book has contributions from four of his colleagues who put his life and achievements in context. A short and accessible biography illustrates the man's approach to his work and subsequent technical chapters give an overview and assessment of three of his main contributions to theoretical physics: antimatter theory, magnetic monopoles and the Dirac equation.

The Trachtenberg Speed System of Basic Mathematics. Ann Cutler and Rudolph McShane (Souvenir Press, London, 2000). Pp. l + 270. £7.99.

This is the latest edition of a best-selling method for improving an individual's speed in arithmetics. Application of the Trachtenberg Method is reputed to achieve startling results among those with even a rudimentary grasp of arithmetics. The

complete system is given, including keys and methods for long multiplication, division, addition and subtraction and square root calculation. An introduction describes the development of the system, remarkable for the fact that it was completed while Trachtenberg was a prisoner in a German concentration camp.

Galactic Astronomy. James Binney and Michael Merrifield (Princeton University Press, Princeton, 1998). Pp. xiv + 796. $99.50/£70 (hardcover); $35/£22.50 (paperback).

This book is a largely technical treatment of galactic astronomy requiring an understanding of physics to undergraduate level. The book presents the current understanding and theories of stellar, chemical and galactic evolution, measurement of galactic distance, and phenomenology of stellar and galactic clusters, as part of a comprehensive treatment of the field. It is well referenced with regards to the original literature. *Galactic astronomy* also includes a brief chapter on the history of this scientific discipline.

Isaac Newton: The Principia. Mathematical Principles of Natural Philosophy: A New Translation and Guide. Ed. by I. Bernard Cohen and Anne Whitman (University of California Press, Berkeley, 1999). Pp. xii + 974. $35 (paperback).

Newton's *Principia* was first published in 1687, and it laid the fundamental mathematical principles of time, force and motion that form the backbone of modern mathematical and physical science. This new version (the first translation in 270 years) is based upon the 1726 edition. This edition provides a new modern and accessible translation of Newton's ideas, one that is both readable and understandable. The guide to using and reading the *Principia* is comprehensive and detailed, as is the index. Overall, this is likely to remain a definitive edition of Newton's work, one that will be invaluable to scholars for many years to come.

La Collezione degli Strumenti di Psicologia. Edited by Gigliola Terenna and Francesca Vannozzi (Nuova Immagine Editrice, Sienna, 1999). Pp. 78.

A survey of the collection of psychometric testing materials held by the Istituto di Psicologia at the Facoltà di Medicina e Chirurgia dell'Università di Siena. The earliest items are from the 1960s, when the Istituto was founded, and the majority date from that and the following decade; the collection includes Stanford-Binet and other intelligence tests, optical illusions, and equipment for testing manual dexterity and reflexes. Each item is illustrated, with a brief accompanying description. There are also short histories of the Istituto itself and of the development of psychological testing, and indexes of instruments and of their designers and manufacturers.

L'Invenzione del Tempo Libero 1850–1960. Ed. by Alain Corbin (Editori Laterza, Rome, 1996). Pp. 449. L.68,000.

An Italian edition of *L'avenement des loisirs* (1995), a collection of essays exploring various aspects of leisure in nineteenth- and twentieth-century Europe. Some articles focus on particular countries (England, Italy, France), others on the development of specific activities such as walking, mountaineering, football, cycling and cinema. Other essays examine general themes: "nature" as a holiday pursuit, tiredness, and the notion of "time for oneself" away from work.

Capabilities of the Alchemical Mind. Eric Ratcliffe (Four Quarters Press, Stevenage, 1999). Pp. 64. £4 (paperback).

A brief history of alchemy, told in *terza rima* and seeking to capture the "essence and flavour" of the subject rather than to engage in detailed analysis. As well as covering the central concepts, the verses also touch on particular issues such as Newton's involvement with alchemical thought. There are plentiful illustrations, an explanatory introduction, and detailed glossaries.

Dust: A History of the Small and Invisible. Joseph A. Amato (University of California Press, Berkeley, 2000). Pp. xii + 250. $24.95 (hardcover), $15.95 (paperback).

A philosophical examination of the nature of dust, presented as the story of the "small and invisible" — of the microcosmic. Dust pervades every aspect of human life, and from medieval times has been considered intermediate between the visible and the invisible, or between the airy realm and the earthly one. As such, it has been the subject of fascination for many centuries — although in recent times it has been somewhat upstaged by such extreme minutiae as microbes and subatomic particles.

A History of Color: The Evolution of Theories of Lights and Color. Robert A. Crone (Kluwer Academic Publishers, Dordrecht, 1999). Pp. 282. NLG110/£38.

A comprehensive history of the science of colour, reprinted from *Documenta opthalmologia*. The various theories are traced from Greek and Arabic sources through the scientific revolution of Kepler and Newton, then through Romantics such as Goethe to modern ophthalmological science, with its new understanding of the retina and the brain. The impact of quantum physics on colour theory is explored, as are the psychological aspects of perception. The book is aimed at both ophthalmologists and historians of science; it contains an extensive bibliography and many illustrations, all black-and-white.