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A SURVEY OF THE VIEWS OF IRANIAN SAVANTS (ESPECIALLY PERSIAN MUSLIM PHYSICIANS) ON THE SUBJECT OF CONTAGIOUS DISEASES AND IMMUNITY

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Ever since man acquired knowledge of himself, he became aware of certain diseases, witnessed the deaths they inflicted with regret and tried, as much as his rudimentary knowledge permitted, to remedy them. Among the various diseases, the contagious and communicable diseases, were, and still are, of prime importance. We find traces of such diseases in written records existant from the earliest times. Indeed, the history of communicable diseases is as ancient as man himself.

In order to throw light on the origins of data concerning communicable diseases in Iran and to determine the resistance of man's body, we will first of all in this article glance over indications and symptoms of such diseases in ancient Egypt, in the religious texts of Avesta and in the old Testament to be followed by a brief comment on the ancient philosophers of Greece and Rome whose knowledge along with the knowledge of Ancient Iranians entered the Islamic world and the Muslim Iran via the Jundi Shapour school and was later transferred to the Western World after being impregnated with fresh knowledge. We shall then study the relationship between the holy Islamic religion, as reflected in the Holy Quran, with the issues of health and medicine. Next to this we shall consider the movement for the translation and transfer of the medical sciences of Greece and of the Jundi Shapour to the World of Islam.

Finally, we shall cast an analytical view over the works and the discoveries of Iranian physicians such as Mohmmad Zakaria Razi, Sheikhal-Rais Abu Ali Sina (Avicenna), Sayyed Ismail Jorjani, Baha-addowlah Nourbaksh Razi and others in the matters of contagious diseases and immunology. At this point it must be said that ancient medicine of Iran is a boundless sea requiring life-time depth investigation by researchers of considerable insight.

What I, with my scant scientific knowledge, have been able to put forth here is buta minor token and I ask the lord for success.

Documents Relating to Contagious Diseases in Ancient Egypt

Certain written scrolls of papyrus[1] discovered in archeological excavations contain indications to contagious diseases. One such writing reads: « A dust rose engulfing all of Egypt in it. It caused blisters to appear in man and beast. Blisters that are caused by subcutaneous boils...» Here, it probably refers to several diseases such as smallpox in men and animal pestiferous viruses. Another papyrus scroll deals with tetanus developed as a result of a concussion of the skull, it says: «It is a patient for whom noting can be done.»

References to Contagious Diseases Noted in the *Avesta*

Opinions differ with respect to the date of *Avesta*, the holy book of the Zoroastrians and the time of Zoroaster himself. The Iranian prophet Zoroaster (Zartusht) is said to have lived sometime between 11th and 5th centuries, B.C. Some say he is more ancient

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than these dates suggest. *Vandidad*, part 3 to the *Avesta*, sets forth the laws and commands of Zoroastrianism and its jurisprudential edicts. References to communicable diseases are numerous in this holy book.

Views on communicable diseases embodied in the *Vandidad* can be summarized as follows:

Diseases enter human and animal bodies by means of « angreh mainiveh » or malicious reason, or Ahriman, or devil. Man or beast is made ill by this contact. A human corpse and a carcass are unclean and they make the land, the living environment as well as men, all unclean and such unclean objects must be avoided. The possibility of men becoming carriers of disease by such contacts is related in this text. He who has touched a corpse must seek ablution with the urine of a bull[2] or with clean water. This is necessary to drive away unclean spirits from himself. The land polluted by a carcass may not be cultivated for one year. The affection of a buried carcass lasts for 50 years, in the ground. If we consider the survival of various forms of spores and resistant resting cells and microbes, thiscontention may perhaps be justified.

The *Vandidad* mentions dogs with rabies, speaks of leprosy and other infectious diseases. Fire pans for burning sweet- smelling plants to disinfect the air in a room is also spoken of. This was used especially in the graveyards. To this end the sap of a plant, an intoxicant named « Huom » with the farsi version of « Gokerna » meaning cow's ear was used in religious ceremonies. Moreover, other herbs with Avestan names of Ourusen, hukoona, dehoukartu and hade panbeteh or any other fragrant herb were used. Such herbs were possibly of the varieties such as sandal wood, sandarac, aloe or frankincense. Portions of the *Vandidad*[3] relating to the above is given below:

Vandidad: Chapter 6, section 1, page 51: «... How long should the piece of land on which a man or an animal has died remain uncultivated? Ahura Mazda then replied:

« ... O holy one. The land on which a dog or a man dies should not be cultivated for one year.»

Section 2: ... «Therefore Mazda worshipers may not plant and sow anything nor bring water to a piece of land in which man or beast dies».

Section 3 : If the worshipers of Mazda bring under cultivation or water a land in which a man or an animal has died they have, by their act, transmitted the impurity of the corpse or carcass to the land, water and trees.»

Section 46: Sub-sec, 7 : «..... Ahura Mazda then said: «... O holy Zoroaster, the land on which a carcass is lain for a span of one year and been subject to light and sunshine shall become fit for cultivation.»

Section 48: Ahura Mazda then said: «... O Sepantman, the land in which a corpse or carcassis buried shall return to its former condition after 50 years.»

Section 35, page 79: «How is a man who has approached a dead dog to be cleansed?

Section 36, page 79: « Let such man clean himself with bull's urine and pure water. »

Chapter 10, Section 6, page 79: «We oppose a corpse's uncleanliness that comes to it from the «dao». We oppose the direct and the indirect uncleanliness of a corpse. We shall keep such impurity away from our homes, from our neighbourhood, our tribe, our province and from our bodies. We shall keep away from the man or woman who have been near or by the side of the dead...»

Chapter 7, section 33, page 115: «... If a dog, mad with rabies, therfore in want of reason, be had in the house of a Mazda worshiper what should other Mazda worshipers do? « Ahura Mazda replied:» Treat it as you would treat a mad but chaste person...»

Chapter 19: Zoroaster inquired of Ahura Mazda: «... O Absolute knower, sleepless one, If «dao» kills someone and that person (the dead) become directly unclean by the «dao» and if a good doer person becomes polluted directly or indirectly by that corpse, will he become clean again?»

Chapter 20, page 152: And to counter the dirty disease of leprosy, and to counter snake bites. and to counter an infectious disease and to counter the evil eye, the pollution and filth that Ahriman brings to mens' bodies...»

Views Expressed in the Old Testament and other parts of the *Torah*

The holy book of the Jewish religion regards dead corpses, carcasses, semen, etc. unclean. It has considered diseases such as leprosy as contagious and has recommended their isolation. This religion also talks of communicable diseases such as plague or cholera among the cures that God sent down on the Pharaohs and the people and the animals of Sammarah. Severely infectious diseases of men and beast are mentioned in said book like cholera, plague, glanders... The following is an excerpt from the old testament to this effect:

Torah, Exodus, chapter 9,[4] p.95 «Verily God's hand shall descend on your domestic animals in the plains- on horses, donkeys, camels, and cattle and sheep» that is,- a plague of severe nature. In continuation of the chapter the book reads: «... A burning is developed and boils and abscesses in men and beasts».

Torah, the Lavian Book, Chapter 15, page 176... and God addressed Moses and Haroun and said, «Tell the children of Israel whatever flows out from a man's body is unclean be it from his flesh or his ear. A bedding used by such man is also unclean. Anything that sits on such bedding is also unclean.»

Torah, the Book of Numbers, Chapter 5, page 211... «Order the children of Israel to expel from the camp anyone whose body oozes and anyone who is made unclean by a dead body.»

The Book Amos, Chapter 4, page 1332 concerning catastrophes that were sent down upon the people in the region of Samarrah: «And you did not return unto me so I made you suffer poisoned blasts of winds and jaundice and locusts ate up your orchards of grapes, figs and olives. And God says you still did not return to me so I sent you plagues the way I did to Egypt and your youth met the sword; your horses were taken away and infection of your camps filled your nostrils.»

Comments in Ancient Greek and Roman Works Concerning Communicable Diseases

Homer, the most ancient epic poet of the world who lived in 6th century B.C., in his *Illyad*, Homer has made haphazard references to infectious diseases. He has likened the invaders of the city of Troy as dogs inflicted with rabies.

Illyad, page 285[5]: «Hector, Zeus' spoiled one says,« ...I take pride to do something to cleanse our horizons of these mad rabies dogs whom inauspicious fate has carried hither black ships.»

Illyad, page 44: «... Here the Lord engaged them in this struggle, Apollo, son of Zeus who had angered Agomemnon, sent down excruciating agony among the armies whose men met death wherever they turned.

Plutarch: 7th Greek historian who died A.D. 125, has touched upon the subject of contagious diseases he says: «... Bad food[6], heat, sun and contagious diseases take high tolls in lives.» In another passage he says that during the time of Romulus who lived 753 years B.C. a certain disease had appeared in the bodies of men and beasts, killing them instantly.

Hippocrates: Bograt or Hippocrates is ancient world's greatest physician. He lived about 460 B.C., was born on Island of Kos and died in Greece about 370 B.C. Hippocrates has written a valuable book entitled *Epidemia.*

Ibn Ossibaeh, the great expounder of the history of medicine (died in 688 A.H.L = about AD 1222), has refered to this book as *Epidemia*, or *Al-Wafada* diseases, in the book *Oyoon- al- anba fi Tabaqat Al- Attebba*. The book *Epidemia* contains seven discourses. These discourses relate the diseases that come from abroad, and their treatments are recorded, ...« said diseases are of two categories:

One category are all one type. The other is the fatal imported disease called «mutan...» Only some of the diseases listed in this book are contagious.

In 429 B.C. an epidemic of plague took nearly 50,000 lives in Athens. Hippocrates was in Athens at that time. According to him fragrant herbs were burned in the streets until the epidemic subsided. During the reign of Ardeshir, the Achamenian monarch of Iran, a plague epidemic broke out in his army. Ardeshir invited Hippocrates to provide a remedy. Hippocrates declined. Hippocrates believed in a kind of disease- producing balance which gives rise to illness.

Other Physicians:

From Galen, one of the greatest physicians of ancient Rome (died A.D. 210) and, also from Philagros, treatises concerning the bites of dogs with rabies are recorded in the book *Oyoon Al- Anbae.*

Ibn Jaljal of Andolesia in the book the *Tabaqat Al Attaba Val Hokama*, written in the end of the 4th century A.H.L. (about 1000 AD) quotes a physician of the school of Alexandria named Angilavus as having written the book *Fi Asrar Al Harkat* (lit., the Secret of Movements) about chronic diseases, contact with them and the dangers of being in contact with patients with venereal diseases, and ways to cure them. This indicates that the said physician has been aware of the communicability of venereal diseases.

With regard to medical sciences in ancient Greece it should be pointed out that in the opinion of some western medical commentators such as Cyril Elgood,[7] author of the *History of Medicine in Iran,* who bases his arguments on the views and opinions of other learned authorities, states that one of the essential sources of medical science of ancient Greece is the ancient medical science of Iran, the knowledge of medicine existing in Chaldea, Assyria and other points in the Mesopotamia and on the banks of the Euphrates river. Such knowledge has been transferred to Greece in the course of dealings and wars between Iran and ancient Greece.

The Holy Religion of Islam and Comments On Medicine:

Special attention is paid to health and medical affairs in the decrees of the holy prophet of Islam. Medical sciences are highly esteemed in Islam. His Holiness Muhammad (SAWA) has said: «... there are two types of science: The science of the body and the science of religion.» Religion has greatly encouraged men to study medicine and experimental sciences.

Considerable emphasis is made in the Prophet's commands on health and cleanliness, incumbent ablutions, avoiding women during their menses, etc.

In the view of the Prophet of Islam every malaise has its remedy, and illness and cure are both sent down by God. He says: «Cure the patients, for He who has sent the malady has also provided its treatment and

remedy.[8] God has sent no disease without its proper cure.»[9]

In *Surah Al-Fil* (The Elephant) of the Holy Quran which concerns the attacks of the Ethiopian and Yemenite invaders on Mecca it is said that God punished them and their commander, Abrah Ibn Al Sabbah by tiny stones showered upon their heads by swarms of swallows. This event took place in 570 A.D. which coincides with the birth date of Hazrat Muhammad. Some historians ascribe the calamity of the Yemenite army to small pox. Others, including Elgood hold other views. In his work on history and in his explications, Tabari clearly states small pox as the cause of the Yemenites' defeat. It seems that an illness resembling small pox was the cause, not pox proper. Only God knows the truth.

The exegesis written by Abu Jaafar Muhammad ibn Jarir Tabari (224-310 A.H.L. 838-922 AD.) is one of the most important and oldest exegeses (expounding the meanings of Quranic Verses) translated into Farsi in the time of Mansur bin Naoh Samani (who ruled from 350 to 365 A.H.L. 961-975 A.D.) at the instruction of the great and learned vazir, Abu Ali Muhammad ibn Balami, by a group of the Transoxania scholars. Balami himself prepared, in 352 AHL, 963 A.D. the said translation. Both these books refer to the calamity, that beset the above mentioned invaders, as small pox. Following is the Quran text as expounded by Tabari[10] and Balami:

«In the Name of God, the Compassionate, the Merciful. Do you not see how your Lord dealt with the masters of elephants, Did He not dispel and return their deceit? He sent down waves upon waves of small birds carrying hell stones to them with which they smashed the invaders and pounded them to pulps fit for dogs to eat». Tabari says in his commentary:

«Almighty God sent down birds like swallows which went to the beach each carrying back morsels of mud in each of their claws and beaks. Then they soared high up and the morsels of mud they had with them turned into stones which they showered on the heads of that invading army of men, killing them all. (The stones turned into small pox pustules,... see the Aiya Sophya version of the book).» The Balami commentary[11] reads:

«... And Almighty God sent down hordes of swifts or swallows which fetched each three morsels of mud from the sea, one in each beak and claw. They then stood or floated in the air above but near the militia men. From the hell rose a scorching breath turning the mud pods into granites. Flesh departed the bodies of all who were hit by the pelted pebbles, small pox boils covered such bodies, plaguing the men with itching sensation...»

The Movement for Translation of Greek Texts into Arabic and Entry of Old World's Medical Heritage into the World of Islam

The medical school of the Jundi Shapoor University which enjoyed a large hospital, was very active during the first and second centuries A.H. However, after the Bagdad school of science came of age, the Jundi Shapour school of medicine received set backs. The learned men and physicians of this school have translated the classic sciences of Greece, Rome and Iran into Arabic and Syriac and thus, the foundations of the sciences of medicine, mathematics, natural science, etc were laid in the Islamic world. Later on, these sciences were gradually fortified and enhanced through Islam by various nationalities, particularly the Iranians and these books, the originals of which had been destroyed, were transmitted to Europe by means of translation from Arabic only. Thus was the classic and the Islamic heritage of modern sciences transplanted to the Western World.

The first attempt at translation from Greek to Arabic was made by Stephen at the insistence and encouragement of Khalid, son of Yezid (died in 90 A.H.L. 708 AD). The text was a chemistry book. Later on, by the end of the Ommayad dynasty rule, the learned men of the Masserjuya family translated other scientific texts. The Bokhshitooa family had a major role during the translation movement to translate medical books.

Georges Bokhshitooa, president of the Jundi Shapour university and physician to Caliph Mansur Abbassi (died early in second century, A.H.L.) is the first physician to have translated, in 213 A.H.L. 828 AD, a medical text into Arabic from Greek. Mention can be made of other great translators such as Yuhanna bin Massuya of the Massuya family (died 243 A.H.L. 857 AD.) and Huneyn Ben Isshaq of the Huneyn family (died 114 A.H.L. 732 AD.).

In short, through these physicians, the books of Hippocrites, Galen and others were translated into Arabic. In the end, medical science made considerable progress in Islamic countries especially in Iran accounting for such outstanding learned men as Muhammad Zakariah Razi, Abu Ali Sina (Avicenna), Seyyed Ismail Jorjani, Bahaaddolah Razi Dailami and others who have enlightened the world with their knowledge. Herebelow, we shall study the views and opinions of these learned men concerning communicable diseases and immunology as set forth in their works.

Abu Bakr Muhammad Zakaria Razi's Views Concerning the Emergence of Small pox and Discovery of Allergy

Abu Bakr Muhammad ben Zakaria Razi, the great

Fig. 1. Razi, examining a sick girl.

Iranian physician was born in Rey about the year 240 A.H.L. corresponding to 854 A.D. and died in 313 A.H.L. or 925 A.D. Razi is oneof the world's greatest physicians and learned men. Hewas the first scientist to take up and discuss the communicable diseases and study them with scrutiny. He wrote a book on smallpox and measles by the name *Al-Jadri Val Hasba* (here by Hasbah is meant measles). Castiglioni, a prominent expounder of medicine, writes about the book *Al-Jadri Val Hasbah* in his own book *Histoire de La Médicine*:

«It is the first exact and authentic book written about infectious (or contagious) diseases.[12] Sorina, an outstanding specialist in the evolution of medicine writes in his three- volume book on pharmacology, dental medicine and veterinary medicine published in 1977: «The book small pox and measles because of its extracare and exactness about the spread of this illness and its diagnosis of most of the infectious diseases has, since long ago, held the epidemiologist in wonder and awe.»[13]

In this book Razi has, for the first time in the history of medicine, presented a special view or theory about contagious diseases. It is said that his theory is: «The Theory of Fermentation», that is, it is a theory that was put forth by Pasteur 900 years later and lead him to the discovery of the microbic causes of diseases. Razi regards as the cause of smallpox a certain fermentation in the blood transmitted from mother to the fetus. This fermented leaven enters the blood vessels in order to destroy harmful agents in the blood. One contracts smallpox by the interaction of these elements and his illness (smallpox) may be contracted by others. Following is an excerpt of the Book *Al-Jadri Val Hasbah*:«The blood[14] of youngsters and children is like a juice not yet fully developed and it lacks fermentation and ebullition. The blood of the young is like boiled extracts

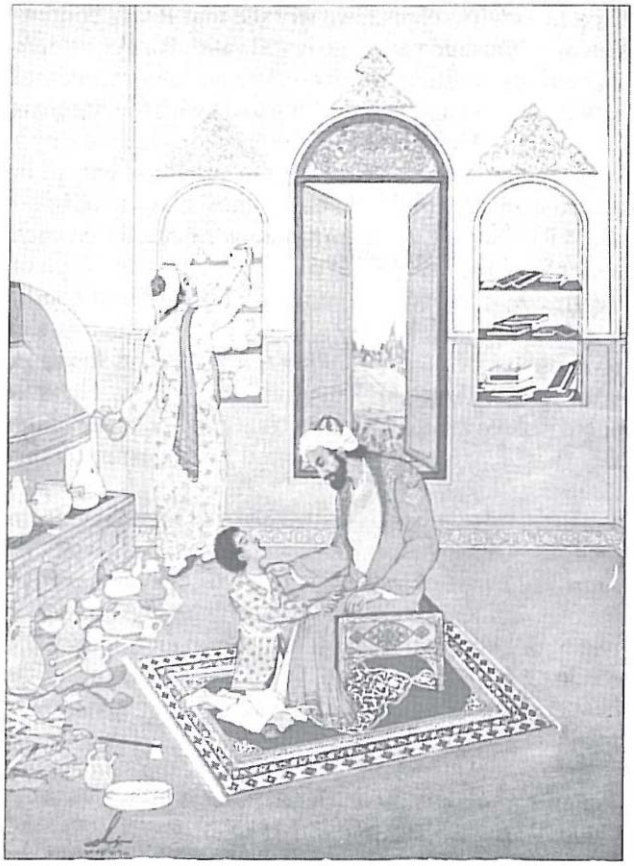

Fig. 2. Mohammad Ibn Zacharia Razi,(865-925. A.D), the great Moslem Iranian physician and chemist, and a patient. Oil on canvas painted by the famous Iranian artist Hosein Behzad.

from which gases and residues have been withdrawn, like a wine that has matured and settled and its potency is set. But the blood of the old is like a wine that has lost its potency, is near cooling stay and about to turn to vinegar.

«However, smallpox is produced when blood is boiling with infection so that extra gases can leave it, so that infantile blood which is like damp juices be turned into the blood of the young which is like mellowed wine. By nature, smallpox is like that percolation with bubbles that is found in boilings of times. This is why youngsters especially boys are not immune to it because their blood must revolt from one condition to another just as boiling juices restore to pre- percolating state.»

As stated above, Razi literally says «The smallpox itself is like bubbles[15] and boils which appear in juices that is in wines so that the wine may mature. It seems that Razi points, by inference, to a kind of culprit agent known as smallpox. Western medical historians confirm this view as Cumston says:[16]

«If we consider this view in the light of modern causes and replace the fermentation clause with a

bacteria or virus clause, we will see that Razi's contention of a thousand years ago is still valid. Razi considers that blood condition, bodily resistance, environmental conditions, etc, have something to do with the progress of smallpox. He believes also, that older folks enjoy a kind of immunity or resistance to smallpox except in severe or acute epidemic cases known as "aerial plague." Razi says: "After contracting the smallpox, each patient has his modes and physical condition. Type of treatment, customs and mores, climate blood conditions in the vessels all vary and because of this the progression of illness is slower in some and faster in others and its degree of malignancy also varies. However old people are prone to contract smallpox in unclean air, that is atmosphere infected with germs of this disease..."[17]

It was Razi who distinguished smallpox from measles for the first time as the title of the book "*Al Jadri Val Hassba*" indicate. Razi earnestly believed in the communicability of this disease as he says in chapter two of this book: "Except for the times mentioned, the disease may be present and, when it is dealt with and it is best to avoid it when it is observed that it is slowly spreading..."[18]

In another book titled "*Tales and Stories of Patients*" which is a compendium of clinical observations, Razi has mentioned that smallpox may be contracted through milk and sputum as he says: "the daughter of Hosein Abduya drank camel milk by habit without consulting me.[19] When tympanites set on she took the "Dava AI Sumak"[20] without letting blood or taking any purgatives. Following this, she came down with typhoid fever and symptoms of smallpox appeared in her.[21] She had four consecutive attacks of smallpox. I reckoned this was due to residual sputum not purged by physic and I could not effect immediate purging because of her weak condition..."

Razi's opinion of communicability of smallpox via boils and bubbles from mother to her fetus has been vastly held valid in Iran as Hakim Afzal- Addin Ebrahim Khagani Shervani (died in 592 A.H.L. 1195 AD.), a man well- versed in sciences of his time has said:[22]

"A fetus on menstrual pus for nine months fed
May well with smallpox come out of its shell
what would suction of people's blood
over thirty years produce, maybe a flood."

Razi's View Concerning Allergy

For the first time in medical history, Razi explains the onset of head colds, or what is known as hay fever, a kind of allergy during the spring by smelling roses. He has a small treatise on this which Abu Raihan Biruni mentions in a book named *Fi Ellat Allati Men Ajalaha Yoarazul Zokam La bi*. Zeid al Balkhi is a theologian contemporary of Razi. A manuscript of this treatise comprising 54 lines exists under no. 4574 in the Melli Malik[23] library and entitled there as "*Fi Ellat alati Yahdathul Waram Val zokum Fi Raousae Nas Waqt al Ward.*" Early in the treatise it is mentioned that Shahid ben AI Hosein Belkhi wrote Muhammad Zakaria Razi asking for the causes of head cold during spring that result in some from smelling roses and the treatise is Razi's answer.

In the index prepared by Ibn Nadim (Tehran press, p. 533) the above treatise is mentioned as *Kitab Fi Ellat Allati laha Yahdath al Waram men Azzokam Fi Raous Baaz Al Nass*.Then Abi Ossibaah names the treatise in these words: *Fi Ellat Allati Yadith Al Noam Men Azzokam Fi Raouse Haaz al Nas Shabihe Gel Zokam.* By mention of these titles it is meant to prove that various scholars have attested to the ascription of this treatise to Razi's.

The allergy head cold was later explicated by numerous Iranian scholars including Seyyed Esmail Jorjani, Bahaddole Nourbakhshi as shall be seen later. This issue is beautifully put forward in some lines of poetry by an Iranian learned poet of the sixth century by name Shahab addin Shah Ali Abu Reja Ghaznavi (Shah Burja, died 580 A.H.L.). We quote below a few lines of the poem:

"When dawn's magic hand furls[24]
Twilights carpet of velvet gray
And stars on royal stead depart
The rising sun peeps out of its filigree (from Eastern countries)
as dagger pulled out slow by degree
Fighting for one's land a noble deed
on the face of rose
a sneeze of head cold may well be fit."

Combining Razi's Views on Transmission of Smallpox Producing Agents from Mother to Child with Modern Views on Cancer Production:

Smallpox agent is a virus agent which is definitely not transmitted from mother to child. But, the fermentation view as held by Razi can be adapted with the cancer- producing view, the proto- oncogenesis. Tests have been made to determine whether human cancer cells contain any DNA sequences similar to the sequences of cancer viruses, the viral oncogenes. It is established that all human cancer cells do have such sequences. To be sure, natural cells do have these sequences, and they are termed "proto- oncogenes" and these resemble some of the oncogenic viruses. These initial discoveries establish the above- mentioned view maintained by R. Huebner and G.Todero. According to these men the oncogenic viruses essentialy emanate from the natural gene cells and are subsequently formed into oncogenic viruses. A "compendium" of genes related to the activity and

production of RNA viruses are acquired through infection, and insertion of provirus or/and other genetic interchange early in the human evolution shape. Among this collection of genes which *in toto* is termed Virogenes, there exist one or two genes that are responsible for the malignant transformation. These genes are known as oncogenes. It is presumed that virogenes and oncogenes embodied in them exist in the tissues of every human being. Oncogene possibly has a part during the fetus formation processes (embryogenesis).[25]

Now let us go back to the views of Muhammad Zakaria Razi. He says smallpox agents are transmitted by mothers to all children and makes itself manifest under certain conditions. Therefore, it must be among the collection of genes. According to the proto-oncogene concept, cancer-producing viruses is present in all men. It follows that this gene is transferred from all mothers (and naturally, it has a paternal origin as well) to all children as heritage and it is, under specific conditions, generated as a cancer-producing virus. In other words, Razi essentially states the points which are now, after 1100 years, subject of discussion and proofs are being presented to establish them. Mighty food for thought and wonder !?!

Abu Ali Sina's Views on Communicability of Diseases

Sheikh Al Rais Abu Ali Hosein ibn Abdullah ibn Hassan ibn Sina (ibn = son of) (Avicenna) was born in 373 A.H.L or 980 A.D.: he died in 1036 A.D. He, too, is one of the greatest physicians and learned men of the world who has endowed the medical science with interesting new ideas and knowledge.

As external causes of illness, Abu Ali Sina believes that some foreign matter (humour, phlegm, mucus, etc) enters the body from outside and causes infection and illness. As we read in book Two of his *Code* (Canoun)..."[26] The second type of blood is that in which malignant phlegm has entered and altered the blood. This type, too, has two varieties:

A) The harmful humour or phlegm may have invaded and infiltrated the body from outside and corrupted it.

B) Or the bad phlegm has generated in the blood itself.

For instance, an amount of it in the blood may have developed infection and as a result its substance has changed ito a bitter bile and its thicker substance into ultrabile...and abnormal bile develops under two states: The first state is when the bile mixes with foreign bodies and loses its natural state. In the second state the abnormality cause bile within the blood itself."

Avicenna believes in the transmission of diseases by means of water and thinks that the infections, purulent boils, diarrhea, gastrointestinal ulcers, the four-day fever are caused by contaminated water.

Fig. 3. Ibn Sina (Avicenna), the great Islamic scholar in philosphy and medicine.

Thus we can conclude from Ibn Sina's views that an unknown and communicable agent causes the development of bodily infections and contraction of some diseases. Contaminated water can be made safe by distillation and boiling. Here, indeed, sterilization is considered by Ibn Sina. Some of the foregoing accounts can be studied in pages 225- 230 of vol. 1 of the translation(Farsi) of the *Code*, Tehran print. Some passages are quoted herebelow:

"... However, exposed water is not desirable, it is better that water be covered. Unwholesome water can be made safe by evaporation and distillation and if this is not possible it must be boiled. Infected water spoils the phlegms in the body and it is not compatible with respiratory and vocal organs. If rain water is boiled without delay it becomes less susceptible to infections. Well water from the qanats (underground channels connecting deep water wells) are less desirable in comparison with spring water, for qanat water has been lodged deep underground for long times and has mixed with dirts and infectious matter may have entered it."

"Such captive waters may cause urination problems in youngsters, inflated bellies and leg boils in adult, and such boils are incurable. Such afflicted individuals may suffer diarrhea associated with pain, intestinal ulcers,

excessive appetite, the four-day fever. In older persons burning fever may develop because old folks have arid stomach (constipation) and constitution."

"Ibn Sina believes in cauterizing and says it prevents spread of infection..." cauterizing controls the spread of contamination: it burns up the infectious matters that have invaded an organ or limb..."

The views of Seyyed Ismail Jorjani Concerning Communicable Diseases and Immunology

Jorjani is one of the greatest Iranian physicians and scientific investigators. The entire value of his scientific research is not yet fully known. Born in 434 AHL 1042 AD. at Gorgan, Jorjani died about AHL 530 (1135-6 A.D.) in Marv. Jorjani was a physician to the court of Ghutbuddin Muhammad ibn Anushtakin (crowned AHL 491, 1097 AD died 521 AHL/1127 AD) the founder of the Kharazmshahyan dynasty and his son Alauddowla Atsez. Jorjani was also a contemporary of Sultan Sanjar, the Seljuk. The book named *Zakhirah Kharazmshahi*, which is a veritable medical encyclopedia, is the most important book, in ten volumes, in medicine in Farsi and written in AHL 504 dedicated to Ghutbuddin Kharazmshah. The book has about 500,000 words. It is a world of facts about classic medicine and contains the views of forerunners such as Razi, Avicenna and others as well as Jorjani's own opinions and commentaries.

We give below accounts from the ***Zakhireh Kharazmshahi*** taken from a manuscript dated 603 AHL photo-printed in as is condition by the Cultural Foundation of Iran:

Jorjani on Communicable Diseases

Jorjani has regarded certain diseases as communicable. These include tuberculosis, leprosy, smallpox, rabies, cholera, etc and considers their contagion via contaminated air and water. The cholera air (infectious air) is an air that contains disease-producing or illness-generating agents. By mixing with plants or foul lands and marsh land or infected waters as well as impure steams that is found in some grounds and graves, water becomes polluted. The infection of the air eventually causes the infection of the blood and bodily liquids (phlegms).

Water becomes polluted by contact with infected air and contaminated ground and causes bodily infection. Jorjani maintains that boiled and filtrated water takes

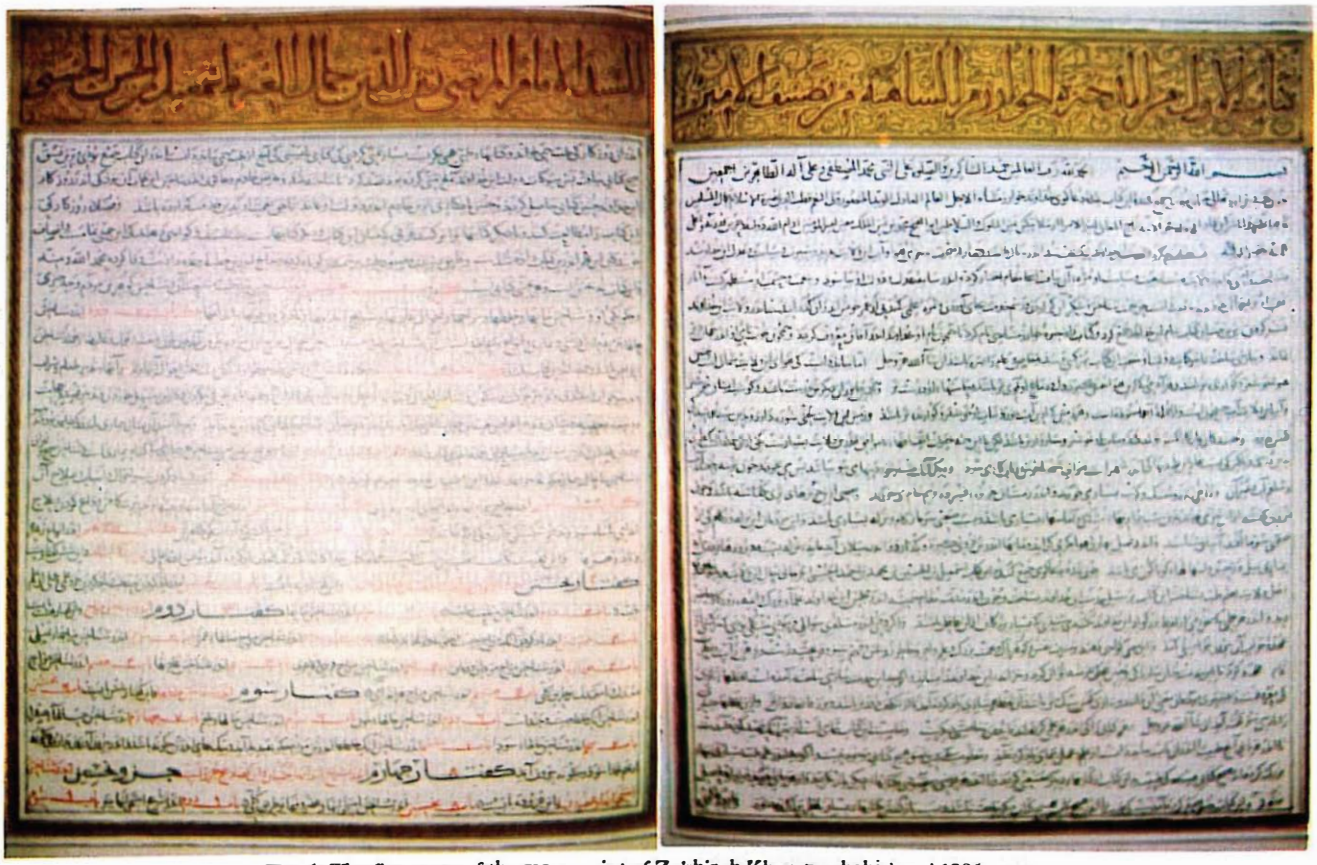

Fig. 4. The first page of the manuscript of Zakhireh Kharazmshahi dated 1206, AD.

longer to contaminate and if already polluted its infection will be taken away by the heat. Here in addition to sterilization by heat which was referred to earlier, the question of sterilization by filtration, which centuries later became the practice and vogue in Europe, is indicated. The following are a few passages from the above book (*Zakhireh Kharazmshahi*) regarding the point at issue:

Chapter 10 , Discourse 1, Book 2, Page 72: "On diagnosing diseases that are transmitted by fathers to their children as heritage and diseases that people contract frome one another: these, cases transmitted by fathers to their offsprings are of six varieties: 1- pannus. 2- gout. 3- leprosy, vitiligo. 4- ...And the diseases which people contract from one another especially if houses be small and congested and fumes get locked up in the air, are also of six types: 1- tuberculosis. 2- leprosy. 3-vitiligo. 4- smallpox. 5- eye troubles, particularly if one stares in diseased eyes. 6- plague fevers.

Discourse four of book 7, p. 594 "Concerning leprosy, its symptoms, causes, conditions, cures, etc." and "... air pollution, childbirth during menstruation and physical contact with lepers are among causes of this disease."

Book three, Discourse 2, Chapter 2, page 124 concerning recognition of waters, their nature, effects uses and harms... : "Rain water, though highly good, rots soon because it is very light and soft and soft things are more readily affected by infections of air and ground and if thus polluted and people drink it in that condition, their humours will suffer and rot. If such water is cooked "before it is polluted it will resist infection longer. Acids deter the harms of infections."

In Chapter 5 of above Discourse[28] concerning water sanitation, Jorjani says: "... One way is that you filtrate it several times or place it (the water) in clay jars so that it may ooze out... and a third way is to boil it (lit., to cook), for this way more water can be collected..."

Book 5, Chapter one, Discourse 3 pages 245-246: Concerning causes of pollution or infection... :"The third is bad air such as cholera air, of dense forests and over standing water. Here there can be two situations for infection or contamination- either situated in the entire body or in a particular limb that is warmed up by some unknown heat or by pain... the humours or phlegms become infected and in contact bile, the blood is contaminated and typhoid fever results."

Chapter 4, Discourse 4, Book 5, page 278 "Concerning diagnosis of cholera (infectious) fevers, their symptoms and cure:" First of all it must be known that cholera means the rotting of the air. Just as stream water if it remains long in one place, its nature changes. Also contact with bad weeds or contaminated ground makes it contract infection and its natural state will alter. So it is with air. If air stays locked up in pits among dense trees or passes through rotten places and grave yards carrying bad fumes, it corrupts other airs. Sometimes rotten fumes are developed and come to the surface and air and water become unwholesome. Therefore, if for any of the causes just mentioned the air pollutes or procreates infectious air and because nothing is better mixed with the animal soul than air, then when the air is bad, illness and death appear among beasts."

Toward the end of the book *Zakhireh*, in a discourse on the diseases or illnesses of the physicians, Jorjani describes in a vivid and logical manner, the communicability of the diseases. He makes explicit mention of the "fume of illness" as the cause of contagion. Now, if we replace the term "the fume of illness" with the term "microbe," even today we shall not be able to find a better expression for contagion than Jorjani's statement.

Zakhireh, page 645 with respect to diseases that befall physicians: "The general causes from which illness grows are of five categories: one is that air be contaminated for any reason. However, whatever befalls for reason of change in the air, the physician cannot do more about it than he can if the air of his own house gets rotten... But the physician is not left alone. He will be taken to the patients. If he contracts the disease two major causes can be cited for it. One reason is that the air of his abode become like that of outside of his house. This means hourly change of good air into bad air makes one sick. The second cause may be that nearness to a patient, the atmosphere surrounding the patient and his breath and fume of the disease can make him sick. If these two conditions are present but the physician does not become ill it then is something to wonder..."

Jorjani's Views Concerning Rabies

Jorjani describes rabies very well and differentiates between an ordinary bite of a dog and the bite of a dog with rabies. He calls such a dog a "mad" dog. He states that other animals like wolves, foxes, jackals, etc can contract rabies and they may transmit it to men. He thinks the latent period of this disease last from one week to six months. He elaborates the symptoms of rabies and the fear of water exactly as it is done today.

Zakhireh pages 638- 639 ; Chapter 3: "Concerning symptoms of mad dog and wolf and jackal: What makes dogs and others mad is that their constitutional temperament change and the poisonous affection dominate them. And this domination is caused by two things: one is the air the other edible things. With regard to edible things, it is like drinking animal bloods shed by butchers and eating infected waters and carcass flesh.

The wolf becomes more ferocious than the dog is - Foxes and jackals too become mad. It is said that a man was maddened by the bite of his mad fox. At last Jorjani explains man's condition and states his death. With respect to the latency period of the disease he says: "There are those who are overcome with fear after one week (meaning hydrophobia), some after 6 months and still others after 40 days.

Jorjani's Views Concerning Smallpox and Measles and their Causes

Jorjani clearly differentiates between smallpox and measles. With respect to the appearance of these two diseases, Jorjani recounts more candidly and at greater length, the fermentation theory of Razi and says that both these diseases emanate from the boiling of the blood, fermentation like that of grape syrup. Again, he expresses belief in the transmission of disease from mother to child. With considerable frankness Jorjani contents that people contract smallpox from one another. The following are excerpts of what Jorjani says with regard to smallpox:

Zakhireh, chapter one, Book 5, Discourse 5, pp. 279-280: "Smallpox and measles are akin for both have considerable boils that appear on the skin and both rise from the boiling of the blood (fermentation). They are different types, however. Smallpox blood serum is plentiful and warm and tends to pervade but measles being bile and of small volume, tends to be dry and it is for this reason that its pustules are tiny and do not part with the skin. However, measles is more fatal because it produces malignancy from rotten blood. Both are "contagious" illnesses, which in Arabic are termed "wafeda," that is, one patient can contaminate many people in a town. The cause of smallpox is that sometimes blood in the body comes to a natural boil; sometimes it becomes too thin and watery. With extra heat it comes to a boiling point. But when it boils due to a natural cause like boiled grape juice when warmed it changes, and its components are separated. Then "Zegol" or light weight waste[29] matter comes up and heavier matter settles and the clear matter remains in the middle."

Jorjani believes in old folks' resistance to smallpox but he adds that such resistance may not be effective when there is a severe epidemic on hand as he says: "... Old people shall not suffer smallpox except in days of cholera (epidemic) when most people shall contract it. The bad air and patients' conditions strike him (old folks) at the heart, turning and spoiling his soul.

With regard to the convalescence period, Jorjani mentions the possibility that disease-producing agents may still exist in the body: *Al Zakhirah*, page 285:

Jorjani's Views Concerning Allergy

With respect to head colds caused by allergy, allergic asthma, the author of *Zakhirah* mentions the musk and some herbs of the salep group as the cause. He also regards the aroma of some drugs, foods, drinks and "warm" perfumes as possible causes of colds and their accompanying dry coughs. The *Zakhira* says in pages 376- 377 of Book 6, Discourse 4, Chapter 10 : "Concerning head cold, its symptoms, causes and cures..." External cause are of two types. One is that excessive heat reaches the nose making the moistures in it move and cover up the nose and throat. And this is like a longer stay in the bath, under the sun or by fireside takes place or stay in a warm house during summer lacking air circulation or the odor of something warm like musk and Jundebidestar[30](testicle of sea dog or some plants of the family of the orchid) or other thing come in touch with him making moistures move and drop on the nose and throat..."

Book 6, Chapter 5, Discourse 7 page 403 read: "On dry cough the cause of which be dyspepsia of hot sort:" It happens if patient has stayed long before hot air, and having eaten and drunken hot foods and liquids and fragrant drugs, warm perfumes to which patient be exposed liquids and fragrant drugs, warm perfumes to which patient be exposed for long can cause dyspepsia, and disorder in the nose and breathing organs.

The Views of Bahauddowla Nourbakhsh Razi Dailami Concerning Immunology and Transmission of Whooping Cough

Bahauddowla was one of the last great Iranian physicians who lived toward the end of the Timurid reign and the start of the Saffavid dynasty. There is a discrepancy concerning his real name. In his book, the *History of Persian Medicine*, Cyril Elgood names him as Muhammad Hosein Nourbakhsh. Muhammad Moeen terms him Muhammad Hosein Nourbakhsh, son of Mir Ghavamaddin in his Farsi Dictionary. Kariman, quoting *Hedayatul Arefin*, also the *Haft Iglim* in Qasran book names him Qasim Nourbakhash Ibn Mir Bahauddowla Qavamaddin. In his bibliography of Persian printed books, vol. 2, Khan Bala Mushar calls the author of the book *Khulasetul Tajarib* (Reprinted in India 4 times from 1865 to 1901) Bahauddin ibn Mir Qavamaddin Nourbakhsh Razi Dailami. In his Book, *Prose and Verse in Farsi Language*, Saeed Nafis names him Bahaaddin Mir Qavameddin Qasim Nourbakh Razi. It appears that he was the son of Shah Qasim Nourbakhsh, son of Seyyed Muhammad Nourbakhsh.

At any rate, Bahaaddulah comes from the Nour-

bakhsh family. His grandfather Seyyed Muhammad Nourbakhsh[31] is buried in the village of Suliqan, Tehran. He was born in the village of Tarasht (now Arya Shahr or Sadeqieh) and died about the year 912 AHL 1406 AD. at Rey or in same village. Bahaaddin spent a part of his life in Herat in the service of Sultan Muhammad Bayegra (877- 908 AHL 1472-1502 AD). He later moved to Rey or the present Tehran and penned his valuable book *Khulasetul Tajarib* (lit., summary of experiences) which is mostly his personal experiences about the year 907 AHL, 1501 AD. This book, as was pointed out hereabove was first published in the name of Hakim Muhammad Alavikhan who was once a physician to Nadir Shah Afshar, later they found out the error concerning the name of the author. The book is not yet, unfortunately, published in Iran. A manuscript of it is available in the Tehran University Central Library.

Bahauddowla describes vividly the allergy of the hay fever variety in the last chapter of *Khulasatul Tajarib* devoted to eye troubles. He presents new opinions concerning it. It may be mentioned that the earliest reference to this disease in Europe is dated 1565 A.D (973 AHL). The gist of Bahauddowla's writing is as follows:

"I have seen many a man whose brains heat up during summer as a result of smelling roses with water dripping out of their eyes and noses. The eyelids of such individuals is severely irritated. However, when the season is over the allergy disappears from both the eyes and the nose. Treatment does not yield these patients any good.[32]

In *Khulasetul Tejarab*, Bahauddowla writes something about "siah sorfah" or whooping cough for the first time in history. He expresses interesting views. He describes two successive whooping cough epidemics one in Herat and the other in Ray. He says there were fewer incidences of death during the second epidemic in Herat. In his own words: ..."[33] In Herat the air became contaminated twice causing common coughs without secretion. One time it was so that coughs would not stop until vomiting came. Some children would faint in the process. Many peoples died by the fatigue of coughing and vomiting. This was during the first attack of epidemic. An Indian physician prescribed a daily dose of powdered raw ginger concoction in warm water, most of them got well by this treatment during the second attack of this disease and fewer people died."

The Opinions of Emad- Al Din Mahmud ibn Masoud Kashani Concerning Syphilis

Syphilis probably entered Iran with European travellers during the second half of 9th century AI-I. (1447-1495 AD.) There are no references to it in the annals of Iranian medicine prior to this time. And the disease "Nar" mentioned in ancient records has reference to anthrax. Bahauddowla mentions syphilis in his book *Khulasatul Tajareb*. During the Saffavid dynasty, unfortunately, this disease was rampant in Iran. It was called "Ateshak" (= chancre) and sometimes minor or major scab. As Eskandar Beig, the Turkman in his work "*Alem Araye Abbasi* (written in 1025 A.H.L. 1616 AD.) describing the biography of Hakim Emadaldin Mahmud says:[34] "Physicians rely on his worthy treatises and exotic medical prescriptions and preparation of electuaries and his treatment of chronic diseases and "hot" matters especially the major and the minor scab commonly known as chancre (ateshak). "Meanwhile sometimes chancre was named Franche variola.

Transmission of syphilis via coition was well known, its indirect transmission was exaggerated.

Hakim (physician) Emad- al Din Mahmud ibn Masoud Kashani, physician to the Safavid Monarch, Shah Tahmasib I, as mentioned earlier, wrote a treatise in 977 AHL 1569 AD. titled "Ateshak," a manuscript copy of which is kept in the Majlis Library. In this treatise contraction of syphilis by intercourse is clearly stated and the cause is said to be the vapors or fumes existing in the body of the patient. He, however, overemphasizes the possibility of contagion by inhala-

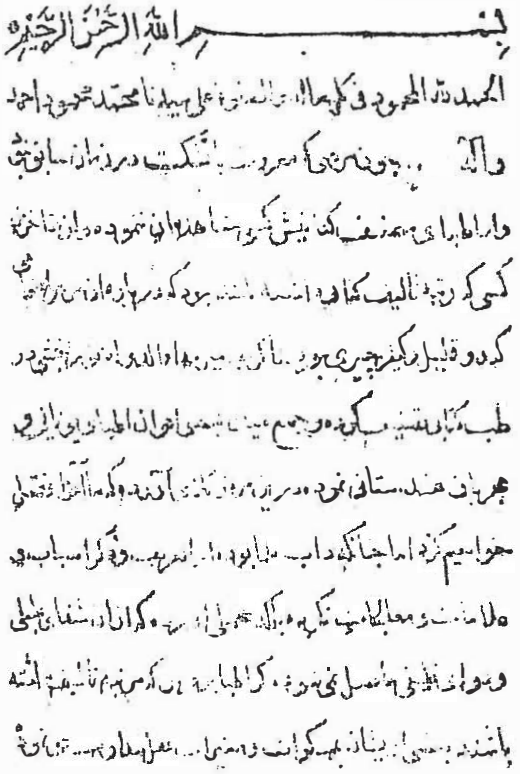

Fig. 5. The first page of the manuscript of Atteshak (chancre) by Emad-Aldin Mahmud, dated 1576, AD.

tion and indirect means. At the same time, he does not consider syphilis as hereditary.[35-36]

Cowpox Inoculation (Vaccination) in Iran by Modern Techniques

The Edward Jenner technique of cowpox (vaccination) inoculation was introduced in Iran by the end of the first half of the 13th century A.H. (approx. 3rd decade of the 19th century A.D) probably by English physicians serving in Tabriz in the army of Abbas Mirza, crown prince to Fathalishah Qajar.

By order of Abbas Mirza, Doctor Cormick (English physician appointed by the East India Company to serve the Crown Prince) wrote a treatise titled: *Smallpox Inoculation and the Need for Its Universal Use.* This and the Khoii paper were translated and developped in Farsi by Mohammad ben Abdolsaboure Khoii in the year 1245, A.H. (approx 1829 A.D), it was printed in Tabriz (one of the earliest printed works of Iran).[37,38]

One of the useful measures taken by Mirza Taqi Khan Amir Kabir, chancellor to Nasereddin Shah Qajar, was the universalisation of smallpox vaccination. This he achieved, first through Dr. Klukee and then through Dr. Toulousan, French physician to Nasereddin Shah. In the accounts of his travels, Dr. Pollack, Austrian physician and professor of the Daralfunoon College, indicates that pox vaccine, originally brought into Iran from Europe, was secured from inoculated children in this country. Thus, vaccine was directly transmitted from one individual to another and its culture thus conserved. Dr. Pollak writes: "some time ago (in 1273 A.H = 1857 A.D.) I recommeded that vaccine be not taken from the homes of city

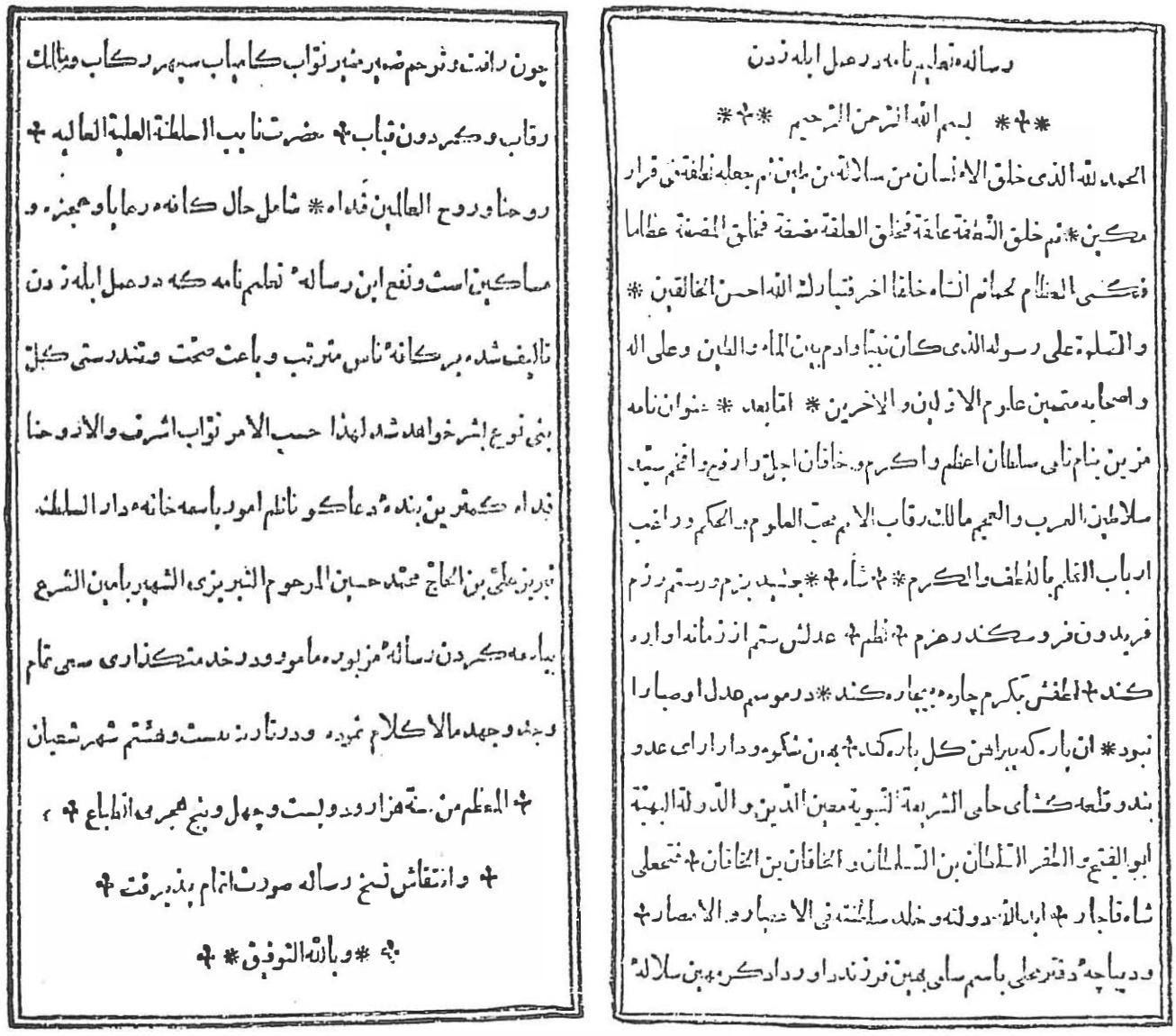

Fig. 6. The first and the last pages of the measures for the vaccination against smallpox, 1829 AD.

foundlings to rural areas and, rather, it be brought to the cities from rural areas. Moreover, I suggested the vaccine be extracted from children whose health is confirmed by a physician and that it is better that vaccine be taken from older children."(38)

Several decades later, when the Pasteur Institute was established, vaccine was extracted in Iran from inoculated calves and the danger of transmission of secondary diseases along with cow pox from man to man was averted.

Discussion of immunology with new methods in recent century in Iran belongs elsewhere.

Footnotes:

1- Leca: History of Egyptian Medicine, in *Histoire de la Mėdecine.*
2- Bull urine has been used as a disinfectant. Some believe that the issue of washing the body with bull's urine was added to the *Avesta* during the Sassanid rule when said script was redone. Such addenda are plentiful in the Vandida.
3- See the Vandida, Daey- al Islam translation.
4- See: The Bible, Society for Distribution of Sacred Books.
5- See: The *Illyad*, printed by Society for Translation & Publication of Books.
6- See: The *History of Veterinary Medicine*, pp: 40-42 .
7- The *History of Iranian Medicine* pp. 40-42
8- See: *Tarakul Atnab* P. 408
9- See: *Tarakul Atnab* P. 480
10- See: *The Tabari Interpretation*, pp 2053- 2060
11- See: *The Balaami History*, P. 1014
12- See: *Histoire de la mėdicine*, Paris 1931 by A. Castiglioni, cited in Najmabadi, *"A Biography of Razi*, P. 181.
13- See: Page 201 of the text Leca, A.
14- See: *Al- Jadri Val Hasba* page 39
15- " " " " " " 4
16- Cited by Najmabadi in translation of *Al Jadri* p. 49.
17- *Al Jadri Val Hasbah*, p. 40.
18- *Al Jadri Val Hasbah* p. 6.
19- See the *Tales and Stories of Patients*, 11th history, p. 33.
20- Dava AI Samak has been a kind of antidote composed of the musk, sabr and rhubarb.
21- Here it probably means septicemia.
22- See the *Divan of Khagani*, Abdul Rasouli print, pp. 194-195.
23- See Biography of Razi, pp. 215-216.
24- See *The Lobab al Bab*, pp. 378-381.
25- See *Microbial World*, 4th print p. 399, 5th print p. 633 and the *Genetics of Bacteria* by Tadjbakhsh, Tehran University Press, 3rd print pp 532, 1988.
26- See The *Code* (on medicine: Canoun) Teh. Print pp. 33-39
27- See The *Code* (on medicine) p 510.
28- To avoid undue prolongation where possible interim passages have been deleted.
29- Here a certain word could not be deciphered. It sounds as "Zoghal" (carbon) but from the passage it is clear that it is meant to be that chips that come to the top in boiling or fermentation.
30- Bidestar is a kind of sea dog that is amphibian and is a mammal of the castoridae variety.It has soft skin and wool. Its testes are termed Gond bidester meaning testicles in Farsi- Gond or Jond- bidesteris a sedative anti- convulsion. See Dehkhoda Encyclopedia Letter B p. 482 and Moin's Persian Dictionary p. 3408 . However from the general sense of the passage it is clear that by Jondebidester is meant an orchid of the salep group.
31- Seyyed Muhammad Nourbakhsh was a 9th (15th AD.) century mystic who found the mystic Nourbakhshi Sect. Born in 1392 AD. and died in 146 AD. in the village of Sulaqan. Fearing Shahrukh, son of Timor (the Lame) he fled from Herat and took refuge in Sulaqan (See Turaequl Haqayeq (lit, roads to truth), vol. 3 p. 71 & Moin's Dictionary, vol. 6, p. 2152.
32- See: The History of Persian medicine, pp. 509-510
33- The quotation copied verbatim from the Book *Khulasatal Tejarib* (from section on Saffavid period by Dr. Cyrill Ellgood as Translated by Muhsen Javidan, p. 11.
34- See the *Alam Araye Abbassi*, vol. 1, p. 168.
35- See *Emad- Al Din*, manuscript No. 6307 , Majlis library.
36- See *Ahsan Altavarikh*, pp. 303-304.
37- See: *"From Saba to Nima,"* page 231 and also see the Measures for the Vaccination against Smallpox, by Mohammad Ibn Abdolsaboure Khoii.
38- See: *"Pollak's Travel Accounts: "Iran and the Iranians", P. 463.*

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