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(*fl*. Baghdad, *ca*. 897; *d*. *ca*. 922)

geometry, astronomy.

As his name indicates, al-Nayrīzī's origins were in Nayrīz, a small town southeast of Shīrāz, Fārs, Iran. For at least part of his active life he lived in Baghdad, where he probably served the 'Abbāsid caliph al-Mu'tadid (892–902), for whom he wrote an extant treatise on meteorological phenomena *(Risāla fī ahdāth al-jaww)* and a surviving work on instruments for determining the distances of objects.

The tenth-century bibliographer Ibn al-Nadīm refers to al-Nayrīzī as a distinguished astronomer; Ibn al-Qịftī (*d*. 1248) states that he excelled in geometry and astronomy; and the Egyptian astronomer Ibn Yūnus (*d*. 1009) takes exception to some of al-Nayrīzī's astronomical views but shows respect for him as an accomplished geometer.

Of the eight titles attributed to al-Nayrīzī by Ibn al-Nadīm and Ibn al-Qịftī, two are commentaries on Ptolemy's *Almagest* and *Tetrabiblos* and two are astronomical handbooks *(zijes)*. Ibn al-Qịftī indicates that the larger handbook (*Kitāb al-zīj al-kabīr*) was based on the *Sindhind*. None of these works has survived, but the commentary on the *Almagest* and one (or both?) of the handbooks were known to al-Bīrūnī. Ibn Yūnus cites, critically, a certain *zīj* in which, he states, al-Nayrīzī adopted the mean motion of the sun as determined in the *Mumtahan zīj*, which was prepared under the direction of Yahyā ibn Abī Maṇsūr in the time of al-Ma'mun (813–833). Ibn Yūnus wonders at al-Nayrīzī;s adoption of this "erroneous" determination without further examination and, continuing his criticism of the "excellent geometer," refers further to oversights and errors, particularly in connection with the theory of Mercury, the eclipse of the moon, and parallax.

AI-Nayrīzī has been known mainly as the author of a commentary on Euclid's *Elements* that was based on the second of two Arabic translations of Euclid's text, both of which were prepared by al-Hajjāj ibn Yūsuf ibn Matar (see *Dictionary of Scientific Biography*, IV, 438–439). The commentary survives in a unique Arabic manuscript at Leiden (bks. I-VI) and in a Latin version (bks. I-X), made in the twelfth century by Gerard of Cremona. (The Arabic manuscript lacks the comments on definitions 1–23 of book I, but these are preserved in the Latin translation.) In the course of his own comments al-Nayrīzī quotes extensively from two commentaries on the *Elements* by Hero of Alexandria and Simplicius, neither of which has survived in the original Greek.

The first of these must have covered at least the first eight books (Hero's last comment cited by al-Nayrīzī deals with Euclid VIII.27), whereas the second, entitled "A Commentary on the Premises [*sadr, muṣādara, muṣādarāt*] of Euclid's *Elements*," was concerned solely with the definitions, postulates, and axioms at the beginning of hook I of the *Elements*.

Simplicius' *Commentary,* almost entirely reproduced by al-Nayrīzī, played a significant part in arousing the interest of Islamic mathematicians in methodological problems. It further quotes verbatim a full proof of Euclid's postulate 5, the parallels postulate, by "the philosopher Aghānīs." The proof, which is based on the definition of parallel lines as equidistant lines and which makes use of the "Eudoxus-Archimedes" axiom, has left its mark on many subsequent attempts to prove the postulate, particularly in Islam.

Aghānīs is no longer identified with Geminus, as Heiberg and others once thought because of a similarity between their views on parallels. He almost certainly lived in the same period as Simplicius; and Simplicius' reference to him in the *Commentary* as "our associate [or colleague] Aghānīs," or, simply,"our Aghānīs" (*Aghānīsu, sāhibunā, rendered by Gerard as socius noster Aganis*) strongly suggests that the two philosophers belonged to the same school. There is an anonymous fifteenth-century Arabic manuscript that aims to prove Euclid's parallels postulate and refers in this connection to Simplicius and Aghānīs, but spells the latter's name "Aghānyūs," thus supplying a vowel that can only be conjectured in the form "Aghānīs." Given that the Arabic "gh" undoubtedly stood for the letter λ, "Aghānyūs" may very easily have been a mistranscription of the recognizable Greek name "Agapius." Reading "Aghānyūs" for "Aghābyūs" (Arabic has no "p") may well have resulted from misplacing a single diacritical point, thereby transforming the "b" (that is, "p") into an "n." This hypothesis is the more plausible since we know that diacritical points were often omitted in Arabic manuscripts. it therefore seems reasonable to assume that Aghānīs-Aghānyūs was no other than the Athenian philosopher Agapius, a pupil of Proclus and Marinus who lectured on the philosophy of Plato and Aristotle about a.d. 511 and whose versatility was praised by Simplicius' teacher, Damascius. Agapius' name, place, date, affiliation, and interests agree remarkably with the reference in Simplicius' *Commentary*.

In his commentary on the *Elements,* al-Nayrīzī followed a conception of ratio and proportion that had previously been adopted by al-Māhāni (see *Dictionary of Scientific Biography,* IX, 21–22). Al-Nayrīzī's treatise "On the Direction of the qibla" (*Risāla fi samt al-qibla*) shows that he knew and utilized the equivalent of the tangent function. But in this, too, he is now known to have been preceded, for example, by Habash (see *Dictionary of Scientific Biography,* V, 612).

Again, his unpublished treatise "On the Demonstration of the Well-Known Postulate of Euclid" (Paris, Bibliothèque Nationale, arabe 2467, fols. 89r–90r) clearly depends on Aghānīs. In it al-Nayrīzī argues that, because equality is "naturally prior" to inequality, it follows that straight lines that maintain the same distance between them are prior to those that do not, since the former are the standard for estimating the latter. From this reasoning he concludes the existence of equidistant lines, accepting as a "primary proposition" that equidistant lines do not meet, however extended. His proof consists of four propositions, of which the first three state that: (1) the distance (that is, shortest line) between any two equidistant lines is perpendicular to both lines; (2) if a straight line drawn across two straight lines is perpendicular to both of them, then the two lines are equidistant; and (3) a line falling on two equidistant lines makes the interior angles on one side together equal to two right angles. These three propositions correspond to Aghānīs's propositions 1–3, while the fourth is the same as Euclid's postulate 5: If a straight line falling on two straight lines makes the interior angles on one side together less than two right angles, then the two lines will meet on that side. The proof closely follows Aghānīs.

Al-Nayrīzī, however, claims originality for the theorems that he proves in the extant but unpublished treatise for al-Mu'tadid—"On the Knowledge of Instruments by Means of Which We May Know the Distances of Objects Raised in the Air or Set Up on the Ground and the Depths of Valleys and Wells, and the Widths of Rivers." Al-Bīrūnī also states that al-Nayrīzī, in his commentary on the *Almagest,* was the only writer known to him who had provided a method for computing "a date for a certain time, the known parts of which are various *species* that do not belong to one and the same genus. There is, *e.g.,* a day the date of which within a Greek, Arabic, or Persian month is known; but the name of this month is unknown, whilst you know the name of another month that corresponds with it. Further, you know an era, to which, however, these two months do not belong, or such an era, of which the name of the month in question is not known" (*Chronology,* p. 139).

Al-Nayrīzī's work on the construction and use of the spherical astrolabe (*Fi'l-asturlāb al-kurī*), in four *maqālas,* is considered the most complete treatment of the subject in Arabic.

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