# Contribution of Islam to Medicine

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This text gives an overview of the contributions of Islam to the field of medicine. It highlights medical practices during the spread of Islam and after its consolidation, shedding light on hospitals and therapy under Islamic medicine. The text concludes with brief notes on prominent Islamic physicians, including Al Razi, Al Zahrawi, Ibn Sina, Ibn Rushd, and Ibn El Nafis outlining their efforts and contributions this field.

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# Introduction

*"Wisdom is the lost property of the Believer, let him claim it wherever he finds it"*

Imam Ali (as)

*****

Medicine, as it stands today, did not develop overnight. It is the culmination of efforts of millions of people, some we know and others we do not. The flame of civilization, including medicine, started thousands of years ago. The flame has been handed over from one generation to another and from one country to the other.

Depending on who took the sacred responsibility of hosting it, sometimes it got brighter and sometimes it got dimmer. However, it never died away, because if it did, it would have been too hard to start all over again.

Between the ancient civilizations, namely the Egyptians, Greek, Roman, Persian, Indian, and Chinese, and the Renaissance era in Europe, there was a gap, commonly called "the dark ages", during which the flame was hosted, not by the West, but by another culture and people called the Arabs or the Moslems.

The nomenclature, "the dark ages" reflects the civilization in Europe between the 7th and 13th centuries, but by no means it expresses the state of affairs in the Arab world or the Islamic Empire at that time when an and science were as bright as the midday sun. That era, unjustifiably, has been commonly

neglected and overpassed, as if nothing happened. This paper is an effort to allude to the important events which took place and the significant physicians who lived during that period.

# The Spread of Islam

To understand how medicine developed in the middle ages, we must look back at the history and find out the important things that happened during the Seventh Century.

In 570 A.D., a man was born in a small city in the Arabian Peninsula, called Mecca (Haykal 1976), his name was Mohammed. In 610 A.D. he declared a new religion, Islam. In 632 A.D., he died after uniting the Arab tribes who had been torn by revenge, rivalry, and internal fights. Out of these mostly illiterate nomadic people, he produced a strong nation that encountered and conquered, simultaneously, the two known empires at that time, namely, the Persian and Byzantine Empires.

In a man's life-time, the Islamic Empire extended from the Atlantic Ocean on the West, to the borders of China on the East. In 711 A.D., only 80 years after the death of their prophet, the Arabs crossed to Europe to rule Spain for more than 700 years. In 732 A.D., they threatened Paris and their thrust was stopped at Tours and Poiter (Egeland 1976). In 831 A.D., the Moslems of North Africa invaded Sicily and ruled it for 200 years. By 846 A.D., they controlled the southern part of Italy and encountered Rome (Hitti 1977).

The hold of the Moslems over Italy remained so firm that Pope John VIII (872-882 A.D.) deemed it prudent to pay tribute for two years (Hitti 1977) In 869 A.D., the Arabs captured Malta (Ibn-Khaldun). In the tenth century, from Italy and Spain, the Arabs extended their raids through the Alpine passages into mid-Europe.

In the Alps, there are several castles and walls which tourists guides attribute to the invasion of the Moslems of Sicily. In the southern part of Italy and in Sicily, a great civilization was established and through which the torch of knowledge spread to Europe, mainly through the University of Salerno in the southern part of Italy (Hitti 1977, Parente 1967).

The expansion of the Moslems in Europe was not limited to those from North Africa and Spain. The Moslems, under the Ottoman Empire, invaded Europe from the East. They occupied a good part of Middle Europe and besieged Vienna twice, once during the reign of Sulayman 1 (1520-1566 A.D.) and the other during the reign of Mohammed IV (1648-1687 A.D.) (Hitti 1977).

# Islam and the Promotion of Culture and Science

As the Moslems challenged the civilized world at that time, they preserved the cultures of the conquered countries. On the other hand, when the Islamic Empire became weak, most of the Islamic contributions in art and science were destroyed. This was done by the Mongols who, out of barbarism, burnt Baghdad (1258 A.D.), and by the Spaniards, who out of hatred, demolished most of the Arabic heritage in Spain. The difference between the Arabs and these was the teachings of Islam which:

1. Stressed the importance and respect of learning. For example, the first word revealed to the Moslems' prophet Mohammed was "Read". In Mohammed's era, a captured enemy was freed if he paid a ransom or taught ten Moslems writing and reading. In their holy book, the Qur'an, the importance of knowledge has been repeatedly stressed as it says "Those who know and those who do not are not equal."

The prophet Mohammed stressed learning by saying. "One hour of teaching is better than a night of praying." One of the early princes, Khalid Ibn Yazid (end of the 7th century), gave up his treasure for the study of medicine and chemistry. He studied medicine under John the Grammarian of Alexandria, and chemistry under Merrinos the Greek (Haddad 1942). He also encouraged several Greek and Coptic medical books to be translated into Arabic.

2. Forbade destruction. On conquering Mecca, the prophet Mohammed strongly stated that no homes, animals, or trees should be destroyed. His followers abided with these principles when conquering other countries.

3. Encouraged cleanliness and personal hygiene. Islam instructed them to approach God in their prayers five times a day with bodies and clothes spotlessly clean.

4. Developed in them the respect of authority and discipline. For example, realizing the scourges and terror of plague, their prophet Mohammed (p.b.u.h.) decreed that "no man may enter or leave a town in which plague broke out." And to make this law all the more binding and effective, he promised the blessing of heaven to those who die of plague by stating that if a man died of plague he would be considered a martyr (Haddad 1942). Thus Mohammed (p.b.u.h.) laid for the Moslems the laws governing cordon and quarantine for the first time in history and made it work.

5. Tolerated other religions. The Islamic religion recognizes Christianity and Judaism and considers their followers to be people with holy books like Moslems. Moreover, they candidly treated the Jews at an era when the latter were persecuted in Europe. Dr. Jacob Minkin, a reputable Rabbi and scholar says "It was Mohammadan Spain, the only land of freedom the Jews knew in nearly a thousand years of their dispersion...

While during the Crusades, the armored Knights of the Cross spread death and devastation in the

Jewish communities of the countries through which they passed, Jews were safe under the sign of the Crescent. They were not only safe in life and possessions but were given the opportunity to live their own lives and develop a culture so unique and striking that it went down in history as the 'Golden Ages'. The Moors, the Muslim conquerors of Spain in 711, were not religious fanatics. They were strong in their faith but generous regarding the religious convictions of others.

"The Renaissance of Art in Italy, says George A. Dorsey, has blinded us to the Renaissance of Science in Spain, which fostered science, promoted culture, encouraged learning, and set a premium on intellectual pursuits, no matter whether the intellect was Moslem, Christian or Jew. Not since the days of Greece had the world known such thirst for knowledge, such passion for learning, such spirit shared by the prince and the courtien alike" (Minkin 1968).

The Arabs were assimilated by the vast new countries they reached. From this marriage of genuine characters and righteousness with the ancient and well–established civilizations, a great new nation was born. It is difficult to identify this new breed as Arabs, because although the language was Arabic, all the scientists were not necessarily from the Arabian Peninsula.

It is also equally difficult to describe it as Islamic, because al– though most of the scientists were Moslems, sponsored by Moslem rulers, and governed by the Islamic law, yet some scientists were Christians or Jews, especially at the early phase of the Islamic civilization: the translation period to Arabic, and the decline part: the translation period to Latin and Hebrew. Therefore, in this article, the adjectives Arabic or Islamic will be used as synonyms.

# Medicine Before Islam

To comprehend the contributions of Arabs to medicine, we must have in our minds a picture of the condition of medicine before they arrived at the scene. Generally speaking, two elements are required for medical practice:

## Manpower And Hospitals

### A. Manpower Before Islam

There were medical centers in different parts of the world which were later either under control of the Arabs or in touch with them. For example, in Syria, medicine was advanced and was greatly influenced by the Byzantine civilization which affected also the economic and administrative systems (Hammameh 1962). From the fifth century on, the Greek was the language of learning in Syria. The knowledge of the Arabs of the Greek civilization was mainly through the Syrian scholars who translated it into Arabic.

In Egypt, Alexandria was another center for culture. The Arabs got in touch with both the ancient Egyptian and Greek civilizations through the Egyptian scholars. In Persia, there was a medical school in a city called Jundi-Shapur in which medicine was highly developed.

The Abbasi Caliphs during the 8th century encouraged the Persian physicians to translate into Arabic the medical knowledge therein, to build medical centers in Baghdad, the capital of their empire, and to run newly built hospitals. With further expansion east, the Arabs through contacts with India and China, brought ideas and methods, not only in medicine, but also in mathematics, chemistry, philosophy, etc.

## B. Hospitals Before Islam

Hospitals as we know them now probably were not present. True, there were places for the sick to stay, but these were mainly temples or annexes to temples that were run by priests. Gods were supposed to play a major role in the art of healing. For example, the Goddess Toueris was the Egyptian symbol of fecundity and protectress of the pregnant and parturient.

She was shown as a standing pregnant hippopotamus carrying the hieroglyph meaning protection in one paw, and the sign of life in the other. Small figures of Toucris were popular as amulets (Speert 1973). In those days, sanctuary, prayers, inactation, and hypnosis were integral parts of the therapy.

Characteristic Features of Hospitals in the Islamic Civilization During the Islamic civilization, hospitals had much developed and attained specific characteristics:

1. Secular: Hospitals served all peoples irrespective of color, religion, or background. They were run by the government rather than by the church, and their Directors were commonly physicians assisted by persons who had no religious color. In hospitals, physicians of all faiths worked together with one aim in common: the well-being of patients.

2. Separate wards: Patients of different sexes occupied separate wards. Also, different diseases especially infectious ones, were allocated different wards.

3. Separate nurses: Male nurses were to take care of male patients, and vice versa.

4. Baths and water supplies: Praying five times a day is an important pillar of Islam. Sick or healthy, it is an Islamic obligation; of course, physical performance depends on one's health, even he can pray while lying in bed. Before praying, washing of face, head, hands, and feet must be done, if possible. For certain conditions, a bath is obligatory. Therefore, these hospitals had to provide the patients and employees with plentiful water supply and with bathing facilities.

5. Practicing physicians: Only qualified physicians were allowed by law to practice medicine. In 931 A.D., the Caliph Al- Mugtadir from the Abbasid dynasty, ordered the Chief Court Physician Sinan Ibn-Thabit to screen the 860 physicians of Baghdad, and only those qualified were granted license to practice

(Hamarneh 1962).

The counterpart of Ibn- Thabit, Abu-Osman Sai'd ibn Yaqub was ordered to do the same in Damascus, Mecca, and Medina. The latter two cities were in need for such an act because of hundreds of thousands of pilgrims visiting them every year. This was to prevent taking advantage of these pilgrims and to curb the spread of diseases among them.

6. Rather medical schools: The hospital was not only a place for treating patients, but also for educating medical students, interchanging medical knowledge, and developing medicine as a whole. To the main hospitals, there were attached expensive libraries containing the most up-to-date books, auditoria for meetings and lectures, and housing for students and house staff.

7. Proper records of patients: For the first time in history, these hospitals kept records of patients and their medical care.

8. Pharmacy: During the Islamic era, the science and the profession of pharmacy had developed to an outstanding degree. The Arabic materia medica became so rich and new drugs and compounds were introduced because the Muslims had contact with almost all the known world at that time, either through control or trade. Their ships sailed to China and the Philip- pines, and their convoys made trades with black Africa, Europe and Asia. Chemistry became an advanced science, and there were means and need for a specialization called pharmacy.

Thus, the main Arabian hospitals were models for medieval hospitals built later in Europe. They were rather medical schools to which those seeking advanced medical knowledge, from the East or West, attended.

# The Reasons for the High Standard of Islamic Hospitals

In the Islamic Empire, the hospitals attained a golden era unsurpassed in previous history. The reasons behind such a high standard include:

1. Being part of a civilization as a whole: The people were prosperous; thus, they were capable of taking care of their health and of seeking the best available treatment. Also, Islam stresses the necessity of seeking treatment of every disease; the Prophet says, "For every disease, God created a cure." The required sciences for good medical care were at a high standard e.g. the Arabs were advanced in chemistry, mathematics, administration, pharmacy, medicine, etc. They gave the world the system of

numbering which have replaced the cumbersome Roman numerals.

The world owes to them the knowledge of the following chemical reactions, namely sublimation, precipitation, filtration, distillation, etc. The great. Arab chemist Jabir Ibn- Hayan discovered sulphuric and nitric acids. According to Webster Dictionary, the words sugar, alcohol, alkali, syrup, coffee, cotton, all are Arabic words. Fielding H. Garrison, the author of the well-known work on the "History of Medicine" said: "... The Saracens themselves were the originators not only of algebra, chemistry, and geology, but of many of the so-called improvements or refinements of civilization, such as street lamps, window-panes, firework, stringed instruments, cultivated fruits, perfumes, spices, etc... "

2. High prestige of physicians: The physicians in this era earned a high prestige. Although anyone, irrespective of his social status, can study medicine, yet the route was long and tedious. He had to finish Islamic studies, philosophy, astronomy, art, chemistry, etc. before being accepted as a medical student. Therefore, the physician was a cultured person who had wisdom and knowledge. In fact, the Arabic translation of a physician is "Hakim" which means sage. In the 9th and 10th century, the Court-Physician was in the protocol ahead of the Chief-Justice.

Many eminent physicians, as we will discuss later, showed enough talent, social knowledge, political capabilities, and wisdom to be appointed by the Caliphs as prime ministers (Viziers). Owing to the high prestige and connections of physicians, generous funds for hospitals were easily obtained.

3. Rulers' involvement in public services: The Caliphs of the Islamic empire built magnificent hospitals for one or more of the following reasons:

a. Religion: Their religion stated that money spent on charity is a good investment for Judgment Day.

b. Eternity: The Pharaohs of Ancient Egypt sought eternity by building pyramids, the rulers of Islam sought the same thing by building mosques, hospitals, and schools carrying their names.

c. Politics: To show their people that they cared, and were interested in them, the rulers-built hospitals.

Whatever the motive of the ruler, the population benefited and good hospitals were erected.

4. Adequate financing to run the hospitals: The rulers set aside generous funds to run these hospitals. Also, the philanthropists gave generously, thus following their religious beliefs and imitating their rulers. In Islam, there is a special system called Al-Waqf. A person can donate part or all of this wealth to charity.

The government takes care of such a donation, and its revenues help to maintain and build mosques, hospitals, and schools. Another source of funds and an important pillar of Islam is alms-giving (21/2% of property value). Collected alms goes to the state treasury which takes care of charitable organizations. Very few hospitals in the Islamic era were private. Thus, patient's fees constituted an unimportant source of funding.

# Specific Hospitals

The capital of the Islamic empire kept changing from one dynasty to the other. In each capital, an important medical center developed. Thus, by the end of the 13th century, there were many medical centers spread throughout the Arab world. Space does not allow the description of all the hospitals built throughout these centuries. We, therefore, chose some of the important ones which will be described according to the region where they were developed.

## 1. In El-Sham

El-Sham at that time included what is known now as Syria, Lebanon, Jordan, and Palestine, Damascus and Jerusalem were the important cities.

a. In Damascus: The first known hospital in Islam was built in Damascus in 706 A.D. by the Umayyad Caliph, Al-Walid (Hamarneh 1962). The most important hospital built in Damascus in the Middle Ages was named Al-Nuri Hospital, after King Nur Al-Din Zinki, in 1156. This hospital was built during the Crusade Wars to fulfill a need for a well-equipped and well- staffed hospital. It turned out to be not only a first-class hospital, but also a first-class medical school.

The king donated to the hospital a whole library rich in medical books. It is important to understand why books were expensive and limited in number in the middle ages. This was because they were hand-written as printing was not used until the middle of the fifteenth century. The hospital adopted medical records, probably the first in history. From its medical school, many eminent physicians graduated, an example is Ibn Al-Nafis, the scholar who discovered the pulmonary circulation as will be discussed. The hospital served the people for seven centuries and parts of it still exist.

b. In Jerusalem: In 1055 A.D., the Crusaders built Saint John Hospital. By the end of the eleventh century, it grew to such an extent to include a hospital, a palace for knights, and a convent for the nursing sisters. The medical activities of the hospital were tremendous because of the large number of daily admissions of patients, pilgrims, and wounded soldiers. After the liberation of Jerusalem by Salah Al-Din in 1187 A.D., the hospital name was changed into Al-Salahani Hopital. He expanded the hospital which continued to serve the people until its destruction by an earthquake in 1458 A.D.

## 2. In Iraq And Persia

In 750 A.D., Baghdad was built to be the capital of the Abbasid dynasty by the Caliph Abu-Gaifar Al-Mansur. In 766 A.D., he assigned the dean of the medical school of Jindi Shapur, Judis Ibn-Babtishu', to be the Court-Physician and to establish hospitals proportionate to the glory and prosperity of Baghdad.

When Harun Al-Rashid followed (786-809 A.D.), he ordered the grandson of Ibn-Babtishu and his Court-Physician, Jibril, to build a special hospital named Baghdad Hospital. This hospital developed into an important medic center. One of its chiefs was Al-Razi, the eminent Internist.

In 918 A.D., the Caliph Al-Mugtadir built two hospitals in Baghdad. One was on the east side of the city which he named Al- Sayyidah Hospital, after his mother. The other was on the west side which he named, Al- Mugtadiri Hospital, after himself.

Another important hospital was named Al-Adudi Hospital. It was built in 981 A.D. after King Adud Al-Dawlah. It was the most magnificent hospital built in Baghdad before modern time. The Caliph wanted to outdo his predecessors. It was furnished with the best equipment and supplies known at the time. It had interns, residents, and 24 consultants attending its professional activities. Haly Abbas, who wrote the famous book "Liber Regius (Al-Malaki)", was one of the staff. It was destroyed in 1258 when the Mongols, led by Holagu the grandson of Ghingiz Khan, invaded Baghdad.

## 3. In Egypt

In 872 A.D., Ahmed Ibn-Tulun built a hospital called Al-Fusta Hospital in the City Al-Fustat which is now in old Cairo. It served the growing Cairo population for six centuries. It was divided into separate wards. On admission, the patients were given special apparel while their clothes, money, and valuables were stored until the time of their discharge.

In 1284 A.D., King Al-Mansur Qalawun built an important hospital named Al-Mansuri Hospital. The story behind its construction is interesting. King Al-Mansur Qalawun was an officer in the Arabian army fighting the Crusaders. While in the Holy Land, he fell sick and was admitted to Al- Nuri Hospital.

On recovery, he vowed that if he ever became the ruler of Egypt, he would build a great hospital in Cairo even more magnificent than Al-Nuri Hospital for, the sick. poor, and rich alike. At the dedication ceremony, he asked for a cup of wine from the pharmacy. After drinking it he declared that by taking that portion as a medication, he was signifying that the hospital was serving all people. from the king to the least of his subjects (Hamarneh 1962).

e. It was the best hospital built then as reported by the contemporary historians such as Ibn-Battota and El-Kalkashandi. It had different sections for different diseases. Music therapy was used as a line of treatment for psychiatric patients. It served 4,000 patients daily. The patient's stay in the hospital was free moreover on his discharge, the patient was given food and money for compensation for being out of work during his hospital stay. Al-Mansuri Hospital has served Cairo for seven centuries since it has been built. It is now used for ophthalmology and called Mustashfa Qalawun. Its ancient door is preserved in the Islamic Museum of Cairo.

## 4. In North Africa (Al-Maghrib Al-Arabi)

### A) Tunisia

In 830 A.D., Prince Ziyadat Allah I, built Al- Qayrawan Hospital in a district of the Qayrawan city called Al- Dimnah. Subsequently all hospitals in Tunisia were called Dimnah instead of Bimaristan as they were called in the East, which is a Persian word meaning a hospital. The Qayrawan Hospital was characterized by spacious separate wards waiting rooms for visitors and patients, and female nurses from Sudan, an event representing the first use of nursing in Arabic history. The hospital also included a chapel for prayers.

### B) Morocco

In 1190 A.D., the king Al-Mansur Ya'qub Ibn-Yusuf, built a hospital in the capital city, Marakesh, named it the Marakesh Hospital. It was a huge hospital beautifully landscaped with fruit trees and flowers. Water was brought by aqueducts to all sections. Patients were provided with special apparel: one for winter and another for summer. The pharmacy was taken care of by specialists called the Sayadlah. There was an expensive private section where a patient was charged what is equivalent to $ 1501 day. One thousand years ago, this fee was quite expensive.

## 5. Al-Andalus (Spain)

In 1366 A.D., Prince Muhammed Ibn-Yusuf Ibn Nasr, built the Granada Hospital in the city of Granada which had expanded to half a million population. The hospital represented the beauty of the Arabic architecture in Spain and served the people until the fall of Granada in 1492 A.D.

# Method of Therapy in Islamic Medicine

The patients were treated through a scheme starting with physiotherapy and diet; if this failed, drugs were used, and at last, surgery would be resorted to. The physiotherapy included exercises and water baths. The Arabs had an elaborate system of dieting and were aware of food deficiencies. Proper nutrition was an important item of treatment.

Drugs were divided into two groups: simple and compound drugs. They were aware of the interaction between drugs; thus, they used simple drugs first. If these failed, compound drugs were used which are made from two or more compounds. If these conservative measures failed, surgery was undertaken.

# Medical Ethics In Islam

The medical profession was a well–respected specialty and its leaders kept it this way by laying down proper ethics. Al– Tabari, the chief physician in 970 A.D., described the Islamic code of ethics as follows (Hamamch 1971, Levy 1967):

## 1. Personal Characters Of The Physician

The Physician ought to be modest, virtuous, merciful, and un–addicted to liquor. He should wear clean clothes, be dignified, and have well– groomed hair and beard. He should not join the ungodly and scoffers, nor sit at their table. He should select his company to be persons of good reputation. He should be careful of what he says and should not hesitate to ask forgiveness if he has made an error. He should be forgiving and never seek revenge. He should be friendly and peacemaker. He should not make jokes or laugh at the improper time or place.

## 2. His Obligation Towards Patients

He should avoid predicting whether a patient will live or die, only God (Allah) knows. He ought not lose his temper when his patient keeps asking questions but should answer gently and compassionately. He should treat alike the rich and the poor, the master and the servant, the powerful and the powerless, the elite and the illiterate. God will reward him if he helps the needy. The physician should not be late for his rounds or his house calls. He should be punctual and reliable.

He should not wrangle about his fees. If the patient is very ill or in an emergency, he should be thankful, no matter how much he is paid. He should not give drugs to a pregnant woman for an abortion unless necessary for the mother's health. If the physician prescribes a drug orally, he should make sure that the patient understands the name correctly, in case he would ask for the wrong drug and get worse instead of better. He should be decent towards women and should not divulge the secrets of his patients.

## 3. His Obligation Towards The Community

The physician should speak no evil of reputable men of the community or be critical of any one's religious belief.

## 4. His Obligations Towards His Colleagues

The physician should speak well of his acquaintances and colleagues. He should not honor himself by shaming others. If another physician has been called to treat his patient, the family doctor should not criticize his colleague even if the diagnosis and the recommendations of the latter differ from his own. However, be has the obligation to explain what each point of view may lead to since his duty is to counsel the patient as best as he can. He must warn him that combining different types of therapy may

be dangerous because the actions of different drugs may be incompatible and injurious.

### 5. His Obligations Towards His Assistants

If his subordinate does wrong, the physician should not rebuke him in front of others, but privately and cordially.

# Islamic Physicians

Medicine in Islam passed through three stages:

I. The first stage is the stage of translation of foreign sources into Arabic. It extended mainly during the seventh and eighth centuries.

II. The second stage is the stage of excellence and genuine contribution in which the Islamic physicians were the leaders and the source of new chapters to medicine. This stage extended during the ninth through the thirteenth centuries.

III. The third stage is the stage of decline where medicine, as well as other branches of science, became stagnant and deteriorated. The stage started mainly after the thirteenth century.

During the first stage, Syrian and Persian scholars did a marvelous job by translating honestly the ancient literature from Greek and Syriac in Arabic. They translated different branches of science including philosophy astrology, and medicine. The works of Hippocratcs (460–370 BC), Aristototle (384–322 BC), and Galen (131–210 A.D.) were among those translated From Arabic, the classic Greek literature was translated into Latin, then into Greek because most of the original scripts were lost and the only source was the Arabic translation.

If the Arabs did only one thing, namely, preserving the ancient literature and handing it honestly to Europe, that would have been a sufficient contribution in itself. The Moslem rulers encouraged translation, e.g. Khalif Al–Mamun Al–Abbassi paid the translator the weight of his translation in gold (Haddad 1942). Among the eminent physicians who took part in the first stage were Jurjis Ibn–Bakhtisliu, his grandson Jibril, Yuhanna Ibn–Masawaya, and Hunain Ibn–Ishak; most of them were Christians, yet they were respected and well treated by the Moslem rulers.

It is said, rightly or wrongly, that the history of a nation is the sum total of the history of a few of its individuals. This is particularly true in the history of medicine during the Arab period. In every stage of its development we find men of outstanding repute, the sum of whose efforts has constituted this magnificent chapter. It is impossible to give an account of all the important physicians of Islam.

We thus are going to discuss some of those who were known to Medieval Europe and whose books affected its thinking and practice for centuries (Table 1), I chose an internist, Al-Razi (Razes); a surgeon, Al-Zahrawi (Abulcasis); the physician-philosopher of Islam, Ibn-Sina (Avicenna); the philosopher-physician of Islam, Ibn-Rushd (Averroes); a pioneer in physiology, Ibn-Al- Nafis; and a Jewish Arab, Ibn- Maimon (Maimonides).

## Al-Razi (Razes)

**Al-Razi (Razes) 841-926 A.D.**

His full name is Abu-Bakr Mohammaed Ibn-Zakaria Al-Razi, known to the Western World as Razes. He was born in Ray, a suburb of Tehran, the capital of modern Persia (Profile of Iran 1977, Sarton 1950). He first studied music which was his main interest in his early life. He was a skillful player on the lute. He then studied philosophy, and later medicine. But he was a better physician than a philosopher.

He first became the Court-Physician of Prince Abu Saleh Al- Mansur, the ruler of Khorosan. Then he moved to Baghdad where he became the Chief Physician of the Baghdad Hospital and the Court-Physician of the Caliph. He had a good basis of physics and chemistry as well as medicine.

He published several books which were translated into Latin, French, Italian, Hebrew, and Greek. One of his main books is "Al-Mansuri" (Liber Al-Mansofis) which he dedicated to his patron Prince Al-Mansur. It was composed of ten treatises and included all aspects of health and disease. He defined medicine as "the art concerned in preserving healthy bodies, in combating disease, and in restoring health to the sick." He thus showed the three aspects of medicine namely, public health, preventive medicine, and treatment of specific diseases he listed seven principles for the preservation of health:

1. Moderation and balance in motion and rest.
2. Moderation in eating and drinking.
3. Elimination of superfluities.
4. Improvement and regulation of dwelling places.
5. Avoidance of excessive evil happenings before they become uncontrollable.
6. Maintenance of harmony in ambitions and resolutions.
7. Acquisition of reticence through possession of good habits including exercise.

He also published another book called "Al-Murshid". In it, he emphasized the important lines of therapy that we mentioned earlier. He described the different types of fever including continuous, relapsing, and hectic. He stated that fever can be a symptom of a disease or a disease in itself. He introduced mercury as a therapeutic drug for the first time in history, which was later adopted in Europe. He realized that a man normally does not want to get sick, and he wants to recover as soon as possible.

However, if a patient does not have the will or the desire to get well, the physician's hands are tied and

cannot help him. He stressed the continued medical education of the physician. He advised him to record his own observations. He encouraged him to meet with other physicians to discuss medical problems. He recommended that the physicians should try solving these problems rather than depending on others for finding solutions.

Another book written by Al-Razi was named "Al-Hawi", which means the complete text. It was composed of 22 volumes. It was one of the main text books in the medical school in Paris, especially its 9th volume on pharmacology.

He wrote a treatise on measles and smallpox called "de Peste or de Pestilentia" which was translated to Latin in 1565 A.D. It is a masterpiece in clinical medicine (Browne 1962). It describes the clinical difference between the two diseases so vividly that nothing since has been added (Keys 1971).

## Al-Zahrawi

**Al-Zahrawi (Abulcasis, Bucasis, Alzahravius) 930-1013 A.D.**

His full name is Abu-Al-Qasim Khalaf Ibn'Abbas Al-Zahrawi. He had been known in the Western World as Abulcasis, Bucasis or Alzahravius. He is the famous surgeon of the Arabs. In 930 A.D., he was born in Al-Zahra, a suburb of Cordova. He attended the University of Cordova which had been established for one and a half centuries. At that time Cordova had a population of one million (Hitti 1977). It was the magnificent capital of Al- Andalus where culture and science were at their peak in Europe. In military power the Moslems also reached their zenith, not only in Spain but also throughout Europe after King Abdel-Rahman III defeated the Spanish kings of Navarre, Castile, and Leon at the north in 997 A.D.

Al-Zahrawi became an eminent surgeon. lie was appointed as the Court-Physician of King Abdel-Rahman III. He spent a productive life in Practicing medicine, especially in surgery and medical writings. He died at the age of 83.

He wrote mainly four books. One of them is "Al-Tastif Liman Ajiz'an Al-Ta'lif' which is the best medieval surgical encyclopedia. It was used in Europe until the 17th century. He stressed the importance of basic sciences: "... Before practicing, one should be familiar with the science of anatomy and the functions of organs so that he will understand them, recognize their shape, understand their connections, and know their borders.

Also, he should know the bones, nerves, and muscles, their numbers, their origin and insertions, the arteries and the veins, their start and end. These anatomical and physiological bases are important, and as said by Hippocrates: 'These are many physicians by title and a few by practice.' ... If one does not comprehend the anatomy and physiology, he may commit a mistake that can kill the patient. I have seen someone, who pretended to be a surgeon, incised an aneurysm in the neck of a woman, mistaking it for an abscess. The woman bled to death."

Heller stated that Al–Zahrawi described the ligature of arteries long before Ambrose Pare (Khairallah 1942). Al–Zahrawi also used cautery to control bleeding. He used wax and alcohol to stop bleeding from the skull during cranial surgery. Sprengel said that Al–Zahrawi was the first to teach the lithotomy position for vaginal operations (Khairallah 1942). Al–Zahrawi also described the tracheotomy operation and performed it as an emergency on one of his servants.

He was the first to write on orthodontia. He showed evidence of great experience from details of clinical picture and surgical procedures e.g. his description of varicose veins stripping, even after ten centuries, is almost like modern surgery (Al– Okbi 1971): "... Have the leg shaved if it is much hairy.

The patient gets a bath and his leg is kept in hot water until it becomes red and the veins dilate; or he exercises vigorously. Incise the skin opposite the varicose vein longitudinally either at the ankle or at the knee. Keep the skin opened by hooks. Ex– pose, dissect, and separate the vein. Introduce a spatula underneath it.

When the vein is elevated above the skin level, hang it with a blunt rounded hook. Repeat the procedure about three fingers from the previous site and hang the vein with another hook as previously done. Repeat the procedure at as many sites along the varicose vein as necessary. At the ankle, ligate and strip it by pulling it from the incision just above. When it reaches there, repeat at the higher incision until all of it is stripped.

Ligate the vein and then excise it. If difficulty is encountered in pulling it, ligate its terminal part with a string and pass it un– der the spatula and dissect it further. Pull gently and avoid its tearing because if it does, it becomes difficult to strip all of it and can cause harm to the patient.

When you have stripped it all, put alcohol spanges at the sites of the skin incisions and take care of the incisions until they heal. If the varicose vein is tortuous, you have to incise the skin more frequently, at each change of direction. Dissect it and hang it with the hooks and strip it as previously described. Do not tear the vein or injure it. If this happens, it becomes difficult to strip it. The hooks used should be blunt, eyeless, and rounded, otherwise it can injure the vein".

He also wrote about fracture of the skull (Al–Okbi 197 1): "... The types of skull fractures are numerous, their shapes are different, and their causes are many. For example, some skull fractures are due to a blow by a sword that splits the whole skull and reaches the dura, the same as the ax does to the wood, therefore it is called axial fracture. Sometimes the sword does not split the skull completely; it is thus called incomplete axial fracture. Such a fracture can be small or big.

Another type is comminuted fracture which can be due to a hit by a stone or a fall on a stone; and this fracture can reach the dura or only be limited to the outer part of the bone. This fracture can also be small or big. A third type is the hairy type of skull fracture which is so tiny and linear like a hair.

A fourth type is the depressed fracture which occurs due to a fail or a blow so the bone is depressed like

a brass jar when hit by a blunt instrument. This usually happens when the bone is soft as children. The types of these fractures are diagnosed by examining the wound, removing the debris and contused pan of the scalp, exposing the skull, and feeling it by the spatulas. The hairy fracture is difficult to discover and can be diagnosed by exposing the skull and smearing it with ink; the linear fracture thus appears stained."

In the treatment of fractures of the skull, Al- Zahrawi wrote:
"... If the patient shows serious signs such as high fever, repeated vomiting, exophthalmos, convulsions, and coma, do not touch him because he is probably going to die. Otherwise, treat him as follows: first shave the patient's head. In comminuted depressed fractures, these pieces of bone should be removed as will be explained. If in the process of the patient's examination or during surgery bleeding occurs, it can be controlled by pressure using towels soaked in alcohol and by wax. Then after control of the bleeding, the small pieces of bone are removed using special forceps.

To remove the depressed fracture, first, make trephines in the healthy bone around it. These trephine instruments should not penetrate beyond the skull into the soft tissues underneath, thus they are called non penetrating trephines. They have a rounded ring in their proximal end to prevent them from penetrating beyond certain depths. You should have a number of these trephines that can stop at different depths depending on the thickness of the skull. Connect the holes in the skull using special saws.

First, use a fine small saw, then larger ones. These should be sharp and made of steel. Avoid cutting the dura by the trephine or saw. Once the depressed bone is freed, remove it gently, then smoothen the edges of the skull by special instruments. Wash with alcohol and treat the wound with packs soaked with ointment."

Al-Zahrawi described many dental operations such as dental extractions, fixation, re implantation, and artificial teeth. He described referred tooth pain and cautioned the physician against removal of the healthy tooth to which pain is referred. He used gold threads to fix teeth because other metals would tarnish and cause a reaction. Chapter 6 of his book was all devoted to foreign bodies of the ear and their treatment. He also devoted one whole chapter to midwifery, giving tips to mid- wives, and describing the problems of difficult labor and obstetrical maneuver.

He recommended decompression of the fetal head for obstructed labor and described the instruments used. He described the management of liver abscess by treating it into two stages (Khairallah 1942). The first stage was to allow adhesions around it and to close it from the peritoneal cavity. The second stage was to incise it...."If the procedure is done in one stage, the pus may spread to the whole abdomen and the patient may die."

He described a total of 200 surgical and dental instruments most of them were original (Fig. 3). He said "... Choose your instruments carefully beforehand according to the operation. However, you should

design other devices if needed." Thus he encouraged the physician to be innovative.

During the time of Al-Zahrawi, surgery in the Islamic world became a respected specialty practiced by reputable physicians. On the contrary in Europe, surgery was belittled and practiced by barbers and butchers. In 1163 A.D., the Council of Tours declared the following resolution "Surgery is to be abandoned by the schools of medicine and by all decent physicians."

## Ibn-Sina

**Ibn-Sina (Avicenna) 980-1037 A.D.**

Ibn-Sina's full name is Abu-Ali Husayn Ibn-Abdullah Ibn-Sina, and his titles were Al-Shaykh Al-Rais (The chief Master) or Al- Muallim Al-Thani (The Second Teacher), second to Aristotle (Browne 1962). He is known in the Western World as Avicenna.

In 980 A.D. Avicenna was born in Bukhara which is now part of Russia and known as Uzben. By the age of 10, he was already proficient in the Qur'an and Arabic classics. By the age of 16, he finished Islamic law studies, geometry, anatomy, logic and philosophy. His metaphysics were influenced by an earlier philosopher in Islam, Al-Farabi. By the age of 18, he completed the study of medicine.

Soon after, he became the Prime Minister (the Visier) and Court-Physician of Prince Nuli-Ibn-Mansur, the Samanid Ruler of Bukbara. The prince was impressed by the intelligence and endurance of his Visier and opened for him the royal library which was unique in its literary richness. Ibn-Sina wrote his first book at the age of 21.

Then he became Visier of Ali ibn Maimun, the ruler of Khawarazm or Khiva. But he ultimately fled to avoid being kid- napped by the Sultan Mohammed El-Ghazin. Ironically, fate played an important role in the life of Avicenna who was a mas- ter in planning. The ruler of Hainadan, the southern part of Persia, who was called Amir Shwnsu'd-Dawla, had renal colic. Ibn-Sina treated the Amir's colic. The latter was very pleased and appointed Ibn-Sina, not only his Court-Physician but also his Visier. Avicenna was a proud and arrogant man.

This created enemies leading to a mutiny of the military lead- ers against him resulting in his dismissal and imprisonment. Fortunately, the Amir got renal colic once more and no one could relieve his pain. He thus summoned back Avicenna who cured him. The Amir apologized to Avicenna and reinstated him.

Avicenna's life during this time was extraordinarily strenuous. All the day he was busy with the Amir's services. The great part of the night was passed in lecturing and writing his books, with intervals of wine-drinking, music, and minstrelsy. After many vicissitudes, worn out by hard work and hard living, Avicenna died and was buried in Hamadan, Persia, in 1037

A.D. at a comparatively early age of 57. In his last illness, he treated himself unsuccessfully, so that it

was said by his de- tractors that neither could his physics save his body nor his metaphysics save his soul (Browne 1962).

Avicenna wrote 100 treatises, 21 of them were major of which 16 were in medicine. He wrote in philosophy, medicine, named Al-Qanon fi Al- Tibb (Canon of Medicine). It was an encyclopedia containing more than one million words. It was composed of 5 volumes:

Volume I- described the principles and theories of medicine.
Volume II- contained the simple drugs arranged alphabetically.
Volume III- described localized diseases of the body from the head to the toes.
Volume IV- was addressed to generalized diseases of the body e.g. fevers.
Volume V- explained compound drugs.

The Canon contained all medical knowledge up to the 10th century. It was translated to many languages and was the reference for medical schools in Europe up to the 17th century. Although the Canon was a great book, it overshadowed the important works prior to it by Al-Razi and Al-Zahrawi, and subsequent to it by Ibn-Al-Nafis and Ali Ibn- Abbas, Halle Abbas, (Haddad 1942).

Avicenna wrote Arabic and Persian poems. The last of his Arabic poem, which is considered a classical beauty, describes the descent of the Soul into the Body from the Higher Sphere which is its home (Browne 1962).

Avicenna is considered a great philosopher, and his writings affected the thinkers and influenced many of those who appeared after him. He was a unique phenomenon, not only because of these encyclopedic accomplishments in medicine, but also because of the versatility of his genius. He has been compared in this respect with Aristotle, Leonardo da Vinci, and Goethe. (Keys 1971).

## Ibn-Rushd

**Ibn-Rushd (Averroes) 1126-1198 A.D.**

Ibn-Rashid, or Averroes as known in Europe, was born in Granada in 1126 A.D. He studied philosophy, medicine and law. He was appointed as a judge in Seville in 1169 A.D. where he stayed in office for a quarter of a century. He was affected by Aristotle on whom he wrote important commentaries (Black 1970, Al-A'sar 1972). In these interpretations he asserted that the human soul is not independent, but shares a universal mind. This belief caused a great controversy and was later declared heretical by both the Moslems and Christians alike because it contradicted the doctrine of personal immortality.

He was admired by the Jews of Spain who spread philosophy into Europe especially into Italy and France after they were forced out of Spain. His followers interpreted some of his writings to mean that there are two kinds of truth, a philosophical and a religious truth. This implied a separation of reason and faith and influenced philosophical and theological speculation for many centuries. Because of his bold

ideas, he was dismissed from his work and sent to Morocco where he was kept in prison till he died on December 12, 1198. his important contribution to medicine was "Al- Kulliyat fi Al-Tibb" (Colliyet).

It was a summary of the medical science at that time and com- posed of seven parts. He wrote another book, "Al-Taisir" on practical medicine. It consisted of useful excerpts and a clinical description of diseases including serous pericarditis and mediastinal abscess. He personally suffered from the latter disease and left very careful records of his own symptoms. The book is not known in Arabic, but there are several Latin editions (Haddad 1942). Ibn-Rushd was another example of the cultured Arabic physician.

## Ibn-Maimon

**Ibn-Maimon (Maimonedes) 1135-1204 A.D.**

In 1135, Musa Ibn-Maimon (Moses Maimonides) was born in Cordova, Spain (Minlcin 1968). His father was a Rabbi and had a great influence of Moses in his interests and future achievements. During that period, the Jews had a golden era in Spain. Minkin (1968), a renowned scholar and an eminent Rabbi wrote "It was Mohammedan Spain, the only land the Jews knew in nearly a thousand years of their dispersion, which made the genius of Moses Maimonides possible."

In1160 A.D., Moses emigrated to North Africa to the city of Fas where he studied medicine. In 1165 A.D., he left to Palestine. However, he was dissatisfied with the cultural atmosphere. Therefore, he went to Egypt where he stayed until he died in 1204 A.D. He was buried in Teberias, Palestine.

Maimonides first started his career as the Rabbi of the Jewish Comniunity of El-Fostat city, the capital of Egypt at that time and part of old Cairo now. Later, in life, he practiced medicine. He became an eminent and respected physician. He served both Kings Salah-El-Din (Saladin) and his elder son Sultan Al-Malik Al-Afdel during his short reign (1198-1200 A.D.). He had the confidence of both. During Salah-El-Din war with King Richard, the Lion-Hearted, the latter fell sick.

Although those two kings were at war, they had respect and admiration of each other. Saladin sent Ibn-Maimon to Richard to treat him. After being, cured. Richard asked Ibn- Maimon to join his court. But the latter politely declined and preferred to stay with Saladin (Minkin 1968).

Ibn-Maimon's impact on the Jewish religion is very important. He wrote classical work in the Jewish religion including codification of the Jewish laws (Black and Roth 1970). He also wrote in philosophy. His book, "Dalalat Al-Hai'ran" (The Guide of the Perplexed) is an important achievement which was welcomed not only by those of the Jewish faith but also by Moslems and Christians alike. He was affected by his contemporary Ibn- Rushd, and by Aristotle, but he tried to unite logic and faith. He wrote his book in Arabic. He did not live long enough to see the Hebrew translation of his book which would have given him a great satisfaction.

In medicine Ibn-Maimon did two important things: First, be translated many Arabic books into Hebrew which were than translated into Latin and other European languages. An example of these books is the Canon of Avicenna. Second, be wrote a few books of his own. One of them is "Magala fi Tadbir Al-Sihha" (Regimen Sanitatis) which stressed proper diet, personal hygiene, and moderation in the pleasures of life. It was in the form of letters to the Sultan Al-Afdel. The other was "Kitab" Al-Fusal fi Al-Tibb" (Fisul Musa). This was a collection of 1,500 aphorisms extracted from Galen writings together with forty- two critical remarks. Moses also wrote a book on poisons and their antidotes (Al-A'sar 1971).

When he died, the Jewish Community in Egypt built a synagogue named after him. Some Jews, up-till-now, stay overnight in this synagogue in hope of receiving healing through the spirit of this great physician (Minkin 1968).

## Ibn-El-Nafis

**Ibn-El-Nafis 1208 - 1288 A.D.**

In 1208 A.D., Ala'El-Deen Ibn-El-Nafis was born in a small town near Damascus called Kersh (Fig. 7) (Ibrahim 1971). He learned medicine and philosophy in Damascus and spent most of his life in Cairo. He was a physician, a linguist, a philosopher, and a historian. He was the first chief of Al-Mansuri Hospital in Cairo and the dean of the School of Medicine in 1284 A.D.

During this era, the medical profession together with other branches of science were passing a crisis. The Mongol Tartar invasion and destruction of Baghdad in 1258 A.D. caused an in- jury to the Islamic civilization from which it never recovered. It destroyed forever the Caliphate, symbolic unity of the Arabian Empire, and the preeminence of Baghdad as a center for learning.

Also during that period Islamic culture was declining in Spain. It was then Cairo and Damascus the centers for education and medical prestige. There, the medical profession was characterized by the freedom of discussion and expression of opinion, something that was very new in medicine and not known to Europe until the 17th century when introduced to England by Sedenbam (Ibrahim 1971).

Ibn-El-Nafis was a dedicated person. He used to start his day after dawn prayers by making rounds at the hospital, followed by case discussions with students and colleagues, then hospital administration. His evenings were spent reading, writing and discussing medicine and philosophy with frequent scholar guests at his home in El-Hussein District in Old Cairo. His house was an example of beautiful Arabic architecture, made of marble with a fountain in the central hall.

In the history of mankind, there are persons whose importance is revealed with the flight of time and their truth glows with the passage of centuries; Ibn-El-Nafis is one of those. He wrote many books, ten of them in medicine and a special one in philosophy. In the latter book "Fadel Ibn- Natik", he tried to present the counter point of the philosophical view of Avicenna expressed in his book "Hai Ibn-Yakzan".

He was an authority in theology on which he wrote several books, e.g. "The complete Message of the Prophet" and "Al- Ragol Al-Kamel" (The Perfect Man) supporting Unitarianism. Ibn-El-Nafis had an important character, not being a follower but a scholar. This was evident in his writings whether in philosophy or medicine.

In medicine he wrote many books, two of them are "Mujaz Al- Qanun" which means the "Summary of the Canon". In these two books which were based on avicenna's writings, he criticized the short comings of Avicenna's book and of Galen's views and added to them. That is why he was named by some as Avicenna the Second.

For example, he wrote "... We have relied chiefly on his (Galen) teachings, except in a few details which we think are wrong and were not given after a thorough investigation. In describing the function of the organs, we have depended on careful investigation, observation, and honest study, regardless of whether or not these fit with the teachings and theories of those who have preceded us."

Ibn-El-Nafis added lights to the physiology of the circulation. In the ancient history, Erasistratus of the Alexandria School (310 B.C. - 250 B.C.) believed that blood was contained only in the eight side of the circulation, namely the veins and the fight side of the heart. The left side of the circulation, namely the left side of the heart and the arteries were supposed to contain air because arteries were found empty when an animal was sacrificed, hence the name "arteria".

When Galen came (131 - 210 A.D.), he described blood to pass from the right side of the heart to the left side through minute openings in the septum of the heart, then it mixed with air from the lungs, and sequently distributed to the whole body. For centuries this was the prevalent belief and no one, including the Arab physicians and their eminent writer Avicenna, could dare to challenge this sacred view, Ibn-El-Nafis did. Five times he stated in unmistakable terms that "... the blood from the right chamber of the heart must arrive at the left chamber, but there is no direct pathway between them.

The thick septum of the heart is not perforated and does not have visible pores as some people thought or invisible pores as Galen thought. The blood from the right chamber must flow through the vena arteriosa (pulmonary artery) to the lungs, spread through its substance, he mingled with air, pass through the arteria venosa (Pulmonary vein) to reach the left chamber of the heart... " (Salem 1968). In describing the anatomy of the lung Ibn-El-Nafis stated: "The lung is composed of: first, the bronchi: second, the branches of the arteria venosa; and third, the branches of the vena arteriosa; all of these are connected by loose porous flesh ... The need of the lung for the vena arteriosa is to transport to it the blood that has been thinned and warmed in the heart, so that what seeps through the pores of the branches of this vessel into the alveoli of the lung may mix with what is of air therein and combine with it ... and the mixture is carried to the left cavity of the heart by the arteria venosa" (Haddad 1936).

Ibn-El-Nafis also made other contributions in the circulation. Avicenna, following Galen's description of the anatomy, stated that the human heart has three ventricles. Ibn-El-Nafis rejected that as he said "...

And his statement (Avicenna's) that the heart has three ventricles is not correct, as the heart has only two ventricles... " He was also the first to describe the coronary circulation as he wrote "... Again, his statement (Avicenna's) that the blood in the right side is to nourish the heart is not true at all, for the nourishment of the heart is from the blood that goes through the vessels that permeate the body of the heart... "

Three centuries after the discovery of the pulmonary circulation by Ibn- El-Nafis, others, such as Michael Servetus, Realdus Colombus, Carlo Ruini, Andrea Cesalpino, and Francois Ra- belais, claimed the same thing (Mayerhof 1935). There is a strong suspicion that these authors obtained their knowledge from the Arabic literature which was available at that time to the European investigators without giving credit to Ibn-El- Nafis (Keys 1971, Haddad 1942).

It is considered to be more than a coincidence that Servetus would discover the pulmonary circulation, and also to write a book, similar to that of Ibn-El-Nafis, on Unitarianism. Servetus was burnt with his book, "Restitutio Christianismi" in Geneva in October 1553 at the order of Calvin because he was considered heretic.

# The Arabs and Ophthalmology

The Arabs were much interested in ophthalmology. In the ninth century, Hunayn Ibn-Ishak (Joannitius) translated to Arabic the Greek literature on the eye. As mentioned before, Al-Razi described the changes in the caliber of the eye produced by relaxation and contraction of the iris. He also described the cataract operation.

In 1050 A.D. at Baghdad, Ali Ibn-Isa (Jesu Haly) wrote the classic book on ophthalmology, Tathkirat Al-Kahhalin (A Note for the Oculists). As stated by Cunistan (1921), it is the oldest book in its original language on diseases of the eye. In a clear and logical style, the author described trachoma, conjunctivitis, and cataract, and prescribed treatment (Keys 1971). Avicenna described the six extrinsic muscles of the eyeball.

In the thirteenth century, Ibn Abu-Al-Kawafer wrote a book on therapeutic ophthalmology entitled "Natigat-El-Fikr fi Ilag Amrad El-Bassar" (Conclusions from Expelience on Treatment of Diseases of the Eye). According to Kahil (1929) is one of several textbooks of ophthalmology considered to be superior to any written in Europe up to the eighteenth century.

# Arabs and Anesthesia

Being an obstetric anesthesiologist, I feel obligated to write a little more on the contributions of the Arabs to both anesthesia and obstetrics. First, in anesthesia, the Arabs described in detail the pharmacology of important narcotics such as opium and other central nervous system depressants such as hyoscyamus and hashish (Khairallal 1942). Burton (1886 A.D.) stated that "anesthetics have been used in surgery throughout the East for centuries before ether and chloroform became the fashion in the civilized West. In a Treatise on the Canon of Medicine by Gruner it is stated by Avicenna under the article 8l4 ANESTHETICS: "If it is desirable to get a person unconscious quickly, without him being harmed, add sweet smelling moss to the wine, or lignum aloes.

If it is desirable to procure a deeply unconscious state, to able the pain to be borne which is involved in painful applications to a member. Place darnel-water into the wine, or administer fumitory, opiuium, hyoscyamus (half dram doses of each); nutmeg, crude aloes-wood (4 grains of each). Add this to the wine, and take as much as is necessary for the purpose. Or, boil black hyoscyamus in water, with mandragore bark, until it becomes red. Add this to the wine."

The Arabs also introduced "the Soporific Sponge" which was commonly used for anesthesia in the middle ages. The sponge was soaked with aromatics and narcotics to be sucked and then held under the nostril to provide anesthesia prior to surgery (Keys 1971).

Avicenna wrote more than 1,000 years ago about the effect of pain on ventilation: "Pain dissipates the bodily strength and interferes with the normal functions of the organs. The respiratory organs are inhibited from drawing in air, and consequently the act of breathing is interfered with, and the respiration becomes intermittent, rapid, or altogether unnatural in rhythm" (Gruner 1930).

# Arabs and Obstetrics

Hynayn Ibn-Ishak (Joannitius, 809-873 A.D.) translated the work of the Greek pioneer in obstetrics, Paul of Aegina, into Arabic. Hunayn also translated to the Arabic world most of the work of Hippocrates, Galen, and Ptolemy. Moreover, he was a gifted physician and philosopher. Ali Ibn-Al- Abas Al-Majusi (Halle Abbas) who died in 994 A.D. was the first to describe in his book "Al-Kitab Al-Malaki" (The Royal Book) that the uterine contractions are the cause of delivery of the fetus (Keys 1971). Before him, it was thought that the uterine contractions were only as indication of the onset of labor; subsequently the fetus would swim its way out of the womb and birth canal.

Most of the deliveries were performed by midwives at home. For complicated obstetrics Al-Zahrawi offered advice to midwives as mentioned.

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