HEALTH SCIENCES IN EARLY ISLAM

Volume II

Collected Papers By Sami K. Hamarneh
Edited By Munawar A. Anees

FROM THE PRINTED VERSION

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MUNAWAR A. ANEES

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Publisher's Note

HEALTH SCIENCES IN EARLY ISLAM was published in 1983 by Zahra Publications and Noor Health Foundation. This book is based on the collected papers of the eminent Dr. Sami Khalaf Hamarneh. This collection was a ground breaking project commissioned by Shaykh Fadhlalla Haeri and undertaken by Dr. Munawar Ahmed Anees.

Dr. Hamarneh was born on February 2, 1925 in Madaba, Jordan. He did his B.Sc. in Pharmacy in 1948 from Syria and his Masters in Pharmacology and Pharmaceutical Biochemistry in 1959. He was awarded a PhD from the University of Wisconsin. He retired as Curator Emeritus from the Division of Medical Sciences at The Smithsonian Institution in 1979. Dr. Hamarneh subsequently set up the Institute for the History of Arabic Sciences in Aleppo, Syria and then worked with the Faculty of Medical Sciences, Yarmouk University in Jordan. In his extensive research to collect the papers in this book, Dr. Hamarneh pursued original Arabic manuscripts in libraries throughout the world during a period of nearly thirty years. He passed away in Washington, D.C. on December 3, 2010.

Dr. Anees is an eminent academician who undertook this onerous commission of producing HEALTH SCIENCES IN EARLY ISLAM. Dr. Anees was born in Pakistan and undertook his initial education from Lahore. During his career he has acted as a consultant to the John Templeton Foundation, Personal Advisor to the Deputy Prime Minister of Malaysia, and was nominated for the Nobel Peace Prize in 2002. He founded the premier journal on Islam and the Muslim world, *Periodica Islamica*. He has advised the U.N. in various capacities on reproductive health in the Muslim World. Dr. Anees has been a prolific writer and contributor to major academic journals. He has published a number of seminal works a full list of which is available at http://www.islamicresourcebank.org/bios/aneesmuna.pdf.

The huge effort to bring this groundbreaking work, HEALTH SCIENCES IN EARLY ISLAM, into the digital realm has been made possible through the diligent work undertaken by Mr. Anjum Jaleel. Mr. Jaleel is responsible for bringing the entire Zahra Publications library into eBook format. His incredible dedication and hard work has made this work possible.

HEALTH SCIENCES IN EARLY ISLAM is a pioneering study of Islamic medicine that for the first time made available new chapters of knowledge in the history of healing sciences. This work was published in two volumes in 1983 and, with the publication of this second volume, we

have now completed this eBook project. This book project covers the development of Islamic Medicine between the 6th and 12th centuries A.D. Transcending mere medical historiography, this publication offers a unique and authoritative account of the philosophy, history, methodology and practice of the Islamic health sciences.

This work provides an exceptional opportunity to scholars, researchers and students in such diverse areas as Islamic Studies, Middle Eastern Affairs, History of Medicine and Biomedical Education. It offers unique insight into the history of Islamic medical education, Arab medical historiography, biographies of eminent physicians, pharmacology, surgery, surgical instrumentation, therapeutics and preventive medicine.

This major academic work on the medieval Islamic world, which produced some of the greatest medical thinkers in history and made major advances in surgery, is a necessary text for all interested in understanding the great contributions made during the 6th to the 12th centuries A.D. This work must be a necessary part of any major academic institution or library interested in the contribution of Islam to Health Sciences.

Zahra Publications looks forward to receiving feedback from the readers of this text and hopes to continue publishing major works on Islam digitally.

Book Description

HEALTH SCIENCES IN EARLY ISLAM is a pioneering study of Islamic medicine that opens up new chapters of knowledge in the history of the healing sciences. This two volume work covers the development of Islamic medicine between the 6th and 12th centuries A.D. Transcending mere medical historiography, this publication offers a unique and authoritative account of the philosophy, history, methodology and practice of the Islamic health sciences.

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About Sami K. Hamarneh

Dr. Hamarneh was born on February 2, 1925 in Madaba, Jordan. He did his B.Sc. in Pharmacy in 1948 from Syria and his Masters in Pharmacology and Pharmaceutical Biochemistry in 1959. He was awarded a PhD from the University of Wisconsin. He retired as Curator Emeritus from the Division of Medical Sciences at The Smithsonian Institution in 1979. Dr. Hamarneh subsequently set up the Institute for the History of Arabic Sciences in Aleppo, Syria and then worked with the Faculty of Medical Sciences, Yarmouk University in Jordan. In his extensive research to collect the papers in this book, Dr. Hamarneh pursued original Arabic manuscripts in libraries throughout the world during a period of nearly thirty years. He passed away in Washington, D.C. on December 3, 2010.

FOREWORD

A Discourse on Health by Shaykh Fadhlalla Haeri

Man always seeks his own well-being. From the moment he is conscious of his existence he strives towards this end, attempting to improve his condition along a path of many diverse actions and circumstances. However, in order to attain ultimate well-being man must recognize that all these diverse occurrences must converge upon one state – a state of positive neutral consciousness.

In the same way as there is a direction in time moving from moment to moment, along a seemingly certain pattern, so there is a direction in the pursuit of this state of neutrality. Man's direction in the pursuit of health generally begins outwardly and moves inwardly. There is a parallel improvement in either condition. The less concern one has with outer physical health, the more one is free to attend to inner spiritual health; and that can only be achieved if one is fit and healthy.

We want to be free. Freedom, in fact, is another definition of this state of positive neutrality. Material freedom is sought by man so that he may survive and exist as a biological entity that has a prevailing influence over everything else. It is necessary for him to have outer well-being, but that alone is not sufficient in his quest for neutrality, because he is seeking something that is beyond his own horizon. How can he look at that horizon, let alone beyond it, if he is too preoccupied with his own immediate situation?

We are able to recognize the constant shifting from one extreme to another, from illness to wellness, yet we know there is a foundation of neutrality beyond this duality. In fact, the more we are in a state of stable neutrality, the more we see the extreme ends of the scale of duality. It is for this reason that the more the man of *tawhid* (divine unity) gains materially, the more he recognizes the necessity to debase himself in order to maintain a healthy balance. The man of wisdom also recognizes that the more he has genuinely debased himself, the more he will rise. This is the ecological reality.

Searching for longevity is a proof of the echo of everlastingness within man. But often this is misinterpreted and translated into a desire for perpetual youth. There is a contradiction in man's aspirations; he wants to have complete neutrality, yet he knows that every moment is

based on turmoil, for time arises out of dynamic movement and flux. It is through the light of his own consciousness that he may recognize the folly of this desire.

The man of wisdom recognizes that the solid foundation within him is beyond turmoil, because it is based on timelessness, on a cause that is unchanging. Our fixation with the outside is an indication that we are seeking the changeless, but this search lies in the wrong direction for the outside will always change. Our desire for perpetual life is a proof that we contain in us the essence of immortality. This desire, however, is perverted because it is impossible to preserve our bodies forever. Whether we like it or not, they exist in dynamic flux along the direction of time, from the womb to the tomb.

We have no choice but to seek health, and we should recognize that the purpose of outer health is to produce inner health, which cannot be maintained unless the immediate environment is in ecological balance with it. We would then realize that our immediate environment is not separate from the outer environment around us, from the overall environment, from the whole earth and from the whole universe. Hence we must recognize a universal health. If we start from the microcosmic health, we end up with the macrocosmic health. Therefore, if we want to be healthy we must want to heal those around us. Balanced outer health will eventually lead to inner health. If we maintain full outer health, we increase the possibility of inner health. For the inner self, conviction is its health, vigilance its wakefulness, indifference its slumber. Self-knowledge is its life, and self-ignorance its death. If we feed and nourish the self-knowledge, which is already ingrained in each individual, ignorance will vanish. The result will be complete harmony between the outer and the inner.

We find throughout history that a high degree of respect was always shown both to men of inner and outer knowledge. They were often combined in the same men, for those of inner knowledge were also endowed with much outer knowledge, including the knowledge of outer health. They were men who could nourish people's hearts and reassure them that this transitory existence is only an aspect of the endless existence of Reality, that there is One Cause behind all of these effects – Allah, from Whom everything emanates, by Whose Grace everything is supported, and to Whom everything will eventually be returned. This knowledge is connected with the state of equilibrium and neutrality which was mentioned earlier.

Islamic Medicine takes you into that state of neutrality. It is all based on the Qur'an, on that which is real and permanent, because we are all seeking permanency. Islamic Medicine is the

medicine that is going to cure us. The man of submission recognizes that this world is a laboratory into which we have come in order to learn the meaning of purity. It is another stage of growth within us. First there is growth in the womb of which we are unconscious, then there is growth outside the womb of which we are conscious. What we are conscious of is the problem; we may, for example, be conscious of nothing other than confusion. We cannot be separate from our cause. The effect has come from that cause. The cause permeates all and is closer to us than our jugular vein.

The seeker of reality views this world as a hospital in which he is a patient. Whether we like it or not, we are here to achieve ultimate well-being, which is to drown in the well of Oneness so that we see nothing other than the One Cause behind what appears to be confusion. The real *hakims* were seekers of Reality. They believed that life is from the Most Beneficent, the Most Glorious Creator, and that if we say there is nothing other than His generosity and His all-encompassing mercy, then we take wisdom wherever it comes so long as it is recognizable along the path of *Shari`ah*. They therefore collected outer knowledge from many lands – from Egypt, Greece, Rome, India, China – and unified it to obtain the best prescriptions.

These great men of Islamic Medicine had the strongest spiritual motivation for their work – they themselves wanted to be cured. They were striving for that state of equilibrium and they recognized that the only way they could reach their goal was by abandoning the so-called 'self' in the path of service. Their work was for them a vocation and an aspect of worship, rather than a profession. They wanted health for themselves, so they also wanted it for others. They were the instruments of the divine justice and love of the Creator, for by bringing people into outer health they enabled their patients to recognize that there is nothing higher than the Health-Giver.

The hearts of these practitioners were motivated by generosity and by the joy of serving others. They were not archivists who wanted to collect what everybody said and categorize it for the sole purpose of creating books. Their books served either to gather the information they themselves needed for their work or else to disseminate the knowledge to their students. Their knowledge and information was an integrated part of their life, unlike we today who talk about Islamic Studies yet do not live the teachings of Islam. We merely pretend to be the followers of the blessed Prophet, who prayed that Allah give him usable knowledge. Islam is about practicality. Islam is about living fully and joyfully here and now, while retaining that recognition that this existence is temporary and there is a next experience that is beyond time.

If we start from the premise that we, in this world, are moving along a unified direction towards a state of positive equilibrium, we can only be horrified by the current state of medical practice. We find that over the last few decades our doctors have moved more into the area of suppressing symptoms rather than treating the cause of our maladies. The use of 'wonder drugs' minimizes the human contact between doctor and patient, reducing the former's role to little more than a dispenser. The arrogance of our medical profession has caused there to be a false emphasis on outer appearance. Everything looks beautiful – the teeth gleam, the hair shines, but if we touch them they fall to pieces because they are not real.

The reason for this movement towards suppression of the symptoms rather than treating the cause is that modern men of medicine do not see the ecological inter-connectedness of everything. This is why they fragment medicine into small individual disciplines. Furthermore, once the profit motive enters medicine it ceases to heal, for the patient's overall cure can only come from those who recognize that they want to be cured themselves. The doctor must recognize that inherently he is sick and that his own and others' ultimate objective must be the knowledge and recognition of the one and only Reality.

At all times man is at a loss. His lower tendencies are always there, dragging him down towards the animalistic levels within him, but he also knows that he contains a higher, divine consciousness which he wishes to reach. The way to that higher self is through the path of service. In the service of others he himself is spontaneously elevated; he moves into the realm of abandonment, into that positive neutrality. He recognizes experientially that the more he gives, the more will come to him. The more he is generous, the more the one and only generous Creator will shower him with blessings.

Allah in His Mercy wants to unify what is in us with what is outside us. If we say we believe in Allah, then Allah will afflict us to allow us to witness ourselves, to see whether we truly mean what we say and do what we say we will do. If a person claims to be adhering to the basic tenets of Islamic healing, he must himself profess the abandonment of Islam. If he is in that abandonment he will have total trust in Allah. If he is worried or unhappy, that is his own doing, for at that moment of concern, worry or unhappiness, he is not in a state of full abandonment.

The great *hakims* would often find the medicine close to where the illness lay. They believed that where there is the action there is also the reaction. There is always a solution close to every problem. These *hakims* went to the source of the problem, transforming it, rather than treating its

outer effect as happens more and more in our system of medicine today. Islamic Medicine is far more difficult to practice. It takes inspiration, perspiration and abandonment to reach the root of the problem and unify the cause with the effect.

Through the publication of *'Health Sciences in Early Islam'*, Noor Health Foundation hopes to increase the breadth of the platform from which it will serve. It is a platform based on the belief that no one in this creation is separate from the cause of their existence – every effect is a manifestation of its cause. We are all from the one and only Cause. We are all created by one Creator. We are all sustained by His mercy through diverse ways. The more we can share together on that platform of service and abandonment, under the umbrella of true submission and following in the footsteps of the blessed Prophet, the more we will have a safer and healthier path through this life. Those of us who are endowed with better health and more time and energy will be given more and more of these delights, provided we adhere to the path of abandonment and service.

We hope that this book will help lead to the practical revitalization of our heritage. This will only happen if we claim the knowledge of our forefathers in the correct way. If we inherit something whose value we do not fully comprehend we will end up only talking about it and relegating it to museums. This has hitherto been the fate of the Islamic Sciences, which is a contradiction of the spirit in which they first evolved. They were part of a unified approach to knowledge, derived from the inspirations of men of abandonment. They did not come about in the usual, acquisitive, categorizing manner. There is nothing wrong in categorization provided it is used as an instrument through which a desired objective may be achieved. Nowadays, however, the business of writing and researching has become an end in itself. This is why we find such a big difference between the academic arena and the field of action.

This book supports the ultimate goal of man, which is to live a life of spirituality, a life which is in every sense healthy. With this book, Noor Health Foundation hopes to create interest in a unified approach to the healing arts, and to move hearts to recognize the bad situation into which we have inadvertently fallen by ignorantly renouncing the path of those who knew, the path of the seekers of Reality who went before us.

May Allah bless all those who will benefit from our attempts. May Allah purify our intentions and those of our publishers, who have worked with us. May Allah increase the strength of all of those who will be involved in this endeavor along the one and only path of safe

conduct. May Allah show them that the knowledge of the way lies from within and that its boundaries are the most glorious. May Allah give us the protection so that we recognize the one and only Reality behind everything.

INTRODUCTION

History of Islamic Medicine – An Introduction

The explication of conceptual and methodological basis of Islamic Medicine as the record of its past achievements constitute a challenge to the historians of biomedical sciences. For nearly one thousand years, the form and the content of this medical system have been vigorously pursued, imbibed and practiced in the West – ranging from outright plagiarism of the original Arabic texts in the pre-Renaissance period to the late eighteenth-century studies of Muslim masters across the Western medical institutions. However, when it comes to Islamic Medicine, a curious mixture of silence or a grudging acknowledgement of the historical debt is all that is offered by the historians. Whether this fallacy is a manifestation of the prejudice against things Saracenic or a later attempt for the maintenance of cultural hegemony, intellectual fairness demands that historical justice should prevail.

Beginning with the early twelfth century *Hijra* (eighteenth century C.E.), Islamic Medicine showed a decline in much of the Muslim world, perhaps as a corollary of the colonial rule. The modern medical system, based on mechanistic models and characterized by divisive and fragmented strategies, gradually started taking roots. For a while, the modern medical technology appeared to be outshining the time-honored holistic healing approaches of Islamic Medicine. It must be remembered, however, that in spite of two long centuries of colonial rule with a concomitant sway of the modern biomedical technology, Islamic Medicine could not be wiped out from Muslim lands. In greater part of the rural settings, it still holds the prominence and is beginning to stage a comeback at conceptual and thematic levels, as adjudged by a bibliographical survey of the recent Muslim literature (see *A Select Bibliography on Islamic Medicine*, this volume). Needless to say that a tremendous amount of intellectual groundwork, that spans from a redefinition of epistemological and methodological approaches to the development of appropriate biomedical technologies, is called for if Islamic Medicine is to resume its role as the greatest unifier of human knowledge.

Noor Health Foundation

In an attempt to find ways and means to revitalize interest in the historical role and futuristic applications of Islamic Medicine, the Foundation was incepted in the year 1402/1982. The

Foundation has sponsored a few modest projects, including the establishment of health clinics in the Muslim world, publication of preventive medical education material in vernacular languages, and the development of a depository of rare medical manuscripts for future research and reference. To further the cause of Muslim biomedical scholarship, the Foundation has sponsored publication of present work in the hope of making a contribution towards this great arena of Muslim endeavor.

NHF Monographs

The foundation has established a network of prominent Muslim biomedical who act in an editorial advisory capacity for the development of its program of scholarly publications. A list of members of the Editorial Board appears elsewhere in this volume. The present two-volume work, *Health Sciences in Early Islam*, is based on the collected papers of Sami Khalaf Hamarneh, Curator Emeritus, Division of Medical Sciences, The Smithsonian Institution, Washington, DC. The interest in publishing the present collection developed when this author learnt of Hamarneh's rather premature retirement from the Smithsonian Institution in 1979. First in Washington, DC, and later in Los Angeles, several meetings paved the way for this project. Hamarneh's preoccupation with the newly-founded Institute for the History of Arabic Science in Aleppo, Syria, delayed this project. However, once the Institute and its *Journal* got off the ground and the work was resumed, we realized that our search for a publisher was a futile one. Even Hamarneh's impeccable credentials for scholarly publishing did not do the trick! It was through Shaykh Fadhlalla Haeri's enthusiastic support that an agreement was reached to publish this collection as the premier volumes of *NHF Monographs*.

The papers included in the present collection were published over a period of more than two decades in various international journals. For the sake of uniformity of style, these papers underwent a long and tedious process of editing that involved extensive revisions, deletion of repetitious statements, and many appropriate additions. It must be pointed out that unlike other volumes of 'Collected Papers' that are no more than photo-mechanical reproductions of the original, these papers are distinguished by the following features:

1. Inclusion of *Hijra* dates (approximate) for quick comparison with the Common Era dates.
2. A standardized and uniform phonetic transliteration of Arabic words.

3. A total of eight subject groups with four groups to a volume, followed by the relevant papers in chronological order of original publication.

4. Individualized format with complete bibliographical and copyright information, constituting self-contained papers.

5. The use of standardized Arabic names of authors, i.e., instead of using an-Nafis for Ibn an-Nafis, a major linguistic fallacy, otherwise so prevalent in the Orientalistic literature, has been avoided.

6. Non-cumulative text citations to facilitate individual references for source material.

7. A uniform citation system with little or no abbreviations.

Those who cherish the fruits of human labor and are receptive to a shared cultural heritage, would find an immense wealth of information that has become available to us through Hamarneh's pioneering study of the original Arabic manuscripts. As an index of his life-long meticulous endeavor to dispel the common Western notions, these papers offer a refreshing view of Islamic Medicine. May Allah guide us all to the right path.

Munawar A. Anees
Director
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A Select Bibliography on Islamic Medicine

Islamic Medicine appears to be gaining more patrons than ever before. Over the last three years, at least three international conferences were held: two in Kuwait, and one in the United States. The First International Conference on Islamic Medicine in Kuwait led to the formulation of the *Kuwait Document*, that was to serve as an equivalent to the Hippocratic Oath for Muslim medical professionals. In order that the recommendations of the First Conference are implemented, the International Organization of Islamic Medicine was incepted and the following year, in 1982, the second conference was held in Kuwait. A comparative study of the two conference proceedings indicates that the euphoria at the time of the first conference did fade away. It is yet to be seen what happens at the third conference scheduled to be held later this year[1] in Turkey. The American conference sponsored by the Islamic Medical Association of the United States and Canada too appeared to be euphoric as noted by the outcome reflected in the conference proceedings. The *Kuwait Document* fails to incorporate the norms of current medical practice in their entirety and hence, is far removed from meeting the challenge, say, posed by modern advances in molecular biology, recombinant research and reproductive biology. Instead of attempting to update the code of medical ethics in contemporary terms, it remains an outdated archival work – in that sense truly an equivalent of the Hippocratic Oath.

On the publishing scene, especially in the West, *Journal of Islamic Medical Association* (USA) has been able to sustain itself for more than a decade, though with irregular frequency and unpredictable quality. A proposed in-depth study of the history of Islamic Medicine is yet to see the light of day. Recently, Islamic Press Agency started a monthly from its London office: *Islamic World Medical Journal*. It differs from the latter only in the sense that a far greater number of papers are authored by the Western medical professionals, mostly British. Like its predecessor, *JIMA* (USA), what makes it 'Islamic' is the inclusion of one or two short papers on the history of Islamic Medicine or interpretation of the modern biomedical phenomenon in the light of the Qur'an and the Hadith. National medical associations such as those in Britain, Pakistan, or South Africa have not yet advanced beyond the level of in-house newsletters – 'for members only.'

[1] i.e., 1983.

Recent history records a far greater success for the institutionalized work carried out single-handedly by Hamdard National Foundation in Pakistan. Through a vast network of clinics and a regular system of publications, the Foundation has played a major role in retaining some of the original flavor of Islamic Medicine. Pakistan is perhaps the only country where it is an officially recognized profession that enjoys support from the masses as well. A sister organization in India, Institute for the History of Medicine and Medical Research, has been engaged in similar activities.

The current interest to 'patronize' Islamic Medicine has inevitably given way to a greater volume of papers, proceedings and other publications. A recent bibliographical compilation by Z.M. Agha incorporates a number of works in Muslim-majority languages such as Arabic, Urdu, Turkish etc., which were left out in the previous works of either Hamarneh (1964) or Ebied (1971). Given the consolation of a renewed numerical 'strength,' what are the substantial gains over the last three or four decades of publishing that the said compilation attempts to cover?

In the course of present compilation, the bulk of citations were left out, not for reasons of space or time, but for demands of sanity. It became obvious that the majority of works were either fanciful attachment to the 'glorious' past of Islamic Medicine, or half-heartedly written 'rejoinders' for the attention of orientalists or philologists, like Manfred Ullmann, whose competence for medical writing is not documented by their training. The present compilation is, therefore, limited to Muslim authors who have either remained safe from these 'pitfalls' or have somehow attempted to construct a thematic or conceptual framework for Islamic Medicine in rather contemporary terms. Not that our opinion constitutes a denial of historical validity of the role of Islamic Medicine but the fact is that over-emphasis on the 'bygone glory' without well-documented studies on hundreds of thousands of Muslim medical manuscripts becomes self-defeating.

The present compilation strongly points to a dire scarcity of the material objectively elaborating the conceptual basis of Islamic Medicine that is there with its uniqueness and at once compatible with the medical realities of the day. Islamic Medicine is not limited to the rules for ablution or prohibition of pork. It goes far beyond that. In our quest for a viable system for the practice of Islamic Medicine, we must go to its theory – the Qur'an and the Sunnah. It is of little help to seek medical 'facts' from these two sources; what is to be sought are the normative guidelines and a way for their application. In a sense Islamic Medicine sums up the totality of

our way of life, an index of our quality of life. Its fabric is enmeshed in the Muslim society and culture. The future of Islamic Medicine rests with our abilities to evolve a balanced and harmonious framework – something that nourished it fourteen hundred years ago.

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MUNAWAR A. ANEES

Early Muslim Pharmaceutical Instruments*

Abu al-Qasim az-Zahrawi,[1] the renowned Muslim physician-surgeon, flourished during the last part of the fourth/tenth century in Muslim Spain.[2] He was born in or after 324/936 – the founding year of the royal city of az-Zahra near Cordova, which gives him his nickname – and died about 403/1013. At this period, Spain reached its golden age under the Umayyah caliphate and enjoyed a remarkable increase in cultural productivity.

The fame of az-Zahrawi rests upon his encyclopedic work of *at-Tasrif*.[3,4] This accomplishment in the health field was probably the first of its kind – with such a wide scope and outlook ever to be undertaken in Muslim Spain. *At-Tasrif* contains originality, and personal, thoughtful observations. As a comprehensive textbook, it presents a manual for instruction and consultation by students and practitioners alike. A fascinating feature of this work lies in the instructional drawings (originally made by the author himself) depicting pharmaceutical equipment.

Pharmaceutical Illustrations

In comparison with other parts of *at-Tasrif*, the treatises to which Western literature most often refers are the 30th treatise on surgery and the 28th, in Latin mainly known under the title, *Liber Servitoris*.[5]

Three drawings displayed in the manuscript versions of the 28th treatise are strictly related to pharmacy. Their significance lies in the fact that they were intended more as illustrations of pharmaceutical pieces than as ornamentation of the manuscript.

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[1] The full name of this celebrated figure is Abu al-Qasim Khalaf Ibn `Abbas az-Zahrawi, who is generally known in the West under the distorted, translated name of *Abulcasis*.

[2] Spain, or al-Andalus as known in Arabic literature, is the part of the Iberian peninsula that was under Muslim rule. At az-Zahrawi's time this part constituted the largest portion of the whole peninsula.

[3] The full title of this encyclopedic work is *at-Tasrif liman `Ajiza `an at-Talif*, which embraced 30 treatises. In size, two of these treatises (including the surgical) are approximately as large as a 350-page book, while the smallest in size does not exceed the length of a 15-page article; the rest lie in between.

[4] The University of Wisconsin bought microfilms of these Arabic manuscripts primarily for post-graduate research in the history of pharmacy. In the tedious preparation of this paper the following manuscripts were consulted: Eli Emiri Arabi No. 2854, Veliyuddin No. 2491, and Besir Aga Nos. 502 and 503, all of which are housed at the Suleymaniye Umumi Kutuphanesi in Istanbul, Turkey. Here I wish to extend my deep appreciation to the above-mentioned library for allowing the microfilming of these manuscripts for research and publication.

[5] *Liber Servitoris* was the first Latin translation among the treatises of *at-Tasrif* to appear in print. It was published at Venice in 875/1471.

The first two are drawings of molds – made of ebony or other kinds of wood, of ivory or of grinding stone – for making tablets. The chosen piece of wood, for example, two fingers in thickness (as suggested by az-Zahrawi), is cut vertically in two halves. Then, circles equal to the size of the desired tablets are drawn upon both halves and each circled area is engraved to half the height of the tablet. A mirror image of the name of the manufactured tablets may be inscribed into one side of the mold, so it will be imprinted on each finished tablet. These engravings are painted with a convenient *duhn*,[6] similar or supplementary to the manufactured medication, which probably was used also as a lubricant to prevent sticking in the molds.

In finishing the molds to make the tablets of an exact weight, az-Zahrawi recommends the following procedure: Press a small portion of the kneaded material into the mold while soft, and then weigh it. If it is lighter than the required weight, continue to widen the engravings in the wood until the pressed tablet reaches the required weight.

The third and last pharmaceutical drawing comes under the title: 'How to Strain Decoctions and the Illustration of the Strainers *al-Marawiq*.' It includes three strainers. The first, the smallest in size, is made of thin, porous cloth. The second is larger than the first and is made of less porous cloth; while the third, the largest, is made of thick, cohesive cloth.

The triple strainer was used in this way – the medication was first cooked into a decoction and macerated, then strained through a sieve made of hair. Meanwhile, the strainers were arranged so that one would be suspended over the other, with the coarsest on the top and the finest at the bottom. Then, into the top strainer, a fluffy (carded) piece of washed palm fibers or horse hair was placed. Thereafter, the decoction was poured in and strained from the first to the second to the third. From this last strainer the filtrate was collected in a receiving vessel underneath. The lees was then discarded while the clear filtrate was taken for use either alone or mixed with certain syrups.

[6] The *duhn* is not only the oil of a medicinal plant, as generally accepted, but is the potent fatness of the oily essence that could be extracted by pharmaceutical processes from substances of plant, animal or mineral origin, for internal or external medication.

Surgical Illustrations

In the West, the name of az-Zahrawi reached its highest renown a little while after the translation of the 30th treatise of *at-Tasrif* into Latin in the second half of sixth/twelfth century.[7]

Besides its clear description of surgical operations and technique, this last treatise of *at-Tasrif* displays more than 200 beautiful illustrations of the surgical instruments that were used in the various surgical manipulations, drawn by the author himself (as stated in the introduction).[8] These instrumental drawings – the earliest of their kind we know to have survived – together with the informative text attached to each for the purpose of instruction[9] represent the notable advance in surgery attained by az-Zahrawi.

Although other parts of *at-Tasrif* were translated and favorably considered in the West; nevertheless, the surgical treatise held the greatest attention.[10] As a result of its popularity among Western surgeons it played an appreciable role in the development of rational surgery in that field throughout the late Middle Ages.[11]

The first part of the 30th treatise contains 56 chapters concerning the curing virtues of 'fire' used in cauterization and its advantages and disadvantages.[12] Several simple drawings of instruments are described, together with the method and kind of operation as well as place where cautery is to be applied. The treatise often refers to the need for marking the area to be cauterized with ink so it can be identified easily at the time of the operation. In addition, az-Zahrawi frequently mentions the medication recommended for use after the operation.

Chapters 12 to 16 display a number of crescent-like, olive-shaped, and nail-like cauteries. The 'nail' type may have one thin, pointed end, one straight or concave edge, or have two extended (branching) prongs. These instruments are designed for operations on eye ailments.

[7] The translation of the 30th treatise was carried out by Gerard of Cremona, at Toledo, Spain, This translation was the basis of others in Latin and in the Provencal languages.

[8] Veliyuddin manuscript No. 2491, fol. 105 v.

[9] Ernest F. Gurlt, *Geschichte der Chirurgie und Ihrer Ausubung Volkschirurgie-Altertum-Mittelalter-Renaissance*, Berlin, 1, 621 (1898).

[10] Heinrich Haeser, 'Lehrbuch der Geschichte der Medicin und der Epidemischen Krankheiten,' *Jena*, 1, 587 (1875).

[11] Lucien Leclerc, *Histoire de la Medecine Arabe*, Paris, 1, 437, (1876).

[12] Johannis Channing, *Albucasis de Chirurgia Arabica et Latine*, Oxford, l,x,8 (1778).

Others are used in sciatica (chapter 41) and a variety of ailments of the whole body 'form head to foot.'[13]

In reference to small surgery, az-Zahrawi gives a valuable account on circumcision in the second part of this treatise (chapter 57). He criticizes certain errors commonly perpetrated in such surgery, and recommends the use of the scissors and thread (sutures), which, 'through personal experience I found to be of advantage'. 'The two blades of the scissors being equal,' the author explains, 'make a straight cut (in the skin) at one time,' and the thread helps to tie up the wound.

Of interest also is the warning by az-Zahrawi against allowing the child (especially when he is old enough to be frightened of surgery) to see the surgical instruments. Such discernment in handling the patient suggests a psychological, rational approach important to the success of the operation.

In chapter 58 there is a discussion of retention of urine in the bladder, caused (according to az-Zahrawi) by a stone, blood clot, an opening, or a growth of the flesh (tumor). The operation is carried out by a hollow, smooth silver catheter with the thinness of a probe ending with a small funnel. The figure of the instrument is beautifully displayed in the text.

In the following chapter the author describes a syringe for injecting liquid into the bladder. Although the illustration is primitive, it indicates a step toward our modern syringes.

Conclusion

The illustrations explain in part the character of *at-Tasrif* as a textbook and the interest the author shows in regard to surgery and pharmacy. His minute, detailed description of pharmaceutical processes and equipment is a proof of his concern and appreciation for their significance.

It can be easily shown from the contents of the entire work of az-Zahrawi that no matter how interesting the 28th treatise (*Liber Servitoris*) may be, it represents only a fraction of what the author had to say about pharmaceutical techniques, forms and equipments, and about the therapy and *materia medica* of the time. These studies, it seems clear, occupy a primary place in a majority of the treatises contained in *at-Tasrif*.

[13] *Ibid.*, 6.

After a close examination of the three purely pharmaceutical illustrations from az-Zahrawi, the question immediately arises as to whether these drawings were the earliest of the kind to have survived, as seems to be the case with his surgical illustrations intended for the promotion of efficiency and skill in pharmaceutical practice.

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The Rise of Professional Pharmacy in Islam

The emergence of professional pharmacy in Islam as a separate entity from medicine has followed almost the same pattern of development as that which modeled other branches of the health field. However, there was no clear governmental legislation to prohibit the pharmacist from diagnosing and giving medical treatment to his customers or to restrict the physician from compounding and dispensing drugs to his patients. The charlatan and uncultured from both professions,[1] not only in rural areas but also in cities, prevented pharmacy from attaining professional status. Nevertheless, in larger hospitals and centers close to governmental supervision, retail pharmacists as well as those in hospital and government service enjoyed recognition and prestige.

The first/seventh century saw the institution and the expansion of the Muslim world. In the early second/eighth century, Muslim military power reached its climax under the Umayyah dynasty in Damascus. Then the `Abbasiyyah rulers took over (123-655/750-1258), and the center of activity moved from Syria to Iraq, where a new era of cultural progress shortly started.

Under caliph al-Mansur (136-158/754-775), medicine as well as other fields of learning had a strong impetus to develop. With no discrimination for reasons of race or faith, the caliph encouraged physicians, astronomers, mathematicians, architects, and other learned men to cultivate their talents and help to advance intellectual pursuits. Notwithstanding, the first eight years of al-Mansur's reign were spent in laboring to stabilize and consolidate the empire. Meanwhile, he accumulated enough riches to launch, in 144/762, the building of his new capital city Baghdad, which he called *Madinat as-Salam* (the city of peace).[2] It took over four years to complete this magnificent city,[3] which was destined to become not only the seat of a great

[1] In his *Kitab `Uyun al-Akhbar*, 2, Cairo ed., 1925, pp. 100-104, `Abd Allah Ibn Qutaybah ad-Dinawari (d. 276/890) ridicules the irrational approach of untrained practitioners of the time. Ar-Razi (d. 312/925), in the introduction to his treatise *Fil-Adwiyyah al-Mawjudah fi Kuli Makan*, mentions how uneducated physicians of Iraq prided themselves in memorizing the names of a variety of drugs in order to impress their customers by their 'comprehensive' learning. For this reference I wish here to express my gratitude to the library of Yale University for allowing me to consult the Arabic manuscript No. 21052, item 2, of the work mentioned above. For further information on the part played by charlatans during the Middle Ages, see Heinrich Schipperges 'Der Scharlatan im Arabischen und Lateinischen Mittelalter,' in *Zur Geschichte der Pharmazie*, 12, No. 2 (1960), 9-13.

[2] Details regarding the establishment and description of this celebrated round city is to be found in Isma`il ad-Dimashqi, *al-Bidayah wan-Nihayah* (10, Cairo, 1933), 96-97; and Ahmad al-Baghdadi, *Tarikh Baghdad* (Cairo, 1931), 66-82.

[3] Hitti, Philip K., *History of the Arabs* (6th ed., London, 1958), 292-293.

empire, but also the center of tremendous cultural activity which kept the torch of learning shining brightly for centuries.

The establishing of the first privately owned apothecary shop, marking the beginning of pharmacy's independence from medicine, has been discussed by a number of eminent historians of the health profession. Many reported[4] Baghdad to have been the site in 136/754 or about 132/750 of the first pharmacy shop as the precursor of our modern drug store.[5] But one need not emphasize the inaccuracy of such dating; for, as we have explained, Baghdad was founded and completed only a little over a decade later. These dates were presumably reported because one coincides with the rise of the `Abbasiyyah dynasty and the other was al-Mansur's inaugural year. We see, therefore, the need for a fresh study of the incentives to, and the nature of, the rise of this profession and its consequent development in each particular area of the Islamic world. The present paper is an attempt to throw light on this issue which is so vital to the history of pharmacy.

Early Arabic sources mention the existence of privately owned pharmacy shops (*Dakakin as-Sayadilah*) during the reign of al-Mansur's son, caliph al-Mahdi (158-168/775-785), not very far from the area where the royal palace was located in Baghdad.[6] But a careful study of the records shows that these shops were owned and operated by drug-sellers with no real academic training. They owed their knowledge of the profession rather to wide experience in drug compounding and dispensing. In addition, they practiced the organoleptic method of urine analysis for diagnosis, a practice followed by practitioners until early modern times.

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[4] For some insight into this phase of historical investigation I am indebted to Professor Glenn Sonnedecker of the University of Wisconsin, who encouraged me to consult original sources related to the history of Arabic pharmacy. I also wish to thank Dr. Ernst Stieb for checking with me the major works of the nineteenth and twentieth centuries which discuss the rise of professional pharmacy.

[5] See, for example, C.J.S. Thompson, *The Mystery and Art of the Apothecary* (London, 1929), 80; Giulio Conci, *Pagine di Storia della Farmacia* (Milan, 1934), 351; L. Reutter de Rosemont, *Histoire de la Pharmacie a Travers les Ages* (I, Paris, 1931), 123; J. Berendes, *Die Pharmacie bei den Alten Kulturvolkern* (Halle, 1891), 120-122; and Maurice Bouvet, *Histoire de la Pharmacie en France* (Paris, 1937), 29-30.

[6] Wuestenfeld, Ferdinend, *Geschichte der Arabischen Aerzte und Naturforscher* (Gottingen, 1840), 12, Wuestenfeld apparently relied mainly on the report by Ibn Abi Usaybi`ah (599-668/1203-1270), *`Uyun al-Anba fi Tabaqat al-Atibba* (see 2, Beirut ed., 1957), 79-84, and probably on `Ali b. Yusuf al-Qifti (567-645/1172-1248), *Ikhbar al-`Ulama bi Akhbar al-Hukama* (see Cairo ed., 1908), 280-283.

Among this class of uneducated pharmacists (*Sayadilah*) was `Isa Abu Quraysh, who, in examining a bottle of urine one day, predicted the birth of a male child,[7] an early unscientific method for diagnosing pregnancy and determining the sex of the embryo through the analysis of urine. Mention is also made of other contemporaries of `Isa such as Masawayh,[8] the father of the famous physician Yuhanna b. Masawayh (Mesue the elder); Ishaq,[9] the father of Hunayn; and Sahl,[10] the father of Sabur, the author of the first known Arabic formulary for the use of pharmacists in hospitals and retail drug stores.[11] All of them, we are told, were pharmacists, but we are sure they had no academic training in the profession. The reports of at least two of them show that their knowledge of drugs was only through practical experience.[12]

The ambitious beginning under the Eastern Caliphate in Iraq led, in the first half of the sixth/ninth century, to the rise of a new class of true pioneers of educated pharmacists fully alert to the ethical and technical responsibilities of their calling. It is no surprise, for the expansion of the drug and spice trade, the acceleration in the translation of a great number of invaluable medical works into Arabic, and the vigorous intellectual endeavor then cultivated and promoted in Islam, had brought new challenges and opened new avenues of cultural achievements. It also gave rise to a precise and improved synthesis of ancient learning and to the accumulation of new knowledge which made specialization, particularly in the health field, inevitable.[13] Oculists,[14]

[7] Leclerc, Lucien, *Histoire de la Medecine Arabe* (I, Paris, 1876), 121.

[8] Sarton, George, *Introduction to the History of Science* (Baltimore, Md., 1927), 574; and Khair Allah, Amin A., *Outline of Arabic Contribution to Medicine* (Beirut, 1946), 105.

[9] Brockelmann, Carl, *Geschichte der Arabischen Litteratur* (I, Leiden, 1943), 224.

[10] Ibn Abi Usaybi`ah, *`Uyun*, 2, 98-100; and Bar Hebraeus, *Tarikh Mukhtasar ad-Duwal*, ed. Antun Salihani (Beirut, 1890), 239, 250.

[11] Ibn an-Nadim, *al-Fihrist* (Cairo ed., 1930), 427.

[12] See Leclerc, *Histoire*, I, 103-104, 111.

[13] M. Boubaker Ben Yahia, 'Apercu sur la 'Periode Arabe' de l'Histoire de la Medecine,' *Les Conferences du Palais de la Decouverte*, Series D, No. 19 (Paris, 1952), 35.

[14] Ibn Abi Usaybi`ah, *`Uyun*, 2, 116-117, reports that the well favored Jubra'il al-Kahhal, the oculist of al-Mamun (reigned 197-217/813-833), was equipped with the necessary tools of the oculist to perform his work efficiently. However, charlatans known as the highway oculists (*Kahhalu at-Turuqat*) were numerous and eloquent in advertising their skill and products. They prepared eye-salves from starch and gum Arabic (acacia) colored with red by the addition of minium (red oxide of lead), green by curcuma (kurkum) and yellow by saffron. They also made other eye remedies from the Egyptian ban dissolved in gum mucilage or from the burned seeds of myrobalan mixed with pepper for spraying into the eye. Ahrnad `Isa, *al-Bimaristanat fil-Islam* (Damascus, 1939), 54.

surgeons,[15] alchemists,[16] and educated pharmacists,[17] besides skilled physicians, are reported to have been active in their respective fields. Thus, Castiglioni states[18] that pharmacy 'began its scientific existence with the Arabians because of their special inclination to chemical studies and the great abundance of valuable drugs' pouring into the markets of Islamic cities from countries of the Middle East and the Orient. During the reign of al-Mu`tasim (217-230/833-845) it was reported[19] that educated and morally responsible pharmacists (*Sayadilah*) were granted licenses to operate their own drug stores near army camps, while uncultured drug sellers and quacks were forbidden such privileges. It must be immediately stated, however, that throughout this whole period the two classes existed side by side in all branches of the healing arts.[20] As a result, many eminent physicians preferred to compound their own medicines, or had assistants to do the job under their supervision, rather than write them on prescriptions to be prepared in privately owned pharmacy shops in which they were not always sure of the man in charge. Moreover, the great prestige attained by learned physicians from the rulers and the upper class enticed the ambitious students to seek specialization in the healing art without limiting their career to the practice of pharmacy alone.[21] Therefore, whatever experience they had in the compounding of simples they used in the preparation of medicines for their patients, except for the larger variety of *materia*

[15] Hunayn b. Ishaq translated the surgical writings of Galen and wrote some of his own on the eye. Others as `Isa b. Masih and Ibn Masawayh wrote on minor surgical manipulations. See Sarton, *Introduction*, I, 611; Ibn Abi Usaybi`ah, *`Uyun*, 2, 136-141; and al-Qifti, *Ikhbar*, 249.

[16] No doubt alchemy was widely practiced in Iraq during the third/ninth century. An alchemist who is said to have worked for al-Mamun (197-217/813-833) was Yusuf b. Laqwah, al-Qifti, *Ikhbar*, 129. We also read of Ya`qub al-Kindi (d. 259/873) who criticized in his writings those who believed in the possibility of transmuting lesser metals into gold or silver. See Hajji Khalifah, *Kashf az-Zunun `an Asma al-Kutub wal-Funun* (2, Cairo ed., 1858), 196.

[17] Al-Qifti, *Ikhbar*, 129; in his treatise on *al-Adwiyyah al-Mawjudah* (see note 1), ar-Razi refers to the pharmacist (*as-Sayadilah*) who specialized in the knowledge and compounding of various drugs. Also Vida, G. Levi Della in his article 'A Druggist Account on Papyrus,' *Archaeological Orientalia in Memoriam Ernest Herzfeld*, ed. George C. Miles (New York, 1952), 150-151, studied a record of purchase or sale written on this papyrus of a third/ninth-century educated pharmacist; several pharmaceutical preparations are mentioned.

[18] Castiglioni, Arturo, *A History of Medicine*, tr., E.B. Krumbhaar (New York, 1941), 281.

[19] Ibn Abi Usaybi`ah, *`Uyun*, 2, 92-93; and Bar Hebraeus, *Tarikh*, 244.

[20] This is why *al-Muhtasib*, the government officer authorized to inspect shops and markets against all kinds of fraud and adulteration, included in his varied responsibilities the inspection of the shops of pharmacist, and *`attarin*. He was also supposed to instruct and admonish practitioners in all branches of healing to perform their services to the best of their ability and to punish any misconduct. See Muhammad b. al-Ukhuwwah, *Ma`alim al-Qurbah fi Ahkam al-Hisbah*, ed. Reuben Levy (Cambridge, 1938), 7, 80-86, 115-123, 150-169; and `Isa, *al-Bimaristanat*, 57-58.

[21] Many started their careers in the apothecary shop before turning to the practice of medicine. The celebrated poet Abu Nuwas (139-197/757-813) was sent by his widowed mother first to work as an apprentice in an apothecary shop at al-Basrah, Iraq. Then young Abu Nuwas turned to literature and poetry and deserted pharmacy. See Ahmad al-Iskandari, *et al., al-Mufassal fi Tarikh al-Adab al-`Arabi* (I, Cairo, 1934), 197.

medica and those popular pharmaceutical preparations which were normally sought at the apothecary shop.

During the third/ninth century, nevertheless, pharmaceutical literature reached a high standard of adequacy. Ibn an-Nadim mentions[22] a certain Riwaq as-Saydanani (the pharmacist) who wrote one of the earliest Arabic works on pharmacy, *Kitab as-Saydanah* (*Book of the Apothecary Art*), which apparently is lost. Yuhanna b. Masawayh (d. 242/857)[23] as well as Ya`qub al-Kindi (d. 259/873) wrote[24] treatises closely related to the art of pharmacy. But unlike *al-Aqrabadhin al-Kabir* of Sabur (d. 255/869), theirs could hardly be classified technically as formularies. Yet such works demonstrate the authors' acquaintance with, and interest in, pharmaceutical and chemical techniques. Of great importance to pharmacy in particular, however, was the translation of Dioscorides' *Materia Medica*[25] about the middle of the century. It enriched and enhanced the scientific approach to this art throughout the period. Then about the turn of the century Muhammad Ibn Zakariyya ar-Razi (d. 312/925), the greatest clinician of Islam and a pioneer chemist, wrote[26] several chemical and pharmaceutical treatises of great value to the profession which he acknowledged as separate from medicine. This was over a century before Abu ar-Rayhan al-Biruni (362-439/973-1048) wrote his monumental *Kitab as-Saydanah fit-Tibb*.[27]

In this investigation so far we have been using the words apothecary and pharmacy and their derivatives interchangeably both for learned and untrained pharmacists (*Sayadilah*) as the case might be. However, the *`attarin* (perfumers and spicers, also sellers of drugs, mainly medicinal

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[22] Ibn an-Nadim, *al-Fihrist*, 454.

[23] Ibn an-Nadim, *al-Fihrist*, 375, 425-426; and al-Qifti, *Ikhbar*, 245-246.

[24] One of these works by Ya`qub al-Kindi was edited, translated and annotated by Karl Garbers, *Kitab Kimiyya al-`Itr wat-Tas`idat*, Leipzig, 1948.

[25] This translation by Istifan b. Basil, corrected by Hunayn b. Ishaq, was edited, translated and annotated by Cesar E. Dubler, and Elias Teres, *La Materia Medica de Dioscorides*, 5 vols., Tetuan and Barcelona, 1952-1957.

[26] Part seven of *Kitab al-Hawi fit-Tibb* by ar-Razi discusses pharmacy in the medical art (*Saydalat at-Tibb*); Ibn an-Nadim, *al-Fihrist*, 431-433.

[27] The introduction to this work has been edited, translated and annotated by Max Meyerhof, 'Das Vorwort zur Drogen Kunde des Beruni,' in *Quellen und Studien zur Geschichte der Naturwissensch. und der Med.*, 3 (1933), Arabic text 1-18 and German translation and annotation, pp. 1-52. Of interest to our topic here are pp. 7-8 of the Arabic text wherein al-Biruni regrets that many in his time did not differentiate between the learned pharmacist (*an-Natasi*) and the uncultured *`attar*. Recently, Dr. Bedi N. Sehsuvaroglu published a study of this work in an article, 'Abu Rayhan Biruni ve *Kitab al-Saydala,' Istanbul University Tip Fak. Mec.*, (1959), 1010-1030 based on the manuscript No. 149 at Bursa Library, Turkey.

herbs) in Iraq were specialized in extracting sesame and other oils (*adhan*) from seeds of plants, as well as the making of butter out of milk,[28] besides distilling aromatic waters.

These developments no doubt influenced other areas of the Islamic world. In Syria and Egypt, for example, the shops of the *`attarin* continued to operate throughout this period of Islamic history and up to modern times.[29] Meanwhile, a new class of qualified pharmacists was gradually rising to acquire high recognition after the fifth/eleventh century, both inside and outside the hospitals and government service. Yet in the first half of the sixth/twelfth century, physicians were still reported to have owned and operated pharmacy shops,[30] which reminds us of similar cases in the history of American pharmacy during the seventeenth to the nineteenth centuries. However, eminent physicians associated with an-Nuri hospital at Damascus, which contained a well-equipped pharmacy (*Khizanat al-Adwiyyah*)[31] did not compound medicines for their patients. Instead, they wrote prescriptions to be dispensed by pharmacists. Names of physicians mentioned in this regard include the one-time hospital director `Abd ar-Rahim ad-Dakhwar, and his associate Radi ad-Din ar-Rahbi.[32]

At this time, when the apothecary's art became recognized in Egypt, the output of pharmaceutical literature reached a high standard. In the late sixth/twelfth century, Musa b. Maymun (Maimonides. 529-600/1135-1204) wrote a glossary of drug synonyms and a manual on poison.[33] Then at the beginning of the seventh/thirteenth century *ad-Dustur al-Bimaristani* (*Hospital Formulary*) was completed by Ibn Abi al-Bayan.[34] A more popular work written in Egypt during this period as a manual for the apothecary was *al-Minhaj ad-Dukkan wa Dustur al-`Ayan* by Abu al-Muna Kohen b. al-`Attar in 657/1259. The last three doctors who flourished in Egypt were of the Jewish faith but they wrote their works in Arabic.

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[28] Khayr ad-Din az-Zarkali, ed. *Rasa'il Ikhwan as-Safa* (2, Cairo, 1928), 330.

[29] Meyerhof, Max, 'Pharmacology During the Golden Age of Arabian Medicine,' *Ciba Symposia*, 6 (1944), 1866-1867.

[30] Ibn Abi Usaybi`ah, *`Uyun*, 3, 240-257.

[31] `Isa, *Bimaristanat*, and Ahmad al-Maqrizi, *Kitab al-Khitat*, (I, Cairo, 1853), 406. A similar pharmacy section for storing, manufacturing and compounding drugs was also instituted in the great al-Mansuri hospital of Cairo. *Ibid*.

[32] Ibn Abi Usaybi`ah, *`Uyun*, 3, 396-397.

[33] Meyerhof, *Ciba Symposia*, 6, 1863; and *Un Glossaire de Matiere Medicale de Maimonide*, ed. and translated into French by Meyerhof, Cairo, 1940.

[34] This work has been edited by Paul Sbath, 'Le Formulaire des Hopitaux d'Ibn Abil-Bayan, Medecin du Bimaristan Annacery au Caire au XIIIe Siecle,' *Bulletin de I'Institut d'Egypte*, 15 (1933), (13) -78. See also Martin Levey, 'Arabic Dental Pharmacotherapy at the Turn of the 12th Century', *Janus*, 49 (1961), 101-103.

In 'Ifriqiyya', Tunisia of today, Ishaq b. `Imran (f. 286/900), who gained much popularity 'in the knowledge of drugs and the treatment of disease', wrote prescriptions for his patients[35] to secure their medicines from privately owned apothecary shops. However, Ahmad al-Jazzar (d. 399/1009) of al-Qayrawan appointed an assistant to prepare the necessary medicines for his patients, under his supervisions.[36] This was probably either because of fear that his prescriptions would fall into the hands of unqualified *`attarin*, or due to the fact that physicians who sold their own prepared drugs amassed much wealth, especially if their drugs proved successful. For these reasons, many physicians owned pharmacies or had special sections at their 'clinics' for this purpose.

The development of pharmacy in Morocco was similar to that of al-Andalus (the part of the Iberian peninsula under Islamic rule). In both countries physicians throughout the third/ninth to the fifth/eleventh centuries compounded their own drugs.[37] We are also told[38] that Ahmad b. Yunis established, by order of caliph al-Hakam II (reigned 349-365/961-976), a pharmacy shop (called then *al-Khizanah* or *Khizanat al-Adwiyyah*) in a room at the palace. Up to the end of the fourth/tenth century, this shop was never surpassed in contents and elegance, in al-Andalus. Ahmad had therein twelve young men working under his supervision to prepare remedies, many of which were dispensed free to the poor. Az-Zahrawi (d. 403/1013) refers to the *`attarin* repeatedly in his *at-Tasrif*, with no mention of the educated pharmacists. In the 25th treatise of his work he also reports that the *`attarin* were engaged in the preparation of water and oil-of-roses and other *adhan* of plants for medicinal use. Later on, the *`attar*, depending on his previous education and training, occupied the position of the pharmacist in Morocco and Muslim Spain (al-Andalus). By the second half of the sixth/twelfth century we read of the physician Abu Bakr az-Zuhri of Seville[39] who depended on apothecary shops for his orders. He wrote prescriptions

[35] Ishaq was also the author of the medical work *Nuzhat an-Nafs*. See Sulayman Ibn Juljul, *Tabaqat al-Atibba wal-Hukama*, ed. Fuad Sayyid (Cairo, 1955), 84.

[36] See Sulayman Ibn Juljul, *Tabaqat al-Atibba wal-Hukama*, ed. Fuad Sayyid (Cairo, 1955), 88-89.

[37] Sa`id b. Ahmad al-Andalusi, *Tabaqat al-Umam*, ed. Louis Cheikho (Beirut, 1912), 78, 80; and Ibn Juljul, *Atibba*, 93-97.

[38] Ibn Juljul, *Atibba*, 112-114.

[39] Ibn Abi Usaybi`ah, *`Uyun*, 3, 128-129.

for his patients to obtain the drugs they needed. Thereafter, Ahmad al-Qurtubi (of Cordova) wrote a book concerning the shop of the *`attar* entitled *Hanut al-`Attar*.[40]

In the great hospital founded about 585/1190 in Marrakesh, then the capital city of Morocco, there was a section designed as a pharmacy shop. The manufacturing, compounding and dispensing of drugs were the specialty of trained pharmacists (*Sayadilah*) appointed to the medical staff.[41] Herbs were cultivated in the hospital's garden for medical consumption. Up to modern times, writings of that period which pertain to pharmacy and the identification and 'virtues' of drugs[42] continued to be followed uninfluenced by the later Western scientific accomplishments in this field.

In regard to the West, these developments have played a significant role. The Muslims brought from their homelands new impetus to progress into Sicily during its occupation from the middle of the third/ninth century to the fifth/eleventh. The advanced knowledge embodied in a growing medical literature no doubt became accessible in the island. At that time, therefore, the stage was set for the edict of the Emperor Frederick II in 637/1240 in which he gave official recognition to pharmacy in the West as a profession separate from medicine.[43] From the late fourth/tenth century al-Andalus became increasingly a center of great cultural activity. The emergence of professional pharmacy in the sixth/twelfth century under Islam led to its further development and maturity in Spain from the seventh/thirteenth century onwards.[44]

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[40] Khalifah, *Kashf*, I, 318.

[41] `Abd al-Wahid al-Marrakushi, *al-Mu`jib fit-Talkhis Akhbar al-Maghrib*, ed. R. Dozy (2nd ed., Leiden, 1881), 208-210.

[42] A work entitled *Tuhfat al-Ahbab: Glossaire de la Matiere Medicale Marocaine*, edited by H.P.J. Renaud and Georges S. Colin, Paris, 1934, shows a sample of this continued tradition.

[43] For more detail on the significance of this 1240 edict, see Kremers, Edward and Urdang, George, *History of Pharmacy: A Guide and a Survey* (2nd rev. ed., Philadelphia, 1951), 49-50.

[44] For the development of professional pharmacy in Spain, see Rafael Folch Andrea, 'L'Enseignement Pharmaceutique en Espagne du Moyen Age a nos Jours', *Revue d'Histoire de la Pharmacie*, 48, No. 167 (1961), 425-426.

'Pharmacy in Islam from the Eighth through the Thirteenth Century,' in *Radovi sa Odrzanog Prigodom Proslaves 700 Obljetnice Spomena Ljekarne u Trogiru*. Zagreb, pp. 165-172, 1973.

Translations:-

1. German, by Georg Dan in *Zur Geschichte der Pharmazie* 14:10-13, 1962.

2. Italian, by G. Nebbia in *Quaderni di Merceologia* 4(11):1-11, 1965.

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Unification of Weight and Measure Standards in Islamic Medicine

In the first/seventh century, upon conquering the whole region of the Middle East, the Muslims came in contact with many nations of various cultural backgrounds. Instead of destroying the marks of existing civilizations, they preserved, utilized, and improved upon whatever they found and thought worthwhile in the sciences and cultures of the peoples of those countries. The advantages of this conquest were accompanied by disadvantages that faced the Muslims, among which was the multiplicity of weight and measure systems. They varied greatly according to the different states, provinces, and even cities that were of some commercial importance. And thus, with the expansion of trade, business transactions were, as always, embarrassed by the endless diversity of the various systems which kept changing from one locality to the other throughout the wide Muslim domain.[1]

The early metrological standards of ancient Mesopotamia, Egypt, and Syria influenced the Greek and Roman systems which developed later.[2] Muslim metrology soon displaced the already modified weights and measures used by the Romans.[3] Moreover, in Islam, metrological development had been stimulated by religious impetus. The Holy Qur'an emphasized accuracy and honesty in weights and measures.[4] The caliphs, therefore, endeavored to promote exactitude and veracity in tools and coins used in commerce. They also provided officially stamped standards of weights and measures, many of which are still extant,[5] in an attempt to secure

[1] Edward Nicholson, *Men and Measures, A History of Weights and Measures Ancient and Modern*, London, Smith and Elder, 1912, pp. 32, 47, and 232; Charles Warren, *The Early Weights and Measures of Mankind*, London, 1913, p. 78; William Hallock and Herbert T. Wade, *Outline of the Evolution of Weights and Measures and the Metric System*, New York, Macmillan, 1906, pp. 38-39; and Bruno Kisch, 'Weights and Scales in Medieval Scandinavia, A New Proof of Arabic Influence on Northern Europe in Viking Times', *Journal of History of Medicine and Allied Sciences*, vol. 14 (1959), 161-168.

[2] Flinders Petrie, *Ancient Weights and Measures*, London, 1926, pp. 1-12; and Algernon Ed. Berriman, *Historical Metrology, Archaeological and Historical Evidence Relating to Weights and Measures*, London, 1953, pp. 6-17 and 31-55.

[3] Hans Joachim von Alberti, *Mass und Gewicht; Geschichtliche und Tabellarische Darstellungen von den Anfangen bis zur Gegenwart*, Berlin, Akademie, 1957, pp. 12-25 and 32-49; and Nicholson, *Men and Measures*, pp. 3-7, 13-14, 232, and 271-273.

[4] *Qur'an Karim*, 7:7-8, and 85; and 26:180-183.

[5] There have been published already several catalogs on private and museum collections, such as Stanley Lane-Poole, *Catalogue of Arabic Glass Weights in the British Museum*, London, 1891; A. Launois, *Estampilles et Poids Foibles en verre Omeyyades et Abbasides au Musee Arabe du Caire*, vol. 3, Cairo, Extrait des Melanges Islamobliques, 1956; C. Mauss, *La Pile de Charlemagne et le Sa du Prophete, etc.*, Paris, 1897; P. Casanova and U. Bouriant, *Catalogue de Pieces de Verre des Epoques Byzantine et Arabe de la Collection Fouquet*, vol. 6, pt. 3, Paris, Mission Archeologique Francaise, 1893; George C. Miles, *Contributions to Arabic Metrology, I. Early Arabic*

uniformity and precision and to guard the public and state interests. Officially stamped glass disks on weights and measures can be traced to the first half-century of the Umayyah period in Damascus (40-132/661-750).[6] The aims for which these disks were used, their elegance and design, suggest a new and significant step forward in the art of stamped vessels for official and medical purposes. Also deserving the mention is the rare Arabic measuring cup dating around 80/700, now at the Metropolitan Museum of Art in New York City, which holds exactly 50cc or about 1-2/3 fluid ounces.[7] Similar cups were generally used to measure aromatics and spices greatly valued in medications and cosmetics. In the late second/eighth century, weighing in Islam reached a remarkable degree of accuracy.[8] It became, no doubt, a more vital issue with the expansion of trade and the progress of the healing arts during the third/ninth century. At this time, Thabit Ibn Qurrah of Harran (d. ca. 288/901) and Qusta Ibn Luqa of Ba`albak (d. ca. 299/912), wrote what could perhaps be considered the first important known texts in Arabic on balances, weights, and measures.[9] Later, authors who wrote on the subject were numerous. Muhammad al-Khwarizmi devoted a chapter to Arabic metrology in his *Mafatih al-`Ulum*,[10] completed about 369/980. Around the turn of the century Abu al-Qasim az-Zahrawi discussed in some detail the weights and measures used in medicine in the Eastern Caliphate and in his native Spain.[11]

Glass Weights and Measure Stamps Acquired by the American Numismatic Society 1951-1956, New York, 1958; and Silvester de Sacy, *Arabic Weights and Measures*, London, 1905.

[6] George C. Miles, *Early Arabic Glass Weights and Stamps*, New York, The American Numismatic Society, 1948, pp. 3, 20, 23-24, and 70; and Richard Ettinghause, 'An Umayyad Pound Weight', *Journal of the Walters Art Gallery*, vol. 2 (Baltimore, Maryland, 1939), pp. 73-75.

[7] Florence E. Day, 'An Umayyad Pharmacist Measure Cup,' *Metropolitan Museum of Art Bulletin*, vol. II, no. 9 (May, 1953), p. 259.

[8] Flinders Petrie, 'Glass Weights', *Numismatic Chronicle*, 4th series, vol. 18 (1918), pp. 111-115; and Eric J. Holmyard, 'Accuracy of Weighing in the Eighth Century', *Nature*, vol. 115 (1925), 963-964.

[9] Thabit b. Qurrah's *al-Awzan wal-Makayil* was reported by Muhammad Ibn Ishaq Ibn an-Nadim, *al-Fihrist* (Cairo, Istiqamah, 1929), p. 272. For his other work on the Roman balance (*Liber Karastonis*), See Eilhard Wiedemann, 'Die Schrift uber den Qarastun', *Bibliotheca Mathematica*, vol. 12 (1912), pp. 21-39; F. Buchner, 'Die Schrift uber den Qarastun', *Sitzungsber. der Phys. Med. Sozietat*, vol. 52 (Erlangen, 1921) pp. 141-188; and Ernest A. Moody and Marshall Clagett, *The Medieval Science of Weights (Scientia de Ponderibus)*, Madison, Univ. of Wisconsin Press, 1952, pp. 77-117, which most probably is a translation from the Greek with additions and improvement.

[10] In referring to al-Khwarizmi's *Mafatih al-`Ulum*, now and hereafter, I am using the Cairo edition, Muniriyyah, 1923, pp. 11-12.

[11] Khalaf Ibn `Abbas az-Zahrawi devoted a complete chapter in his 29th treatise of *at-Tasrif liman `Ajiza `an at-Talif* to the discussion of weights and measures.

In the last two chapters of his famous medical encyclopedia *al-Qanun fit-Tibb*, Ibn Sina (369-428/980-1037) mentioned, or better compiled, two lists of weights and measures 'to benefit others with it…since measures are not uniform and one (physician) uses a (standard) not used by another'.[12] Then about 514/1121, `Abd ar-Rahman al-Khazini completed his book, *Mizan al-Hikmah*, which contained an important description of the uses of balances and the specific gravities of a variety of substances.[13] Several other physicians and pharmacists compiled brief or detailed discussions and comparison lists on weights and measures commonly used by practitioners.

The first in this period to my knowledge, however, who proposed the standardization of weights and measures used in medicine, was the surgeon-physician Abu al-Faraj Ibn al-Quff (630-684/1233-1286). He was born in the city of al-Karak in Transjordan, studied medicine under the medical historian Ibn Abi Usaybi`ah and others, and practiced the profession both in `Ajlun and in Damascus, mainly within the army installations and camps.[14] Here he developed a high measure of surgical skill and wrote his well-known manual on surgery, *al-`Umdah fi Sina`at al-Jirahah*,[15] composed of twenty treatises. In the last treatise on what is defined as *al-Aqrabadhin*, or the formulary within a particular medical work, the author devoted eleven chapters to discussing usages and dosages of simple drugs of the *materia medica*, the compounding and dispensing of pharmaceutical preparations, and the various medicinal forms used before, during, or after the application of surgical manipulations.[16]

Chapter Four of this closing treatise in *al-`Umdah* centers around a discussion 'on physicians' terminology of weights and measures'. Here the author seems to have seen clearly

[12] In referring, now and hereafter, to Ibn Sina's *al-Qanun*, containing the two chapters on weights and measures, I am using the Typographic edition (Book 5, Rome, 1953), pp. 267-268. These two chapters conclude this encyclopedic medical work.

[13] George Sarton, *Introduction to the History of Science*, (vol. 2, pt. I, Baltimore, Md., Williams and Wilkins, 1931, pp. 216-217; and Carl Brockelmann, *Geschichte der Arabischen Litteratur, suppl.* I, Leiden, Brill, 1937, p. 902.

[14] For more detail on the life and works of Ibn al-Quff, see S. Hamarneh, 'Thirteenth Century Physician Interprets Connection between Arteries and Veins', *Sudhoffs Archiv*, vol. 46 (1962), pp. 17-26.

[15] In the preparation of this article, including the translation of the chapter under discussion, I consulted the printed edition of Ibn al-Quffs *al-`Umdah*, vol. 2, Hyderabad, Deccan, India, Osmania Publishing Bureau, 1937, pp. 233-235; and the two Arabic manuscripts (Add. 23409 and Add. 5930, fols. 127b-128a and 113a-114b, respectively) at the British Museum. I am grateful to the library staff of the Department of Oriental P.B. and Mss. of the British Museum for kind permission to microfilm and study these manuscripts for publication.

[16] For early formularies in Islam see Hamarneh, 'Sabur's Abridged Formulary, the First of its Kind in Islam', *Sudhoffs Archiv*, vol. 45 (1961), pp. 247-248 and 253-256.

the danger in having multiple standards of weights and measures throughout the whole region, especially in regard to variations in medical texts. The practitioner, it is obvious, was getting information from these works that mentioned doses in a variety of popular standards depending on the area wherein the authors lived or the sources from which they compiled their information. Ibn al-Quff, therefore, felt that such a state of affairs led the physician to err in prescribing the exact weight and dosage in his medications, when such weights were in all probability based on other standards than the one he used.

It is here for the first time that a physician publicizes the need, significance, and sagacity in unifying all metrological systems in the Arab states and makes an appeal for the adoption of his proposal. First the author defines the act of weighing as 'the proportion (*mu`adalah*) between two similar (*mutajanis*) substances such as gold, silver, and iron, or dissimilar ones such as silk and wool. We mean by similarity the evenness (equally, *musawah*) in lightness and heaviness (*thiqal*), and imponderance (buoyancy, *latafah*) and density (*kathafah*)'. After giving this definition the author continues, 'Whereas a different weight is designated for the (same) weighed body in each and every particular country (literally in the various nations, *bi-ikhtilaf al-Umam*) and province (regions, *al-aqalim*) in accordance with conventional or customary usages or terminology, necessity (duty) dictates that there should be a general standard, (the weight) of a fixed natural object (unchangeable in quantity) which should be made the basic unit (*asl*) of weight and on which we reconstruct the whole system of our weights (*jami` al-awzan*). Let this (unit) be the barley corn'.[17]

We see, therefore, that in a rational way Ibn al-Quff showed the urgency of meeting the challenge. Then he suggested an international or at least pan-Islamic general metrological system based on a unit already known and in use for centuries. This becomes the more important when we realize that for several centuries there had been a crying need for standardization of systems used in the Arabic states among physicians and pharmacists who were dependent upon practically the same texts yet using different systems of weights and measures. And let us also remember that such an appeal for international or regional unification and reform was not voiced until the twelfth/eighteenth century of our era.

[17] Ibn al-Quff, *al-`Umdah*, vol. 2, Hyderabad edition, pp. 233-234.

Following his appeal, Ibn al-Quff went on to explain: 'We say, then, that if this grain is multiplied four times it makes the *qirat* (*carat*), which in Damascus and vicinity is the *kharrubah* (carob or locust-bean). If the *qirat* is multiplied three times it makes the *daniq*. If the *daniq* is multiplied six times it makes the *dirham* (*dram*), and if the *dirham* is multiplied so many times, according to the different conventional usages of the inhabitants, it makes the *awqiyyah* (ounce), which when multiplied makes the *ratl* (pound). If that (the *ratl*), as is customary in Iraq, is multiplied it makes the *mann*, which if multiplied makes the *qintar*'.[18] With this the author concludes his proposal.

Perhaps aware of obstacles and difficulties in the way of adopting his proposal and realizing the diversities of existing systems of weights and measures, ibn al-Quff turned, like others before him, to compile a comparison list for the benefit of practitioners who referred to *al-`Umdah* as a guide. Thus he continued: 'Now let us mention, further, the medical weights (*al-Awzan at-Tibbiyyah*)'. The listed weights are of interest to metrology and especially in regard to the healing arts. A brief annotation, therefore, might be in order, and, it is hoped, will throw more light on the weight and measure units used by physicians and pharmacists during that period. The following is my free translation of the author's original text:

> I have already mentioned that the *qirat* equals four barley corns, that the *daniq* is three *qirats*, and the *dirham* is six *daniqs*. The *mithqal*, which equals the *darakhmi* (*drachme*) makes 1-1/2 *dirhams* plus three barley corns. The *habbah* is 1/2 barley corns or one third of a *kharrubah*. The *tassuj* equals 2-1/2 *habbahs*,[19] the *nawah* is six *qirats*, and the *istar* makes six *dirhams* plus two *daniqs*. The *bundupah*, to some, is one *dirham*, to others is 1-2/3 *mithqals*. The *baqilah* is of three types: the Greek equal 24 barley corns, the Alexandrian is nine *qirats*, and the Egyptian is 48 barley corns. The *turmusah* (lupine) is two *qirats*. The *jawzah* is of two kinds: the common equals seven *drachmes* and the imperial is six. What could be carried by the *asba* is one *drachme*, while the palm carries six

[18] From this passage we realize that Ibn al-Quff was aware of the fact that *awqiyyah* equaled so many *qirats* in one locality and a different number in another. The same was true with various other units. He purposely, therefore, left such multiplication unmentioned so that the practitioner would choose the number used in his particular area as he saw fit.

[19] The comparison between *dirham* and *mithqat* on the one hand and *habbah* and grain and *tassuj* on the other shows the inexpedience and cumbersomeness of the commonly employed systems of the time.

dirhams.[20] The *buntul* is six *dirhams*, the *dawraq* is three *ratls*, and the *hamin* is five *ratls* plus 20 *istars*. The *awqiyyah* makes 7-1/2 *mithqals* or 10-5/7 *dirhams*, while the *ratl* is 129 *dirhams*. The *mann* is of five types: the *Intaki* (from Antioch) makes 16 *awqiyyahs*; the *Rumi* (Greek), one; the *Iskandarani* (Alexandrian), 30; the *`Itri*, 22; and the *Yahudi* (Jewish) is 50 *siflins* – the *siflin* is 20 *abuluses* (*oboli*), and one *abulus* (Greek, *obolos*) equals three *qirats*.

The statement by Hinz that the foundation of Muslim metrology is based on the *dirham* and the *mithqal*, which is a modified form of the *solidus* in the Roman-Byzantine metrological system,[21] is too general and not always very pertinent. The matter is not as cut-and-dried as it sounds, especially outside of its application to the coinage system. Nevertheless, when the *dirham* or *mithqal* varied from one locality to the other, the *awqiyyah* and the *ratl* likewise varied. And because of the multiplicity of units in common use in one province or another, many weight standards are involved resulting in this great complexity, confusion, and lack of uniformity. The same is true of measures of capacity then employed. Let us examine the issue after the manner in which it is explained by Ibn al-Quff. He continues:

As for measures of capacity, it should be stated that they determine the proportions between one measure (*kayl*) and another, with the purpose of finding out the amount in each part (portion, *juzu*) of the measured substance (*al-makil*). There are two kinds (of measures), one to measure solid substances and the other for liquids. The ones employed in measuring dry material are determined by their conventional usages and according to the cities (countries, *al-buldan*) wherein they are used. For example, the residents of Aleppo use the *makkuk*, of Egypt (e.g., Cairo) the *irdabb*, of Damascus the *ghirarah*, and of Hamah the *sunbul*. Liquid measures are likewise numerous in accordance with customary usages. I will only mention here what seems applicable in this respect. I start with the spoon. It has two measures: one for honey, which holds four *mithqals*, and the other for medications, holding one only. The *qutuli* (Greek Attic standard *cotula*) is also two: one for olive oil, which holds

[20] It is clear that such measures could not be too accurate and were indeed far from being quantitatively reliable or adequate.

[21] Walther Hinz, *Islamische Masse und Gewichte, Umgerechnet ins Metrische System*, Leiden, Brill, 1955, p. 1.

nine *awqiyyahs*, and the other for wine, holding ten.[22] The *sukrujah* is either large, representing a vessel that holds nine *awqiyyahs*, or small, holding six. The *qist* is 20 *awqiyyahs*. The *jarrah* is either large and holds 24 *qists*, or small and holds four plus *ibriq* (pitcher or ewer) *manwan*.[23] The *kuz* (*tankard*) is of two kinds: the one for *duhn* (fixed and volatile oils and other extraction from fruits, seeds, and various products found in the contemporary *materia medica*) holds 48 *istars*, and the second is to measure the *tila* (paste-like remedy used externally in medical treatment) and holds 60 *istars*. The *dawraq*, according to what Ibn Janah says in his *at-Talkhis*,[24] equals four *ratls*.

Etymologically and from a historical point of view, the origins of a majority of the above mentioned weights and measures could be traced back to metrological systems of earlier civilizations with certainty. Two points, however, need here to be clarified. One is the fact that the exact origins of most weight and measure units are entirely circumstantial. Second is the obvious conclusion that a standardization based on the barley corn for weights, as proposed by Ibn al-Quff, like that of the feet, for example, used for linear measurement for long centuries, could not possess the slightest claim to invariability. The nomenclature of such units of weights and measures is, nevertheless, still with us even to this day.

Amongst most of the early civilizations (Egyptian, Babylonian, Phoenician, Roman, etc.) the barley and wheat grains were employed as standards of weights. For example, references to the heaviness of wheat kernels in weight are encountered in 1500 B.C.E. Egypt and in later periods.[25] The Arabic *qirat* (from the Greek *keration*, the Carob seed) was, according to E. v. Zambur, adopted by the residents of Syria and Egypt from the Byzantine ceratonia silqua, in the

[22] The survival of the *cotula* as a measure for oil and wine shows the religious influence on the continued use of this unit. Its capacity, however, changed with changing times and localities as seen in the work of Epiphanius (completed 392 C.E.) in the English translation from the Syriac version by James Elmer Dean (editor), under the title *Epiphanius' Treatise on Weights and Measures*, Chicago, University Press, 1935, pp. 2, 13. Here the *cotuli* was considered equivalent to one-half *xestes*. In the classical period the *cotula* varied in capacity from measuring the equivalent of a quart to less than one pint.

[23] This phrase is not clear in the Hyderabad printed edition or in the two manuscripts. The last word could read *'sinwan'* also.

[24] Abu al-Walid Marwan b. Janah, a philologist of fifth/eleventh century Muslim Spain, wrote several books, including *at-Talkhis*, which was used as a medical formulary. See Sarton, *Introduction*, vol. 1, p. 763.

[25] Keith Gordon Irwin, *The Romance of Weights and Measures*, New York, Viking, 1960, p. 71. Also an early eighth/fourteenth century document states that the English sterling penny, round without clipping, weighed 32 grains of wheat dry in the middle of the ear (See Berriman, *Historical Metrology*, p. 162).

first/seventh century.[26] But the designation of four barley corns for one *qirat* (carot) possibly came later and was established in Baghdad during the reign of al-Ma'mun (197-217/813-833).[27] The *kharrubah*, a term frequently found on glass weights of the second/eighth century, is synonymous with the *qirat*. The weighing of well-preserved glass weights found in the area provides an average weight of 0.196 grams (or three grains) for the *qirat*.[28] However, in spite of continued enforced inspection of weights by official bureaus in Islamic states, variations and inaccuracies in weights existed, so that it becomes hazardous to give definite figures.[29] In later centuries the *qirat* became the unit of weight for precious stones, equaling 1/24 of a pure gold unit.

The *daniq* was known in ancient Mesopotamia, where several other weight and measure standards are also found to have been in use, which later were transmitted to other civilizations. In Egypt such a unit was reported at about the middle of the first/seventh century B.C.E., if not earlier.[30] In Arabia the *daniq* was in use to denote a certain weight or as a coin unit before the rise of Islam. It continued to be used thereafter. Six *daniqs* were generally considered equal to one *dirham* as early as the reign of caliph `Umar (12-23/634-644), and it was so listed by author.[31]

The Sasaniyyah officials adopted the classical *drachme* (equivalent to 3.54 grams) as a unit of coinage from the Greeks who used it before for the same purpose. According to al-Baladhuri (d. 278/892), there were three types of *dirhams* weighing 10, 12, and 20 *qirats*, respectively. As an average of the three, therefore, the early Arabic *dirham* equaled 14 *qirats*, or seven-tenths of

[26] *Encyclopedia of Islam*, vol. 2, pt. 2, Leiden, Brill, 1927, p. 102.

[27] Nicholson, *Men and Measures*, p. 28. The idea of four corns to a *carot* came possibly from the Greeks, who used four instead of ten in their measures. They counted, for example, four palm-widths for a foot and four finger-widths for a palm-width.

[28] E. v. Zambaur, 'Kharruba', *Encyclopedia of Islam*, vol. 2, pt. 2 1926, p. 916; and Miles, *Early Arabic Glass Weights* 1948, p. 9. In this century, the *qirat* in Egypt weighs 0.193 grams, while the English Troy carat equals 0.2053 and the Dutch 0.2059.

[29] In ancient Greek the *keration* made four *sitarions* or the equivalent of 3.858 grains, and 3.1616 grains during the Ptolemaic period in Egypt (or 1/114 of the Roman *uncia*). See Horace Doursther, *Dictionnaire Universel des Poids et Mesures Anciens et Modernes*, Bruxelles, 1840, pp. 88-89; Warren, *Weights and Measures*, p. 75; Alberti, *Mass und Gewicht*, p. 32; and A.J. Pierre Paucton, *Metrologie*, Paris, Desaint, 1780, p. 275.

[30] S.R. Glanville, 'Weights and Balances in Ancient Egypt', *Proceedings of the Royal Institution of Great Britain*, vol. 29 (London, 1935), pp. 12 and 16.

[31] Six *daniqs* were likewise considered equal to one *dirham* by Hasan al-Jabarti as reported by Henry Sauvaire in his 13th article on 'Arab Metrology', in *Journal of the Royal Asiatic Society*, vol. 10 (April, 1878), p. 258. See also Hinz, *Islamische Masse*, p. 11.

the *mithqal* (the gold dinar of a *mithqal* weight). Then with the coinage reform of `Abd al-Malik, about 75/695, the *dirham* was made *qirats*.[32] With the variation of the *qirat* later on, we find the *dirham* equivalence varied also in accordance with period and place, from 12 to 14, 15, 16, 18, or 20 *qirats* averaging from 2.85 to 3.411 grams (theoretically 2.92 to 3.2 grams).[33] The proportion, however, of 10 to 7 between the *dirham* and the *mithqal* was more fully recognized in Arabic metrology. Therefore, the *mithqal* which was known to the Arabs, was equivalent to 1-3/7 *dirhams*, or simply 10 *dirhams* weighed 7 *mithqals*.[34] And as the Romans divided their currency unit into 24, so did the Arabs divide the *mithqal* (comparable to the Roman *solidus*) into 24 *qirats*.

In most cases, 12 *awqiyyahs* (from the Roman *uncia*) made one *ratl* (Roman *pondus*). As pound, weighing the equivalent of 327.54 grams or about 5049 grains troy, was divided into 72 *aurei* (*exaqium solidi*), the Arabs divided their *ratl* into 72 *mithqals* (one-sixth of an *awqiyyah* each).[35] Nevertheless, with the variation of the *mithqal* and the *qirat* from one locality to the other, the exact weight of the *awqiyyah* and the *ratl* accordingly changed considerably. Extant examples testify to this fact. The preserved *ratl* at the Walters Museum of Art in Baltimore, Maryland, weighs 337.55 grams, while the one in the Damascus Museum in Syria weighs 351, and a third at the Louvre in Paris, 437.[36] Miles, howev.er, considers the commonest *ratl* to weigh 128-4/7 *dirhams* or 395-408 grams.[37] Then one hundred *ratls* make a *qintar*.[38]

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[32] Ahmad b. Yahya al-Baladhuri, *Futuh al-Buldan*, Cairo, Misriyyah Press, 1932, pp. 451-452.

[33] Miles, *Early Arabic Glass Weights*, p. 6; and E. v, Zambaur, *Encyclopedia of Islam*, vol. 2, pt. 2, p. 1024.

[34] al-Baladhuri, *Futuh* p. 453. The sixth/twelfth century *Muhtasib* `Abd ar-Rahman b. Nasr ash-Shayzari in his *Nihayat ar-Rutbah fi Talab al-Hisbah*, edited by Albaz al-`Arini Cairo, 1946, pp. 16-17, considered the *mithqal* equivalent to one *dirham* plus 2-1/2 *daniqs*, 24 *qirats*, or 85 barley corns. Others, however, considered the *mithqal* equivalent to 96 barley grains, and 60 or 72 *habbahs* depending on the commonly used weight. See Sauvaire, 'On a Treatise on Weights and Measures, by Eliya, Archbishop of Nistbin', *Journal of Royal Asiatic Society*, vol. 9 (July, 1877), pp. 294-295.

[35] Nicholson, *Men and Measures*, pp. 94 and 246-247; and Petrie, *Ancient Weights*, p. 26.

[36] Marcel Jungfleisch, 'Les-ratls Discoides en Verre', *Bulletin Instit. Egypt*, vol. 10 (1927/8), pp. 62-71. Sauvaire in several articles on Arab metrology, see for example, *Journal of Royal Asiatic Society*, vol. 10 (1878), pp. 259-261, shows the great variations in *ratl* weight from one city or region in the Muslim world to another. The seventh/thirteenth century *Muhtasib* Muhammad b. Ahmad b. al-Ukhuwwah in *Ma`alim al-Qurbah fi Ahkam al-Hisbah* (see edition by Reuben Levy, printed by Cambridge University Press for the Gibb Memorial, and published by Luzac, London, 1938), pp. 80-82, gives a comparison list of various *ratl* weights common in his time, and so does ash-Shayzari, *Nihayat*, pp. 15-16.

[37] Miles, *Early Arabic Glass Weights*, pp. 13-16.

[38] See ash-Shayzari, *Nihayat*, p. 15; and Ibn al-Ukhuwwah, *Ma`alim*, pp. 80-81.

The *menen* or *manu* (Arabic *mann*) is reported to have been in use in ancient Mesopotamia. It was also used in ancient Egypt. The oldest known is a pear-shaped stone dating from about 2400 B.C.E., preserved at the Ashmolean Museum in Oxford, England.[39] The Greek *mina* (*mine*) weighed 100 *drachmes*, the equivalent of 5462 grains, or about 436 metric grams. The Roman *mine* made 2-1/2 *libras* or 160 *Nero drachmes*.[40] Paulus, in the first/seventh century, mentioned that the Roman *mina* equaled 20 ounces.[41] About 365/976, al-Khwarizmi considered the *mann* to equal 251-1/7 *dirhams* or 180 *mithqals*. Sauvaire and Hinz consider the common Arabic *mann* to equal 260 *dirhams* and in Baghdad, as Ibn al-Quff stated, two *ratls*.[42] In sixth/twelfth century. Muslim Spain the *mann* of vinegar weighed 2-3/4 *ratls*, 44 *awqiyyahs*, or 880 *dirhams*, while the *mann* of sheep milk equalled 3-1/4 *ratls*.[43]

Of interest is the distinction made between the *sha`irah* (barley corn) and the *habbah*, which equals one-third of a *kharrubah* (or about 1-1/2 barley corns), so that 72 barley corns make one *dirham*, whereas 72 *habbas* make one *mithqal*.[44] The *tassuj* or *tasu* is about one-fourth of a *daniq* or 1/24 of the *mithqal*. Sauvaire reported that the *tassuj* equaled two barley corns or one-half *qirat*.[45] In eighth/fourteenth century it weighed the equivalent of about 0.18 grams.[46] According to al-Baladhuri (d. 278/892), the *nawah* is an Arabic unit that weighed five *dirhams* (about 15.6 grams) in early Islam.[47] But later it was gradually decreased to one-third of a *dirham*.

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[39] Berriman, *Historical Metrology*, pp. 6-9 and 55; and Alberti, *Mass und Gewicht*, pp. 15, 24 and 38-39.

[40] *Ibid.;* and Nicholson, *Men and Measures*, p. 35.

[41] Paulus, vol. 3, *Book* 7 (English Edition), p. 610.

[42] Sauvaire, 'Treatise...by Eliya', *Journal of Royal Asiatic Society*, vol. 9 (1877), p. 299; and Hinz, *Islamische Masse*, p. 16-17.

[43] Muhammad b. Abi Ahmad as-Saqati, *Fi Adab al-Hisbah*, edited with introduction in French and linguistic notes by G.S. Colin and E. Levi-Provencal under the title, *Un Manuel Hispanic de Hisba*, Paris, Leroux, 1931, p. 13.

[44] Ahmad al-Qalqashandi, *Subh al-A`sha*, vol. 3, Cairo, Dar al-Kutub, 1938, p. 436. Other Arabic documents of the period also mention that 60, 85, 96 *habbahs* or more equaled one *mithqal*, and 48, 60, 85, 96 barley corns or more equaled one *dirham*, respectively. See Sauvaire, 'Treatise…by Eliya', *Journal of Royal Asiatic Society*, vol. 9, p. 294; and E.v. Zambaur, *Encyclopedia of Islam*, vol. 2, pt. 2, p. 1024. Ibn al-Ukhuwwah, *Ma`alim*, p. 82, stated that the *mithqal* equaled 72 *habbahs* in the early days of Islam.

[45] Sauvaire, 'Arab Metrology', *Journal of Royal Asiatic Society*, vol. 10, p. 260.

[46] Hinz, *Islamische Masse*, p. 24. The *tassuj* unit was also used in weighing precious gems. See Abu ar-Rayhan Muhammad b. Ahmad al-Biruni, *al-Jamahir fi Ma`rifat al-Jawahir,* Hyderabad, India, Osmania, 1936/7, p. 49.

[47] Considering the *awqiyyah* 40 *dirhams*, then the *nawah* equaled one eighth of the *awqiyyah*, al-Baladhuri, *Futuh*, p. 453.

The *istar* (from the Greek *stater*) was known to the ancient Egyptians and to the Greeks. The Roman gold *stater* weighed the equivalent of 8.42 to 8,62 grams. In Islam it was commonly equal to about 4-1/2 *mithqals* or 6-2/5 *dirhams*.[48] Ibn Sina, however, considered 20 *istars* to make one *ratl* while one *istar* equaled four *mithqals*. The weight of the *bunduqah* (Arabic for nut) varied from one to more than two *dirhams*. Ibn Sina considered the *bunduqah* equal to a *mithqal* (*drachme*).[49] The *baqilah* (string or kidney beans) equaled two-thirds of a *dirham* (about 2.34 grams), but lesser weights are reported down to about one-sixth of a *dirham*. The Egyptian *baqilah* weighed 12 *qirats*.[50] The Arabic *turmusah* (*lupine*), from the Coptic or Greek *thermas*, was used in classical times as equal to two *siliques* or 5-1/3 *chalcos*, or two-thirds of an *obolus*. The Ptolemaic and Asiatic *drachme* made six *lupines*. Miles mentioned a stamped full measure of *lupine* struck during the reign of caliph al-Mansur (136-158/754-775).[51] There were two types of the *jawzah* (walnut) as stated by Ibn al-Quff, both based on the *mithqal* unit, and as a result their weight varied whenever the *mithqal* changed. The two amounts reported by Hinz as the *jawzah's* equivalents are exactly the same two mentioned in Ibn al-Quffs list.[52] But while our author considered the *buntul* two *daniqs* less than the *istar* (e.g., six *dirhams*), Ibn Sina made it equal to two *istars*. Ibn al-Quff, nevertheless, agreed with Ibn Sina that the *dawraq* (the commonest then in Syria was that of Antioch) equaled three *ratls*. As a unit of capacity, however, the *dawraq* measured four *ratls*, as quoted earlier from *al-`Umdah* manual. The *hamin* (from Greek *hemina*) was also used by the Romans as equivalent to one-half *sextarius* or 1/12 of the *congiorium* in measuring corn, oil, and wine. Thus it is more widely recognized as a measure of capacity, as we shall see later in discussing the *qutuli* (*cotula*). The *hamin*, however, must have been well known in Islam during the fourth/tenth century if not earlier, and Ibn Sina considered it equal to five *istars* plus 20 *dirhams* and four *oboli*.

[48] Hinz, *Islamische Masse*, p. 15.

[49] Ibn Sina, *al-Qanun*, Book 5, Rome Edition, 1593, p. 267.

[50] Hinz, *Islamische Masse*, p. 10.

[51] Miles, *Early Arabic Glass Weights and Stamps: A Supplement*, New York, American Numismatic Society, 1951, p. 14.

[52] Hinz, *Islamische Masse*, p. 12.

In dividing the measures of capacity into two types, that is, units of dry and liquid substances, Ibn al-Quff followed the Greek tradition as represented in Paulus.[53] Since they varied greatly, he neglected to mention their equivalents. However, the sixth/twelfth century physician Muhammad al-`Antari, in his *Aqrabadhin*, considered the *makkuk* to equal three *ratls* and so did ash-Shayzari.[54] But in Egypt (fourth/tenth to eighth/fourteenth centuries) this measure varied between 4.61 and 15 *ratls*.[55] The *irdabb* was known in ancient Egypt, and was widely used in the early centuries of our era.[56] It also was the principal unit of capacity in medieval Egypt. Although theoretically it equaled 15 *manns* or 48 Egyptian *ratls*, it varied greatly ranging in its volume from 30 to 180 *rails*.[57] It formed, nevertheless, the basis for similar standards in Mediterranean countries and is still well known in Egypt today. The *ghirarah* in Damascus was 2-1/2 *makkuks* and three in Aleppo, but 'since these measures are conventional', ash-Shayzari reported, 'they vary with the change of rulers'.[58] During the sixth/twelfth century the *sunbul* in northern Syria equaled 1-1/2 *ratls* (e.g., 1026 *dirhams*), or one-half of a *makkuk*.[59]

Ibn al-Quff listed only a few liquid standards which are pertinent to medicine and pharmacy. The spoonful mentioned for measuring medication has the same capacity as that described by Ibn Sina. In volume it corresponds rather closely to our modern teaspoonful capacity. The *qutuli* (Greek *cotula*), which measured one-half of a *xestes*, although it varied according to peoples and places, was so called because the *xestes* was cut in two. Therefore, sellers of oil or wine were known as *xestes kotylistai* for they divided up what they sold into small quantities.[60] The amounts of the *qutuli* mentioned by Ibn al-Quff were generally accepted as the commonest. Al-`Antari added the information that for measuring honey this volume unit equaled 13-1/2

[53] See the last chapter, *The Seven Books of Paulus Aegineta*, in the English translation by Francis Adams, Book 7, vol. 3, London, The Sydenham Society, 1847, pp. 609-610. Here also Paulus explained that weight is determined by the degree of heaviness, and the measure by the capacity of the vessel.

[54] Michael Casiri, *Bibliotheca Arabico-Hispana Escurialensis*, vol. 1, Madrid, 1760, pp. 281-282; and ash-Shayzari, *Nihayat*, p. 17.

[55] Hinz, *Islamische Masse*, p. 44.

[56] Epiphanius, *Weights and Measures*, p. 138.

[57] Hinz, *Islamische Masse*, pp. 39-40; and Nicholson, *Men and Measures*, p. 232.

[58] ash-Shayzari, *Nihayat*, p. 17.

[59] *Ibid.*; and Hinz, *Islamische Masse*, p. 51.

[60] Epiphanius, *Weights and Measures*, pp. 54-55 and 65.

awqiyyahs.[61] The two *sukrujahs* (platter) were not widely employed as measures. The smaller one generally equaled one-half of a *ratl*.

The word *qist* came from the Greek *xestes* and was known in ancient Rome as the *sextarius*. Therefore, one could assume that this unit was known to the Arabs before Islam. With the reforms of measures in Islam the *qist* often signified a specific or authorized unit of capacity varying according to place and time, and also in relation to the kind of measured commodity. Commonly it is considered to equal about one pint,[62] and as the imperial measure pint it equaled 20 *awqiyyahs* (ounces) as also indicated in Ibn Sina's compiled list. In Iraq, however, it measured from three to six *ratls* (780 *dirhams*) and in other regions its volume varied according to the liquids used: of oil it measured 18 *awqiyyahs*, and 27 of honey.[63] As the *qist* varied, the capacity of the *jarrah* (jar, earthen vessel) varied also. The small-sized *jarrah* held about 6-2/3 *ratls*. The Arabic *kuz* (*tankard*) comes probably from the *kuza*, the usage of which was associated with religious practices. In fourth-century Syria and Palestine the two types were considered a sacred measure.[64] Under Islam, the *kuz* in Syria equaled the *qadah* (tumbler) of Egypt frequently used in liquid medications. The capacity of both measures varied from 232 dirhams to more than double that volume.[65] Sauvaire considered the *qadah* to equal 442-6/7 *dirhams*.[66] In Mulsim Spain the *qadah* was used to weigh coriander, and it held 11 *ratls* or 3520 *dirhams*.[67] The *dawraq* (decanter) was considered roughly equivalent to four *ratls*.

From an economic and social point of view, this wide range of weight and measure standards and comparison lists and tables indicate the greatly expanded trade and communications among the various regions of the Muslim world during the Middle Ages. However, precision in weighing and measuring were jeopardized to an alarming extent. In addition, confusion and disorderliness made commercial transactions the more complicated. In medical practice, uncertainty resulting from these variations of commonly used units endangered

[61] Casiri, *Bibliotheca*, vol. 1, p. 282.

[62] Miles, 'Egyptian Glass Pharmaceutical Measures of the 8th Century', *Journal of History of Medicine and Allied Sciences*, vol. 15 (1960), p. 385.

[63] Miles, *Early Arabic Glass Weights*, p. 19.

[64] Epiphanius, *Weights and Measures*, p. 56.

[65] Hinz, *Islamische Masse*, p. 48.

[66] Sauvaire, 'Arab Metrology', *Journal of Royal Asiatic Society*, vol. 10 (1878), p. 260.

[67] as-Saqati, *Adab al-Hisbah*, p. 12.

safety and public health. One could easily, therefore, see reasons for the genuine concern expressed by Ibn al-Quff regarding this situation.

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Early Arabic Professional Pharmacy

A series of manuals on pharmacy practice and management, and on the application of medical therapy appeared during the early Arabic period. These compendiums can be traced from *al-Aqrabadhin* by Sabur b. Sahl (d. 255/869)[1] to *al-Hawi fil-`Ilm at-Tadawi* by Najm ad-Din Mahmud ash-Shirazi in the late seventh/thirteenth century.[2] Several of them not only show the progress achieved in the apothecary's art and the expanding knowledge in *materia medica*, but the high professional standards in practice and ethics emphasized and upheld by the educated minority among practicing pharmacists in each generation. Many of these formularies were translated into Latin and thus rendered a great service to the development of pharmacy in Europe as well. This activity climaxed in *al-Minhaj ad-Dukkan fit-Tarikh al-Adwiyyah an-Nafi`ah lil-Abdan*, addressed at once to the author's son and to pharmacists at large. A practical pharmacy text, it was completed in (658/1260) in Cairo, by the Egyptian pharmacist Abu al-Muna b. Abi Nasr b. Haffaz b. al-`Attar. In it, the author stresses the importance of generally accepted norms of ethics, good management, and methods of practice, to be adhered to by pharmacists. *Al-Minhaj* seems to have superseded earlier manuals, and its use was widespread among pharmacists (*Sayadilah*) and apothecaries (*`Attarin*) from the seventh/thirteenth century up to modern times.[3] Owing to its popularity, numerous copies exist in many private and public libraries. It also appeared in several editions in Cairo, Egypt; in Bulaq, (1287/1870), and (1300/1833), Sharaf, (1305/1888), Husayniyyah, (1330/1912), and in Sa`idiyyah, (1350/1932).[4]

Since the thirteenth/nineteenth century,[5] several authors have pointed out the importance of *al-Minhaj* and outlined its general contents and objectives.[6] In this paper, an attempt will be

[1] `Ali b. Yusuf al-Qifti (d. 645/1248), *Ikhbar al-`Ulama bi-Akhbar al-Hukama*, Cairo ed., 1908, pp. 134 and 141; and Sami Hamarneh, 'Sabur's Abridged Formulary, the First of its Kind in Islam,' *Sudhoffs Archiv*, 1961, 45; 247-260.

[2] I examined several copies of *al-Hawi* of Mahmud ash-Shirazi (d. 730/1330); e.g. British Museum Or. 3512 and Or. 9203, each containing the five treatises. It was edited in part by P. Guiges, *Le Livre de l'Art du Traitement de Najm ad-Din Mahmoud*, Beirut: Catholic Press, 1903.

[3] I examined several copies of *al-Minhaj* of Ibn al-`Attar for this study in London, Cairo, Damascus, and Washington, D.C. See Carl Brockelmann, *Geschichte der Arabischen Litteratur*, vol. 1, Leiden: Brill, 1943, p. 648 and *Supplement*, vol. 1, p. 897.

[4] Despite the many errors in the Cairo Sa`idiyyah edition of 1932, my reference hereafter will be to it.

[5] Lucien Leclerc, *Histoire de la Medecine Arabe*, vol. 2, Paris, 1876, pp. 218-219; and Moritz Steinschneider, 'Eine Arabische Pharmakopie des XIII. Jahrhunderts von Abul Muna und die Quellen derselben,' *Ztschr. d. Deutsch,*

made to evaluate this work critically from the view point of an historian pharmacist who has practiced the profession both in hospital and private pharmacies for a number of years.

The first task is to establish *al-Minhaj's* place with regard to medieval pharmaceutical literature, comparing it with other Arabic formularies and *materia medica* manuals and thus explaining its importance in the history of pharmacy and medical therapy.

The second is to analyze its deontology (in chapters 1 and 23), the relevance of its ethical codes and recommendations to the actual standards applied in pharmacy practices, and their relation to educational and social requirements.[7]

The third task is to consider pharmaceutical preparations and dosage forms described, plasters, poultices, dentifrices, utensils used, and weights and measures (chapters 2 to 19 and chapter 22).

The fourth is to examine its *materia medica*, diet and drug therapy, drug substitution when the need arises, synonyms and descriptions, time, place, and methods of collecting, cleaning, using, or preserving of drugs, and testing procedures to guard against fraud and adulteration (chapters 20, 21, 24, and 25).

Pharmacy and Arabic Formularies

By the early third/ninth century, pharmacy attained professional status under the `Abbasiyyah caliphs. It became an independent, well defined, and organized profession, an entity separate from medicine, yet closely related in cooperation, purpose, and motivation to serve man's well-being and promote good health. Several public pharmacy shops, besides those connected with hospitals, sprang up in the central and commercial cities of Iraq, Egypt, and Syria; the situation was well defined and described by Abu Bakr ar-Razi (d. ca. 312/925) and Abu ar-Rayhan al-Biruni (d. 439/1048).[8] Separation from medicine was less apparent among practitioners in the

Morgenlandischen Gesellsch., 1902, 56: 74-85; and *Die Arabische Litteratur der Juden*, Frankfurt: Kauffmann, 1902, pp. 237-238.

[6] George Sarton, *Introduction to History of Science*, vol. 2, Baltimore: Williams and Wilkins, 1931, pp. 1097-1098; Max Meyerhof, 'Pharmacology during the Golden Age of Arabian Medicine', *Ciba Symposia*, 1944, 6: 1865-1866.

[7] See Martin Levey, *Medical Ethics of Medieval Islam*, Philadelphia: American Philosophical Society, 1967. (*Tr. Am. Philos. Soc.*, n.s. vol. 57, pt. 3), pp. 5-17; and Hamarneh, 'The Rise of Professional Pharmacy in Islam', *Medical History*, 1962, 6: 59-66.

[8] Abu Bakr ar-Razi wrote on pharmacy in his *al-Mansuri* and other works; while al-Biruni wrote a book on pharmacy, *Kitab as-Saydanah*, copies of which in manuscript form, I examined in Istanbul and in Baghdad.

Muslim states of North Africa (Algeria, Tunisia, Morocco) and Spain. Mention can be made of Ahmad b. Yunis al-Harrani[9] (fl. 353/965) and Abu Bakr Hamid b. Samhun (fl. 374/985) of Cordova.[10] Hospitals and pharmacy shops connected with such establishments in Islam were planned, managed, and administered by lay physicians. They also served as important centers for medical and pharmaceutical education throughout this period.[11] Numerous texts in Arabic were available from the third/ninth century on.

Side by side with the educated, conscientious pharmacists (*Sayadilah*), however, were the untutored apothecaries and perfumers (*`Attarin*). Examination and registration of licensed pharmacists or physicians was somewhat restrictive. The *Muhtasib* appointed by the Muslim rulers attempted to enforce professional rules and regulations generally in capitals and larger cities.[12] Translations of medical pharmaceutical writings from Syriac, Sanskrit, Greek, and other languages flourished throughout the third/ninth century. From the Greek, the works of the second-century Galen, and especially the five books of *Materia Medica* completed about 75 C.E., by Pedanios Dioscorides of Anazarba (Asia Minor), enriched Arabic pharmaceutical literature and helped to build Arabic medical botany and the identification, qualities, and uses of drugs.[13]

Besides pharmacy, other health professions, too, attained independence during the same period. Doctors, surgeons, oculists, and veterinarians (farriers), each served in their own field of specialization.[14] Each also found Arabic to be the *lingua franca* then and for many centuries to

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[9] Sulayman Ibn Juljul, *Tabaqat al-Atibba wal-Hukama* (completed in 376/987), edited by Fu'ad Sayyid, Cairo: Inst. Franc. d'Archeol. Orient. 1955, pp. 112-114; and Sa`id b. Ahmad al-Andalusi, *Tabaqat al-Umam*, Cairo: Sa`adah, n.d., pp. 121, 124.

[10] Ahmad b. Muhammad al-Ghafiqi (d. 560/1165), a competent and renowned herbalist, in his text on *materia medica* praised Ibn Samhun as a great and well qualified pharmacist (*Saydali* or *Saydalani*). See Ibn Abi Usaybi`ah (d. 668/1270), *`Uyun al-Anba fi Tabaqat al-Atibba*, Cairo ed., 1882, vol. 2, pp. 51-52; and Brockelmann, *op. cit.*, vol. 1, pp. 635-636.

[11] Hamarneh, 'Development of Hospitals in Islam', *Journal of History of Medicine and Allied Sciences*, 1962, 17: 366-384.

[12] *Idem*; 'Origin and Functions of the *Hisbah* System,' *Sudhoffs Archiv*, 1964, 48: 157-173. See also Ahmad al-Maqrizi, *al-Khitat*, vol. 1, Cairo ed., 1853, pp. 407-420 and 463, and Yaqut al-Hamawi, *Dictionary of Learned Men*, ed. by D.S. Margoliouth, vol. 7, London: Luzac, 1926, pp. 92-94.

[13] Leclerc, 'De la Traduction Arabe de Dioscorides', *J. Asiatique*, Jan., 1867, pp. 5-38; and Hamarneh, *Bibliography on Medicine and Pharmacy in Medieval Islam*, Stuttgart: Veroffentlich. d. Internat. Gesellsch. f. Gesch. d. Pharm., 1964, pp. 43-44.

[14] Ibn Juljul, *Tabaqat, op. cit.*, pp. 97-100; and Ibn Abi Usaybi`ah gives biographies of practitioners, each specialized in his own field of the health profession, see *`Uyun, op. cit.*, vol. 1, pp. 161, 200-203 and 236-237.

come, providing the texts and schools needed for training, learning, and practice.[15] Alchemy at the same time became a widely recognized specialty zealously guarded by faithful adherents. As early as the first quarter of the third/ninth century, it was an entity separate from pharmacy or medicine, despite the fact that many physicians were associated with it.[16]

Seemingly influenced by the work of Dioscorides, and in view of the great need for manuals for pharmacists in hospitals and private practice, Sabur wrote his *Aqrabadhin*, the first pharmaceutical compendium in Arabic.[17] It preceded another *Aqrabadhin*, mainly in the form of medical recipes, attributed to Ya`qub b. Ishaq al-Kindi (d. 260/874), known also as the philosopher of the Arabs.[18] In Cordova, *ad-Dukkan*, in 17 chapters, by Ibn `Abd Rabbih (fl. 317/930) was the first text on the practice of pharmacy in Muslim Spain.[19] About two decades later, the work of Dioscorides was translated into Arabic, also in Cordova, It soon stirred interest in medical botany, and several manuals on *materia medica* were written from the late fourth/tenth century to the seventh/thirteenth century, some with original and valuable additions.[20] We can mention in this brief survey only a few names: Ibn Juljul (fl. 376/987); Ibn Wafid (389-460/999-1068); Ibn Abi as-Salt (460-528/1068-1134); Abu Ja`far al-Ghafiqi (d. 560/1165); and ash-Sharif al-Idrisi (fl. 548/1154).[21]

In the Eastern Caliphate, Sabur's compendium was superseded by *al-Aqrabadhin al-Kabir* of Hibat Allah b. at-Tilmidh (d. 560/1165), almost three centuries later. Composed of twenty treatises, this formulary contains medical recipes of pharmaceutical preparations in the various

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[15] al-Maqrizi, *al-Khitat, op. cit.*, vol. 1, pp. 445-460; `Abd ar-Rahman Ibn Khaldun, *al-Muqaddimah*, Cairo: Tujariyah, n.d., pp. 541-545.

[16] Muhammad Y. Haschmi, 'The Beginnings of Arab Alchemy,' *Ambix*, 1961, 9: 155-161; and Levey, *Medieval Arabic Toxicology*, Philadelphia: American Philosophical Society., 1966 (*Tr. Am. Philos. Soc.*, vol. 56, pt. 7), pp. 8-19. One of the physicians who wrote on alchemy and defended its causes was none other than the famous Abu Bakr ar-Razi. In the early third/ninth century, Ibn Masawayh spoke of alchemy and professional alchemists.

[17] One manuscript of Sabur's *Aqrabadhin* is known to me in Gotha, Germany.

[18] *The Medical Formulary or Aqrabadhin of al-Kindi, translated with a study of its materia medica* by M. Levey, Madison: Univ. of Wisconsin Press, 1966. See also review by S. Hamarneh, *Bulletin of History of Medicine*, 1967, 41: 83-84.

[19] Ibn Sa`id, *Tabaqat, op. cit.*, p. 121; and Ibn Abi Usaybi`ah, *`Uyun, op. cit.*, vol. 2, p. 44. I found a fine copy of Ibn `Abd Rabbih's *Dukkan* at the Zahiriyyah Library, *Catalogue of Arabic Manuscripts on Medicine and Pharmacy*, Damascus: Arab Academy, 1968, pp. 236-241 (Arabic Text).

[20] Ibn Juljul wrote a treatise on simples not mentioned in Dioscorides' *Materia Medica*. There is a copy in Oxford. See J. Uri, *Bibliotheca Bodleiana Codicum Mss. Orientalium*, pt. 1, Oxford, 1787, p. 136.

[21] Ibn Abi Usaybi`ah, *`Uyun, op. cit.*, vol. 2, pp, 46-52; Ferdinand Wuestenfeld, *Geschichte der Arabischen Aerzte und Naturforscher*, Gottingen, 1840, pp. 92-98; and Brockelmann, *op. cit.*, vol. 1, pp. 628, 638-644.

dosage forms, such as tablets, powders, confectionaries, and recipes on how to gain or lose weight. It also lists drugs used to increase or decrease perspiration.[22] It is longer than that of Sabur, but not necessarily better; Ibn al-`Attar quoted from both frequently.

In the early seventh/thirteenth century, Dawud b. Abi al-Bayan, also an Egyptian (born in Cairo in 556/1161), composed his *ad-Dustur al-Bimaristani*, a hospital formulary, mainly about compounded drugs, primarily written as a guide to physicians and pharmacists of an-Nasiri hospital of Cairo and to those in other pharmacy shops in Egypt, Syria, and Iraq.[23] The selected, useful recipes and pharmaceutical preparations 'were compiled from earlier, highly recommended texts to revive and facilitate their use lest they be lost.' They include dentifrices and ointments, 'employed to cure hemorrhoids, fistules, and abcesses.' In his methods of compounding and his technique, the author follows similar procedures found in az-Zahrawi's *at-Tasrif*, which he seems to have read carefully.[24]

In the introduction to *al-Minhaj*, Ibn al-`Attar refers specifically to the work of his senior contemporary and fellow countryman, Ibn Abi al-Bayan. He explains, 'I looked for a comprehensive manual in which one finds all that one needs to know about pharmacy, which, after medicine, is one of the most honored among professions. . . and is indeed a tool of the healing art. . ., and I found none.' He then adds, 'During my lifetime, however, the learned teacher Ibn Abi al-Bayan has written a fine book, entitled *ad-Dustur al-Bimaristani*, supposedly to contain all that is needed in a medical compendium. . . But I am sorry to say that he left much to be desired, although not intentionally, since this was composed primarily for the physician's use.' The above translated statement, therefore, gives an important clue to *al-Minhaj* of Ibn al-`Attar as a work devoted exclusively to the pharmacist, a fact of great historical significance. Ibn al-`Attar goes on to say, 'In our time, pharmacy is also known as the art of the apothecary (*al-`Itr wa ash-Sharab*, literally the making of perfumes, aromatic medications, and syrups).' To assist the practicing pharmacist, Ibn al-`Attar compiled detailed information on the making, preserving,

[22] I examined manuscript copies of Ibn at-Tilmidh's *Aqrabadhin* at the National Library of Medicine, the British Museum, and the National Library of Cairo. To these libraries, I express my deep gratitude.

[23] *Ad-Dustur* was edited from a 873/1469 copy by Paul Sbath, 'Le Formulaire des Hopitaux d' Ibn Abi'l Bayan, Medecin du Bimaristan Annacery au Caire au XIII^{e} Siecle,' in *Bull. Inst. d'Egypte*, 1933, 15:13-28. I also consulted the manuscript at the Zahiriyyah Library, copied by Muhammad b. al-Fayidah in Hamah, on 22nd of *Shawwal*, 936/1530.

[24] Ibn Abi Usaybi`ah, *`Uyun, op. cit.*, vol. 2, pp. 118-119. There is also reference to *al-Bayan* in some of the extant copies of *at-Tasrif* which I examined.

and dispensing of medications and the techniques involved in their preparation.[25] He also refers to the works he copied from or consulted most frequently. These were:

Al-Irshad li-Masalih al-Anfus wal-Ajsad, on what benefits man's body and soul in medicine and hygiene, in four treatises, by Hibat Allah b. Jumay (d. 594/1198). It calls attention to the importance of, and the need for compounded drugs.

Al-Malaki of al-Majusi (Haly `Abbas, d. 383/994), a comprehensive medical encyclopedia.

Al-Minhaj al-Bayan,by Yahya b. Jaziah of Baghdad (493/1100), on drugs and diseases and their treatment.[26]

The two already mentioned compendiums of Ibn at-Tilmidh and Ibn Abi al-Bayan.

In addition, Ibn al-`Attar copied and referred repeatedly to other physicians and pharmacists whose books he had read or under whom he had studied, besides the eminent herbalists he knew – here possibly referring to his senior contemporary, the famous herbalist, Ibn al-Baytar.[27] He also included original ideas and observations, drug recipes, and techniques which he personally had tried and had found useful.

Although Ibn al-`Attar mentions his motivations and reasons for the compiling of this formulary and what he hoped to accomplish by it, very little is known of the author himself. A careful reading of his text, however, might give us a few clues to his life. *Al-Minhaj*, it appears, is his only known literary contribution to the health professions. Indeed, it is the only extant work by him. He must have written it late in life, almost three decades after Ibn Abi al-Bayan composed his *ad-Dustur*. By 658/1260, when *al-Minhaj* was completed, Ibn al-`Attar's son, also a pharmacist, seems to have been sharing the responsibility of managing the pharmacy shop and manufacturing needed medications, until then exclusively under the father's supervision. At this point, Ibn al-`Attar appears in a sense to be stepping out, gradually handing over to a promising son the responsibility and affairs of what seems to have been a flourishing business. We are not

[25] Hajji Khalifah, *Kashf az-Zunun `an Asma al-Kutub wal-Funun*, Cairo ed., vol. 2, 1893, p. 549; Ibn al-`Attar, *al-Minhaj*, 1932 ed., pp. 2-4.

[26] Brockelmann, *op. cit.*, vol. 1, pp. 273, 639-644. Only one work, *al-Malaki*, has been edited in two vols., Cairo, 1877, but all are extant in numerous copies.

[27] There is no doubt that Ibn al-`Attar benefited from *al-Jami*, of his senior contemporary Ibn al-Baytar in compiling his chapter on *materia medica*. See Hamarneh, *History of Arabic Medicine and Pharmacy*, Cairo: al-Mahasin Press, 1967, pp. 36-38 and 54.

told how long the transitional period was nor what took place afterwards, but we may here consider the ethical challenges, admonitions, and recommendations presented by the author. 'The man who perceives in himself willingness to carry on the work of a pharmacist (to undertake the compounding and preparation of medications),' Ibn al-`Attar reasons, 'ought to have deep religious convictions, consideration of others, a sense of responsibility, and be careful and God fearing.'[28] He exhorts his son to be this kind of person. He urges him never to turn away from the teachings of ancient authority, considering any deviation an intellectual rebellion, liable to condemnation by God and man.

Ibn al-`Attar, furthermore, urges his son to follow the golden rule 'to love and help your neighbor just as much as you love and take care of yourself.' Thus, he speaks to his son as a pharmacist, telling him 'in dispensing drugs' to 'prepare them faithfully as though they were for your own loved ones. Beware of negligence and disrespect, shun evil, cheating, malice and satire, and avoid being sarcastic.' He then emphasizes, 'when a sick person calls a doctor to treat him. . .and he writes a prescription for him, that patient looks with much expectation to the pharmacist who is going to prepare that medicine which will be his cure. . .It would be tragic to body, wealth, and soul,' he continues, 'if this confidence were destroyed.'[29] The author thus impresses upon his son, and through him the future pharmacists who read his book, the important part played by the pharmacist in helping the sick, relieving pain, and restoring health, a fact that needs to be stressed even more in our time. In addition, Ibn al-`Attar reminds his reader to give special attention and consideration to the poor and needy, an admonition repeatedly voiced by practitioners in this 'age of faith.'[30] Ibn al-`Attar opens chapter 23 with a new vision and with words of inspiration. He exhorts his son to realize every day's potentials, which bring renewed vigor, as if the universe were reborn every new day.

Ibn al-`Attar then considers the practical aspects related to the upkeep and management of a drugstore. He advises, 'Each morning after opening the shop, the pharmacist ought to clean the balance, the pans, and wipe dirt of the balance's strings. . .and each month or even every two

[28] Ibn al-`Attar, *al-Minhaj*, pp. 4-6, and 233-240.

[29] Compare with Albert Z. Iskandar, 'K. Mihnat at-Tabib,' *al-Machriq*, 1960, 54: 479-481.

[30] Similar ethical instructions were voiced earlier by `Abd Allah b. Ahmad al-Albiri in *an-Nata'ij al-`Aqliyyah*, completed in 570/1175, a copy of which dated 20 *Rabi ath-Thani*, 717/1318 is found in the Zahiriyyah Library, no. 3157. It describes duties of the pharmacist (apothecary, e.g. *`Attar*), and the physician and urges pharmacists to virtuous living, honesty, modesty, and kindness. It stresses dispensing the best quality, unadulterated drugs in accordance with the doctor's instructions. It also discusses minerals, gems, and aging of simples and compounds.

weeks, he ought to clean the weights and measures.' Vessels in which syrups, waters, and anointing oils are stored should be thoroughly cleaned before being filled and stamped by the pharmacist's seal. 'The spoons should also be cleaned daily. . .and be wrapped in clean cloth.' He recommends a moderate, adequate profit on sales and proposes a good display of available remedies to create interest in the buyer's mind; for this reason, as an experienced pharmacist, he urges that the shop be always well stocked with available drugs and spices and, 'When an item is used up, it must be replaced soon.' He thus instructs that the stock be checked at regular intervals, once or twice each month, so that needed items may be acquired and deteriorated compounds replaced by freshly manufactured preparations. He ends by stressing that a pharmacist be friendly, honest and thoughtful, slow to show anger, modest and patient,[31] qualities that are an integral part of professional ethics and moral standards for every age.

Al-Minhaj's Pharmaceutical Preparations and Dosage Forms

These discussions start with chapter 2, on syrups and juleps prepared by mixing already boiled sugar and water with the white of eggs, then cooking to the desired consistency together with the required fruits or flowers; nenuphars, violets, lemons, oranges, tamarinds, pomegranates, pears, dates, or grapes. While syrups have a higher ratio of sugar than fruits, the robs in chapter 3 contain more fruit and less sugar: 'which in Egypt was preferred over honey for better quality and longer keeping.'[32] Conserves and confections, in chapters 4 to 5, are prepared with sugar without adding water. The Arabic word for electuaries (chapter 6), *Jawarish*, meaning helping digestion of food; electuaries contain aromatic spices such as peppers and ginger. Recipes recommended are compiled from compendiums of earlier authors, to whom Ibn al-`Attar often gave credit. The same is true of the dosage for preparations such as powders, tablets (troches), lohochs,[33] pills, and granules (chapters 7 to10). One finds no original contribution either in the compilation of recipes on the *Hiera picra* (compounds of bitters and aromatic spices); theriacs;

[31] Compare with emphasis on specialized training as expressed by A.M. Carr-Saunders and P.A. Wilson, *The Profession*, Oxford Univ. Press, 1933, pp. 490-492.

[32] Ibn al-`Attar, *al-Minhaj*, pp. 650.

[33] For the definition and identification of technical terms and pharmaceutical preparations mentioned here, see Hamarneh and Glenn Sonnedecker, *A Pharmaceutical View of Abulcasis al-Zahrawi*, Leiden: Brill, 1963, pp. 133-136; and Levey, 'Some Aspects of the Nomenclature of Arabic *materia medica*,' *Bulletin of History of Medicine*, 1965, 37: 130-137.

mithridatium;[34] medicated stick and powder for the eye, or salves and collyria; kohls (originally powdered antimony sulfide or stibine to darken eyelids, yet occasionally mixed with other eye medications), ointments; *adhan* (extracts of flowers, spices, and seeds cooked in olive oil); pastes, plasters, and poultices; dentifrices and mouth and gum medications; inhalants; enemas (clysters), suppositories, and ovules; and bandages and the use of splints for bone setting (chapters 11 and 19). Of special interest is chapter 22, on weights and measures, a topic treated by many authors during this period. These directory-like guide-lists, often arranged alphabetically, were intended to help pharmacist to measure and weigh ingredients included in the recommended recipes accurately. No author or guild, however, attempted to establish and enforce state or regional standards. The first appeal we know of for such action did not come until late in the seventh/thirteenth century, when it was almost too late.[35] Governments in the region seldom attempted to enforce such regulations, though weights and measures were inspected and stamped by the local authorities, generally by the *Muhtasib* and his aides.[36] The confusion continued to exist, e.g. 'the *istar* is 4-1/3 *mithqals*, but some say it only equals 4,' yet one finds better organization in Ibn al-`Attar's text than in earlier works.[37]

Al-Minhaj's Materia Medica

Drug substitution played an important role in the history of medical therapy during the Greco-Roman and Arabic periods. The reasons for such concern are obvious: availability of drugs called for, the time of the year, regional differences, urgency, and the drug market. Many Arabic authors, therefore, devoted special chapters in their medical compendiums to this subject. Ar-Razi, about 287/900, composed a whole treatise on drug substitution, *Ibdal al-Adwiyyah*, and az-Zahrawi, a century later, devoted a chapter to it in his *at-Tasrif*.[38] Likewise, Ibn al-`Attar focused his attention in chapter 20 of *al-Minhaj* on the methods, procedures, pharmacological actions and

[34] The universal antidote devised by Mithridates Eupator, King of Pontos (120-63 B.C.E.). See Sarton, *Introduction, op. cit.*, vol. 1, p. 214; and Gilbert Watson, *Theriac and Mithridatium*, London: Wellcome Historical Medical Lib., 1966, pp. 1-5, 33-41.

[35] Hamarneh, 'The First Recorded Appeal for Unification of Weights and Measure Standards in Arabic Medicine', *Physis*, 1963, 5: 230-248.

[36] Boubaker Ben Yahia, 'Falsification et Controle des Medicaments Pendant la Periode Islamique,' *Actes du VII Congres International d'Histoire des Sciences*, 1953, pp. 210-215.

[37] Ibn Sina in his *al-Qanun fit-Tibb*, devotes a chapter to this matter at the end of Book V; az-Zahrawi and other authors behaved similarly.

[38] Khalifah, *Kashf, op. cit.*, vol. 1, 1892, p. 45, attributes a work on the succedaneum of simple and compounded drugs to Sabur b. Sahl (d. 255/869).

occasions when succedaneum is allowed, as well as the dosages and the techniques employed in the compounding. He lists the simples in alphabetical order, giving a substitute in each entry. For example, 'caraway can be used instead of anis and the root of licorice or bugloss (*Anchusa officinalis* L.) in place of the violet.'[39]

Chapter 21 contains a brief glossary on simple drugs such as acacia, fennel, and wild ginger, and their synonyms, in alphabetical order. Ibn al-`Attar begins by saying, 'The scordium (water germander, *Teucrium scordium* L.), known also in Arabic as the wild garlic, has three kinds (species) . . .I have seen and acquired the three.' It concludes identification of certain unfamiliar drugs often encountered by practitioners and reminds us of a similar but larger work by Ibn Maymun (533-600/1139-1204).[40] Ibn al-`Attar's glossary includes a few uncertainties copied from earlier texts and compilations of *materia medica* not based on actual personal observation and exact identification, especially as to the types and species of plants and to impurities in minerals. Fewer credits are given in this part.

Chapter 24 gives instructions, in a nicely organized manner, regarding drugs acquired from the three natural kingdoms: plant, mineral, and animal. It explains where, when, and at what time of the year this material ought to be collected, cleaned, and dried, and how to prepare or keep it for future use. It also contains information regarding 'preservatives,' the type and shape of containers for keeping a particular drug, and how long it resists deterioration, a matter of concern in preserving simple and compounded drugs, seeds, spices, animal parts, syrups, electuaries and theriacs. It ends with the description: 'the castoreum usually keeps well up to fifteen years, then begins to change and deteriorate. This statement I copied from the book of az-Zahrawi.'[41] About 590/1194, al-Qalanisi discussed similar aspects, giving preference to the unadulterated drugs of mineral origin with stronger emphasis on chemotherapy than is found in ar-Razi's writing in the early fourth/tenth century.[42]

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[39] Ibn al-`Attar, *al-Minhaj*, pp. 185-194.

[40] *Un Glossaire de Matiere Medicale*, written by Maimonides, edited with translation and commentary by M. Meyerhof, Cairo: Inst. Franc. d'Archeol, Orient., 1940.

[41] I compared this statement (*al-Minhaj*, p. 247) with az-Zahrawi's text (treatise 29 of *at-Tasrif*) and found the quotation accurate.

[42] Badr ad-Din Muhammad b. Bahram al-Qalanisi completed his 49 chapter *Aqrabadhin* in 590/1194. Al-Qalanisi also spoke of calcination, washing, congealing, mixing of liquids and solids, drug synonyms, and of methods to preserve drugs for future use. See Ibn Abi Usaybi`ah, *`Uyun, op. cit.*, vol. 2, p. 31; and Brockelmann, *op. cit.*, vol. 1, p. 644 and *Supplement* vol. 1, p. 893.

The last chapter of *al-Minhaj* discusses organoleptic methods of testing drugs, e.g., by taste, color, rubbing, or the use of the sun's heat or fire. It thus exposes the adulterations and helps in selecting the good, 'pure and usable' substances. It begins with lapis lazuli and recommends methods of testing – with heat or by rubbing with cloth – to discover whether it is adulterated or not. This is followed by other tests on sandalwood, camphor, horned poppy (glaucium), opium, ginger mercury, tutty, and other simples available then on the drug market. Despite the shortcomings of these primitive and often 'unscientific' methods, such tests were very helpful and were most zealously applied until the modern period.[43]

Finally, one asks whether there was any official enforcement of *al-Minhaj* or the other above-mentioned texts. If the question implies official pharmacopoeias in the modern sense of the word, the simple answer is that there was no such enforcement. *Al-Aqrabadhin* of Sabur and Ibn at-Tilmidh, as well as *al-Minhaj* of Ibn al-`Attar, were among the pharmaceutical and medical formularies that were widely read, relied upon, quoted, and used as guide texts by practitioners in hospital and privately owned pharmacy shops throughout the region. They were also consulted and used by *al-Muhtasib* and other state officials, and by physicians and those connected with the health professions, but they were seldom enforced as the official, standard formularies. This was an inherent weakness, or possibly the strength, of the Muslim society that left the door wide open for free enterprises and trade, though not infrequently with restrictions, controls, and disciplinary measures against violators and abusers of professional and commercial privileges. The *hisbah* system that was established early in Islamic society is a case in point.[44]

In conclusion, one can affirm that these formularies helped to re-shape, organize, and promote the professional practice of pharmacy in Islam. *Al-Minhaj*, in particular, forms a climax in its emphasis and organization. This manual continued from the late seventh/thirteenth through

[43] Compare with the fine analysis given by Ernst W. Stieb with the collaboration of Glenn Sonnedecker, *Drug Adulteration*, Madison: Univ. of Wisconsin Press, 1966, pp. 3-13.

[44] The impetus for this system for the inspection of commodities, drugs, weights and measures came from religious convictions and social tendencies in Muslim lands. Its aim was to prevent adulteration and fraud, to safeguard consumers' interest, and to guarantee the welfare of communal life, as described in Hamarneh's article cited above (Hamarneh, 'Development of Hospitals in Islam', *Journal of History of Medicine and Allied Sciences*, 1962, 17: 366-384.).

the thirteenth/nineteenth centuries to be one of the texts consulted by apothecaries of Egypt and neighboring countries.[45]

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Reprinted from:-

Bulletin of the History of Medicine 42: 450-461, 1968.

[45] Philip K. Hitti, *History of the Arabs*, 6th ed., London: Macmillan, 1958, pp. 484-489; and Gustav E. von Grunebaum, *Medieval Islam*, Chicago, University Press, 1947, p. 337.

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