# MEDIEVAL SCIENCE, TECHNOLOGY, AND MEDICINE AN ENCYCLOPEDIA



God. Each summa is brief because it is based on sources from which the encyclopedist extracts some data. Moreover, brevity implies a structure: the encyclopedist methodically organizes the philosophers' discourses.

The medieval encyclopedia is thus a literary genre between the accessus and the account of a synthetic vision of the Creation. Throughout prologues, the numerous quotations from the authorities, whose names and/or works are specified, reveal some of the conscious process by which scholarly knowledge was rendered into encyclopedic knowledge. The encyclopedist writes for an audience that has little time to spare, such as the mighty or people who lack the knowledge to read the scholarly works on which his work is based. He considers himself a teacher aiming at a large audience. Among his goals are to improve the reader's understanding of the Bible; to help preachers and train princes; to encourage people to study and then improve their moral standards; and to facilitate the reading of more technical texts.

Many medieval encyclopedias were highly successful. For example, the De proprietatibus rerum was translated into five languages beginning in the fourteenth century. The texts survive in many manuscripts of this period, and from the fifteenth century to the eighteenth century many encyclopedias also appeared in several editions. Numerous marginalia in the manuscripts and borrowings from medieval encyclopedias by many authors show that these texts were frequently consulted. Library catalogues also contain many references to these works. Thus it is clear that medieval encyclopedias played a major role in the culture of the Middle Ages and in the diffusion of scientific knowledge among a large audience.

See also Aristotelianism; Astronomy, Latin; Bestiaries; Herbals; Lapidaries; Music theory; Natural history; Quadrivium; Vocabulary

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# ERIUGENA, JOHN SCOTTUS

The Irish-born Johannes Eriugena-his seventeenthcentury editor Thomas Gale named him "Johannes Scotus Erigena"—was "master" (magister) of the cathedral school at Laon and a scholar at the court of King Charles the Bald of France. In 850-851, Bishop Pardulus of Laon refers to "a certain Irishman, named Johannes, who is at the palace of the king." The appelation "scottus" or "scotigena" means "Irish"; the Vatican Librarian Anastasius, for instance, refers to him as "Joannes Scotigena." The name "Eriugena" ("Irish born")—corrupted to "Erigena" in twelfth-century catalogues—was a pen-name used to sign his translation of Pseudo-Dionysius.

Eriugena was probably born before 800 and died sometime around 877. Recognized for his erudition, he had a wide knowledge of Latin Christian sources: St. \*Macrobius, \*Martianus Augustine, Capella, Cassiodorus, \*Bede, \*Isidore of Seville, Ambrose, Hilary of Poitiers, and Jerome. He refers occasionally to \*Boethius (Opuscula sacra) and possibly knew his Consolation of Philosophy (glosses, possibly in his hand, survive). Two partial commentaries, Annotationes in Marcianum (c. 840-c. 850), on Martianus' liberal arts handbook De nuptiis Philologiae et Mercurii (The Marriage of Philolology and Mercury) survive. Pierre Duhem thought that Eriugena, in Book Seven of this Commentary, offers a version of the non-Ptolemaic system subsequently associated with Tycho Brahe. In fact, Eriugena is accurately reporting Martianus' version of Heraclidus of Pontus' theory, but remarkably places Mars and Jupiter also in orbit around the Sun.

In the late 840s Eriugena was commissioned by two bishops to refute a treatise by a Saxon monk, Gottschalk (806–868), who interpreted St. Augustine as teaching a "twofold" or "twin predestination" (gemina praedestinatio) of the elect to heaven and of the damned to hell, based on the opinion of Isidore of Seville, Sententiae II, 6, I. Eriugena's De divina praedestinatione (On Divine Predestination, c. 851) rebuts Gottschalk, rejecting any predestination toward evil by appealing to God's unity, transcendence and goodness. This treatise proceeds through a rationalistic, dialectical analysis of key theological concepts, relying on argument rather than Scripture (something criticized by contemporaries, see PL CXV 1294a). Eriugena holds that "true philosophy is true religion and conversely" (following Augustine, De

uera religione 5, 8).

In De divina praedestinatione Eriugena maintains that God wants all humans to be saved and does not predestine souls to damnation. Humans damn themselves through their own free choices: "Sin, death, unhappiness are not from God." God is outside time and cannot be said to foreknow or predestine. Eriugena locates Gottschalk's errors as midway between the Pelagian heresy that downplays divine grace, and the opposing heresy that denies human freedom. In turn Eriugena himself, due to his emphasis on free will, was accused of "Origenism" and "Pelagianism." Eriugena's treatise was

condemned at the councils of Valence (855) and Langres (859): one reason for the verdict on the work was its reliance on "dialectic" (dialectica).

Around 860, Eriugena translated the works of (Pseudo-) Dionysius the Areopagite—his Divine Names, Mystical Theology, Celestial Hierarchy, Ecclesiastical Hierarchy. He subsequently wrote a long commentary, Expositiones in hierarchiam coelestem, on the Celestial Hierarchy. In his Divine Names, Dionysius draws on Proclus' Commentary on the Parmenides to argue that affirmations are less worthy than negations in referring to entities that transcend being, since negations strip something away whereas affirmations involve "possession of form." Negations concerning God (such as, for example, "God is not good") are "more true" than affirmations (such as "God is good"). Divine names apply metaphorically and not literally to God, who is "beyond all that is." Pseudo-Dionysius maintains that God is not known directly except through theophaniai, divine appearances (*Divine Names*, ch. 7, PG III 869c-d). Eriugena also translated and commented on the work of Maximus Confessor, giving him access to a rich Greek Christian anthropology. These translations gave him both a familiarity with and a preference for the Eastern Fathers.

Eriugena's dialogue, Periphyseon or De divisione naturae (On the Division of Nature), enthusiastically adopts the Areopagite's main ideas, chiefly, his distinction affirmative (kataphatic) and negative (apophatic) theology. He even extends the dialectic of affirmation and negation beyond theology to statements about human nature ("man is not an animal" is more true than "man is an animal"). Overall his outlook is rationalistic; true philosophy is true reason (vera ratio); authority is but right reason (Periphyseon, I.511b). One should introduce the "opinions of the holy Fathers" only where "the gravest necessity requires that human reason be supported for the sake of those who, being untrained in it, are more amenable to authority than reason" (Periphyseon IV.781c-d).

Eriugena's cosmology includes original views on creation, matter, space, and time, corporeal body, the nature of paradise and hell, and so on. For example, heaven and hell are not places. Paradise is perfect human nature (Periphyseon IV.840a), whereas souls trapped in their own fantasies are in "hell." He defines nature (natura) very broadly as the "totality of all things" including both beings and non-beings, both God and creation. All things emerge from and return to the one God, Who is beyond being and non-being. God "creates Himself by manifesting Himself in theophanies" (Periphyseon I.446d). This self-manifestation (I.455b) is identical with the speaking of the Word and the creation of all other things, since all things are contained in the Word. The Word contains the divine Ideas or "primary causes" (causae primordiales) of all creation, which proceed into their created effects. The timeless primordial causes are contrasted with the "mutable and imperfect and as yet formless procession of this sensible world" (Periphyseon II.549b).

### Four Divisions of Divine Nature

Eriugena divides the divine nature into four "divisions" (divisiones), or "species" or "forms," namely: nature which creates and is not created, nature which creates and is created, nature which is created and does not create, and nature which is neither created nor creates.

God is present in all four divisions. The outgoing of all things in creation is balanced by their "return" (epistrophe, reditus, reversio) to God. There is a general return of all things to God. Corporeal things will return to their incorporeal causes, the temporal to the eternal, the finite will be absorbed in the infinite. The human mind will achieve reunification with the divine, and then the corporeal, temporal, material world will become essentially incorporeal, timeless and intellectual. The elect achieve "deification" (deificatio, theosis), merging with God as lights blend into the one light, as voices blend in the choir, as a droplet of water merges with the stream. God shall be all in all (omnia in omnibus, V 935c).

Eriugena controversially claims that God and the creature are ultimately "one and the same" (Periphyseon, III.678c), and that God is the "essence of all things" (essentia omnium) or "form of all things" (forma omnium), expressions that led to the accusation of pantheism. However, Eriugena also stresses the divine transcendence: God is the non-being above being as well as the principle or form of all things.

Eriugena's *Periphyseon* had influence in the schools of Laon, Auxerre, and Corbie, and was popular in the twelfth century, especially when circulated in the "edition" of William of Malmesbury and in the paraphrase, Clavis physicae, of Honorius Augustodunensis. His version of Dionysius was also influential in the twelfth and thirteenth centuries. Linked with two heretical Paris theologians, David of Dinant and Amaury of Bène, Periphyseon was condemned in 1210 and 1225. Meister Eckhart of Hochheim (c. 1260-c. 1328) and Nicholas of Cusa (1401-1464) were both familiar with the Periphyseon.

See also God in Christianity; Nature: the structure of the physical world

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### **EUCLID**

Euclid lived around 300 B.C.E. in Alexandria. He authored the most influential textbook in the history of mathematics, the Elements. Additionally, he wrote at least five other geometrical works (Data, Porisma, On Divisions, Conics, Plane loci, Pseudaria), one text on astronomy (*Phainomena*), an influential text on optics (Optics) and a work on theoretical music (Elements of Music). Others texts on mechanics and on mirrors ascribed to him are not believed to be his works.

Certain axioms, postulates, definitions and theorems of the Elements have been contested since antiquity. During the greater part of the twentieth century, it was believed that Heiberg had successfully established the genuine Euclidean text in a critical edition. This belief was questioned at the end of the century by the works of Knorr, Vitrac, Djebbar, and Rommevaux. Similar shifts of understanding and approach occurred in the course of the century with regard to the medieval transmission of Euclid's Elements. This transmission embraces translations into Latin, Arabic, Syriac, and Hebrew either from Greek or from Arabic texts. A further strand of transmission, often ignored, comprises the translation from Arabic into Persian. The multiplicity of texts translated from one language into the other and transferred from one scholarly culture to the other makes the study of the history of Euclid's Elements one of the most difficult, but also most fascinating, subjects in textual history of medieval mathematics.

The first interest in the text is documented at the beginning of the Abbasid dynasty (750-1258), when caliph al-Mansur (r. 754-775) asked for a Greek manuscript. Yahya ibn Khalid (d. 805), vizier of al-Mansur's grandson Harun al-Rashid (r. 786–809), sponsored the first known Arabic translation by al-Hajjaj ibn Yusuf ibn Matar (d. after 825). No trace of this translation seems to be preserved. During the reign of Harun's second son, al-Ma'mun (r. 813-833), al-Hajjaj produced a second version, the character of which is highly disputed. While Arabic historical sources imply that this second version was a new translation, current research sees it more as a substantially revised edition. Fragments of this version or of editions based on it are extant in at least four different groups in Arabic and Latin, but the relationship betwee these four groups is far from being firmly established.

The second major textual transmission of the *Element* had its start in the last third of the ninth century, who Ishaq ibn Hunayn (830-911) translated in Baghdad different Greek version. This translation was edited an modified by his colleague \*Thabit ibn Qurra (d. 901 Ishaq's translation is apparently lost except for a ver small number of fragments. The extant manuscripts the are acknowledged as representing the two translation efforts contain highly mixed texts with substantial differ ences in some books. There is no agreement amou historians as to what relationship exists between thes manuscripts and the three scholars of the ninth century.

Parallel to the efforts of translating, scholars began i the early ninth century to edit the translated text accord ing to either philosophical or mathematical priorities Almost all evidence for this work seems to be lost excel for small fragments of \*al-Kindi (d. c. 870) and al-'Abba b. Sa'id al-Jawhari (d. c. 860). The most importan versions among those extant are the editions compiled by "Ibn Sina (d. 1037), Athir al-Din al-Abhari (d. 1263) Mu'ayyad al-Din al-'Urdi (d. c. 1266), Muhyi'l-Din a Maghribi (d. c. 1290), \*Nasir al-Din al-Tusi (1201 1274), and an anonymous version printed in Rome i 1594. The most influential of these revised editions wa the one composed by al-Tusi. As pointed out recently b De Young, Tusi's text indicates that until the thirteem century both major Arabic traditions (Hajjaj and Ishac Thabit) were used by scholars across the Muslim work After the thirteenth century, they were replaced by a Tusi's edition.

Other works on Euclid's Elements aimed to solv doubts, fill lacunae or add variants as well as no aspects. The most important authors of these kinds of commentaries were Abu'l-'Abbas al-Fadl al-Nayrizi (d. 922), Abu Sahl al-Kuhi (fourth/eleventh century), Ahma ibn Muhammad al-Sijzi (d. c. 1025), "Ibn al-Haytham (c c. 1041), \*'Umar al-Khayyam (1048-1131), Muhyi'l-Di al-Maghribi (c. 1220-c. 1283), and Shams al-Din a Khafri (d. 1550).

### Translations of the *Elements*

Only a few Syriac texts are extant that testify to an interest in Euclid's work among Nestorian and Jacobii Christians. None is known for the period before 700. A undated fragment of Book I was edited in 192-Historians continue to debate about the language from which it was translated (Greek or Arabic) and about # relationship to the Arabic and Arabic-Latin transmission The second known Syriac extract of the Elements can from the pen of the Jacobite patriarch Abu'l-Faraj ibn a 'Ibri (1226-1286). It is related to the Arabic editions of the thirteenth century, but the precise character of the relationship has yet to be established.

The most influential translation from Greek into Lau before 1200 was made by \*Boethius (c. 480-524/5) in 500. The four fragments that survive from this transl. tion either come from northeast France (Corbie) or from