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also known as **ABŪ'L-'ABBĀS AHMAD IBN MUḤAMMAD IBN 'UTHMĀN AL-AZDĪ**

(*b*. Marrakesh, Morocco 29 December 1256; de Marrakesh[?], 1321)

mathematics.

Some authors, following Casiri, say Ibn al-Bannāʾ was a native of Granada. In any case, he studied all the literary and scientific subject that had culutural value in Fez and Marrakesh. Muḥammad ibn yaḥyā al-Sharīf taught him general geometry and Euclid's *Elements;* Abū Baker al-Qallūsī nicknamed al Fār ("the Mouse"), introduced him to fractional numbers; and Ibn Ḥajala and Abū 'Abd Allāh ibn Makhlūf al-Sijimāsī rounded out his training in mathematics. He also studied medicine with al-Mirrīkh, but he did not delve deeply into the subject. The mystic al-Hazmirī was responsible for directing a great part of Ibn al-Bannāʾ's works to the study of the magic properties of numbers and letters.

He taught arithmetic, algebra, geometry, and astronomy in the *madrasa* al-ʿAṭṭārīn in Fez. Among his disciples were Abū Zayd 'Abd al-Rahmān... al-Lajāʾī (*d.ca* 771/1369) teacher of Ibn Qunfudh, who left us an excellent biographical sketch of Ibn al-Bannnāʾ; muḥammad ibn Ibrāhīm al-Abūli (*d* 770/1368) Abu'l-Barakāt al-Balāfiqī (*d* 771/1370), Who had ibn al-Khaṭīb and Ibn Khaldūn as disciples; and Ibn al-Najjār al-Tilimsānī.

H.P.J. Renaud lists eighty-two works by Ibn al-Bannāʾ. The most important scientific ones are an introduction to Euclid; a treatise on areas; an algebra text dedicated to Abū ʿAlī al-Ḥasan al-Milyānī a book about acronical risings and settings (*Kitāb al-anwāʾ*), which is not as good as his other works on astronomy, such as the *Minhāj;* and an almanac that is possibly the earliest known, in which the word manākh appears for the first time in its Arabic form. The works of greatest merit, however, are the *Talkhīs* and the *Minhāj*.

The *Talkhīṣ* as its title indicates, is a summary of the lost works of the twelfth- or thirteenth-century mathematician al-Ḥaṣṣār. It was later summarized in verse by Ibn al-Qāḍi (*d*. 1025/1616) and was often commented on and glossed. Outstanding commentaries are the *Rafʿal-ḥijāb* by Ibn al-Bannāʾ himself, with notes by Ibn Haydūr and that of al-Qalaṣādī of Granada. These works contain a type of fraction that corresponds to what are today called continuing ascending fractions and an approximate method for extracting square roots that corresponds, more or less, to the third or fourth reduction in the development of the continuous fraction, and is similar to al-Qalaṣādī's

The possible connection between this formula and that of Juan de Ortega seems evident but the transmission has not been sufficiently proved. The works als contain sums of cubes and squares according to the formulas

$$1^3 + 3^3 + 5^3 + ... + (2n - 1)^3 = n^2(2n^2 - 1)$$

one cannot be sure that Ibn al-Bannāʾ was responsible for introducing a system of mathematical notation.

The *Kitāb minhāj al-ṭālib li taʿdīl al-kawākib* is a very practical book for calculating astronomical ephemerals, thanks to the attached tables that are based upon those that Ibn *Isḥāq* al Tūnisī calculated for the year 1222. The theoretical part does not contribute anything new and sometimes gives incorrect relationships between contradictory theories.

Ibn al-Bannāʾ is credited with a Risāla ("epistle") on the astrolabe called ṣafīḥa shakāziyya a variation of the ṣafīḥa zarqāliyya or "al-Zarqālī's plate," which is the topic of many manuscripts in the libraries of north Africa. An examination of some of these manuscripts does scirpts does not show the differences the should, in theory exist between the two instrument.

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J. Vernet