

Arab and Muslim Physicians and Scholars

Ibn Al-Nafis: Discoverer of the Pulmonary Circulation

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The Arab physician Ala' al-Din ibn Abi al-Hazm, well known as Ibn al-Nafis, was born in the year 1210 in al-Qurashiyya, a village near Damascus, hence he was known as Al-Dimashqi. His family originally came from Qarash, a village beyond the River Oxus, and that, according to some authors, gave him the "nisbah" of al-Qurashi.¹

His initial medical studies were in Damascus at the Great Nuri Hospital, Al-Bimaristan Al-Nuri Al-Kabir, built by the Turkish Prince Nur al-Din Mahmoud ibn Zanki after his conquest of Damascus in 1154. Ibn al-Nafis teacher at that hospital was Muhadhdhab al-Din Abd al-Rhim ibn Ali Al-Dakhwar, who established al-Dakhwariyya Medical School in Damascus, and was the Chief of Physicians for Syria and Egypt during the rule of the Ayyubid ruler al-Adil. Al-Dakhwar was appointed by al-Adil's successor, al-Muazzam, as the head of the Nuri Hospital.² Other contemporaries of Ibn al-Nafis were Ibn Abi Usaybi'a and Ibn al-Quff.

In 1236, Ibn al-Nafis moved to Egypt. He became Chief of Physicians (*Ra'is Al-Atibba'*) in Egypt and the private physician for the Mamluk ruler Sultan Al-Zahir Baybars al-Bunduqdari, who ruled Egypt during the period 1260-1277. He had a thriving practice and became wealthy. He built a house in Cairo, and entertained rulers, leading physicians and colleagues. Towards the end of his life, Ibn al-Nafis donated his house and library to the newly established Al Mansouri Hospital, which was built in 1284 by the Mamluk Sultan al-Mansur Sayf al-Din Qalawun al-Alfi.¹⁻³ He died in Cairo on December 17, 1288, at the age of 78, after an unknown illness.

In addition to his medical studies, Ibn al-Nafis learnt Islamic religious law, and became a renowned expert on Shafi'i school of jurisprudence (*Fiqh*). He lectured at al-Masruriyya School in Cairo. His name was included in a book on "Great Classes of Shafi'i Scholars (*Tabaqat al-Shafi'iyyin al-Kubra*) by Taj al-Din al-Subki

indicating his fame in religious law.¹

Ibn al-Nafis was a prolific author. He had an outstanding memory and had written his books from memory without reference to other textbooks or compendia. According to Nagmia, his works can be divided into several categories²:

I. Original contributions:

- *Kitab Al-Shamilfi al-Sina'a al-Tibbiyya* (*Comprehensive Book on the Art of Medicine*). He wrote this book when he was in his thirties. It consisted of 300 volumes of notes, 80 of which were published. This book contained a section on surgical techniques, thus shedding lights on Ibn al-Nafis as a surgeon. According to Iskandar, there are three stages for each Operation: *al-I'ta'* (The presentation for diagnosis); *al-'amal* (the operative procedure); and *al-hifz* (preservation-post operative care).¹
- *Kitab Al-Mukhtar Min al-Aghdhiyah* (*Book of Selection of Nutrients*).
- *Al Muhadhab fi al-Kohl* (*The Polished Book on Ophthalmology*).
- *Bughyat al-Talibin wa Hujjat al-Mutatabbibin* (*Reference Book for Physicians*).
- *Kitab Jame' Al-Daqai'q fi al-tibb* (*The Composite of Details in Medicine*).

II. Commentaries on Greek works

- *Sharh Fusul Al Buqrat* (*Commentary on Hippocratic Aphorism*).
- *Ibidimiya li Buqrat wa tafsiruhu li al Amrad al Wafideh* (*Commentary on the Epidemiology of Disease by Hippocrates*)
- *Sharh Taqdimat Al-Ma'rifah* (*Commentary on Hippocratic Prognostics*).
- *Sharh Tabi'at al-Insan li Buqrat* (*Commentary on Hippocrates book "De Natura Hominis" or Nature of Man*).

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III. Commentaries on Islamic medical works;

- *Kitab Mujaz al-Qanun* (Commentary on *Al Qanun fi al Tibb* by Ibn Sina). This commentary made Ibn Al Nafis most famous, and was published several times. A review of this book was written by Kahya from a copy in Turkey.⁴
- *Sharh Tashrih Al Qanun* (Commentary on the Anatomy in *Al-Qanun*). In this book, he gives the earliest description of the pulmonary circulation.
- *Sharh Mufrada Al Qanun* (Commentary on Simple Medicines in *Al Qanun*).
- *Sharh Masai'l Hunain* (Commentary on Questions of Hunain Ibn Ishaq).

VI. Contributions to Islamic theology and philosophy:

- *Al Risalah Al Kamaliyyah fi al Sira al Nabawiyyah* known also as Fadil bin Natiq on the life story of the prophet of Islam.
- *Al Mukhtasar fi Ilm Usoul al Hadith* (A Short Account of the Methodology of Hadith).

Several articles by Arab and Western authors discuss the role of Ibn al-Nafis in the discovery of the pulmonary circulation.⁵⁻¹⁰ He challenged the Galenic concept of circulation which stated that blood reaching the right side of the heart went through invisible pores in the septum of the left side of the heart, where it mixes with air to create spirit and then was distributed to the body.⁶

Western writers gave credit of the discovery of the pulmonary circulation to Michael Servetus (1511-1553), a Spanish physician and theologian,¹¹ and to William Harvey.¹² Soubani and Khan elaborated on the European descriptions of circulation and the resemblance between the writings of Ibn al-Nafis on this issue and those of later European writers such as Servetus, and Colombo.⁶

Some authors believe that Western writers used Ibn al-Nafis concept of circulation in their “re-discovery” three hundred years later.¹³ One writer raised questions regarding whether Ibn al-Nafis was known to the European scholars during the age of Renaissance and that they opted to ignore his writing or not give proper credit to him.¹⁴

The credit for recognizing Ibn al-Nafis as the discoverer of the pulmonary circulation goes to Dr. Muhyi al-Din al-Tatawi of Egypt. In 1924, Dr. al-Tatawi found a manuscript of “Sharh Tashrih al-Qanun” in the Prussian State Library in Berlin (Manuscript 912), while working on his dissertation for a doctorate at the Faculty of Medicine of the Albert Ludwigs University in Freiburg, Germany.^{2,5-7} Ibn al-Nafis stated the following regarding

the pulmonary circulation:

“...This is the right cavity of the two cavities of the heart. When the blood in this cavity has become thin, it must be transferred into the left cavity where the pneuma is generated. But there is no passage between these two cavities, the substance of the heart there being impermeable. It neither contains a visible passage, or as some people thought, nor does it contain an invisible passage which would permit the passage of blood, as Galen thought. The pores of the heart there are compact and the substance of the heart is thick. It must, therefore, be that when the blood has become thin, it is passed into the arterial vein (pulmonary artery) to the lung, in order to be dispersed inside the substance of the lung, and to mix with the air. The finest parts of the blood are then strained, passing into the venous artery (pulmonary vein) reaching the left of two cavities of the heart, after mixing with the air and becoming fit for the



Ibn Al-Nafis' 13th century treatise *The Concise Book (Kitab Mujiz)* which epitomized the Canon of Ibn Sina.

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generation of pneumonia...¹

In describing the anatomy of the lungs, Ibn al-Nafis stated, "The lungs are composed of parts, one of which is the bronchi, the second, the branches of the arteria venosa and the third, the branches of the vena arteriosa, all of them connected by loose porous flesh". The need of the lungs for the vena arteriosa is to transport to it the blood that has been thinned and warmed in the heart, so that what seeps through the pores of the branches of this vessel into the alveoli of the lungs may mix with what there is of air therein and combine with it, the resultant composite becoming fit to be spirit when this mixing takes place in the left cavity of the heart. The mixture is carried to the left cavity by the arteria venosa.⁹

Ibn al-Nafis also postulated that the nutrition of the heart is extracted from the small vessels passing through its wall. He stated "...Again his (Avicenna's) statement that the blood that is in the right side is to nourish the heart is not true at all, for the nourishment to the heart is from the blood that goes through the vessels that permeate the body of the heart...". This rarely mentioned contribution of Ibn al-Nafis on the nutrition of the heart and its blood supply made him the first to put forward the concept of coronary circulation.⁶

Ibn al-Nafis' works were translated to Latin in Venice, Italy, by Andrea Alpago of Belluno in 1547. He was a physician working for the Consulate of the Venice in Damascus. Few years later, Michael Servetus from Aragon, Spain, described the pulmonary circulation in his theological book, "*Christianismi Restitutio*", in 1553 and wrote, "...air mixed with blood is sent from

the lungs to the heart through the arterial vein; therefore, the mixture is made in the lungs. The bright color is given to the sanguine spirit by the lungs, not by the heart."⁶ The Church accused Servetus of heresy for his insistence on denying the dogma of the Trinity, and for opposing the teachings of Galen. He was burnt at the stake by order of the protestant Geneva governing council as a heretic.

About the same time, Andreas Vesalius, the famous Flemish anatomist, described the pulmonary circulation in his book "*De Humani Corporis Fabrica*", in a manner similar to Ibn Nafis' description. In the first edition of the book (1543), Vesalius agreed with Galen that the blood "... soaks plentifully through the septum from the right ventricle into the left..." However, in the second edition (1555) he omitted the above statement and wrote instead "...I still do not see how even the smallest quantity of blood can be transfused through the substance of the septum from the right ventricle to the left..." It is not clear whether Vesalius had access to Ibn al-Nafis translated work or not.

William Harvey wrote in his book "*Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus*", published in 1628, about the movement of the blood and the importance of valves in the circulation of blood.¹² In his book he described the movement of the blood from the heart to the lung. However, he did not elaborate on the physiology of the pulmonary circulation and its role in the exchange of gases.⁶

We conclude that Ibn al-Nafis should be recognized as the first discoverer of the pulmonary circulation, 300 years before it was described by European physicians.

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