Regiomontanus | Encyclopedia.com

Complete Dictionary of Scientific Biography COPYRIGHT 2008 Charles Scribner's Sons
20-26 minutes

(*b*. Konigsber, Franconia, Germany, 6 June 1436; *d*. Rome, Italy, ca. 8 July 1476)

astronomy, mathematics.

Nothing is known of Regiomontanus before he enrolled in the University of Vienna on 14 April 1450 as "Johannes Molitoris de Künigsperg."[1] Since the name of his birthplace means "King's Mountain," he sometimes Latinized his name as "Joannes de Regio monte," from which the standard designation Regiomontanus was later derived. He was awarded the bachelor's degree on 16 January 1452 at the age of fifteen; but because of the regulations of the university, he could not receive the master's degree until he was twenty-one. On 11 November 1457 he was appointed to the faculty, thereby becoming a colleague of Peuerbach, with whom he had studied astronomy. The two men became fast friends and worked closely together as observers of the heavens.

The course of their lives was deeply affected by the arrival in Vienna on 5 May 1460 of Cardinal Bessarion (1403–1472), the papal legate to the Holy Roman Empire.[2] Bessarion's native tongue was Greek (he was bom in Trebizond), and as part of his ardent campaign to bring ancient Greek authors to the attention of intellectuals in the Latin West, he persuaded Peuerbach to undertake a "briefer and more comprehensible" condensation, in Latin, of the *Mathematical Syntaxis* of Ptolemy, whose Greek style was formidable and whose ideas were far from simple. In those days Greek was not taught at the University of Vienna,[3] and Peuerbach did not know it. He had, however, made his own copy of Gerard of Cremona's Latin translation of Ptolemy's *Syntaxis*. Using this twelfth-century version, Peuerbach reached the end of book VI just before he died on 8 April 1461. On his deathbed he pledged Regiomontanus to complete the project.

Complying with Peuerbach's last wish, Regiomontanus accompanied Bessarion on his return trip to Rome, where they arrived on 20 November 1461.[4] When Regiomontanus finished the *Epitome*, as he entitled the translation by Peuerbach and himself, he dedicated it to Bessarion. In the parchment manuscript, which still survives, he did not address Bessarion as titular Patriarch of Constantinople, an honor bestowed on him on 28 April 1463,[5] a decade after the capital of the Byzantine Empire had been captured by the Turks. Thus, sometime before that date the Peuerbach-Regiomontanus *Epitome* was ready to go to press; but it was not actually printed until 31 August 1496, twenty years after the death of Regiomontanus.

At the end of the fifteenth century, Ptolemy's achievement remained at the pinnacle of astronomical thought; and by providing easier access to Ptolemy's complex masterpiece, the Peuerbach-Regiomontanus *Epitome* contributed to current scientific research rather than to improved understanding of the past. Moreover, the *Epitome* was no mere compressed translation of the *Syntaxis*, to which it added later observations, revised computations, and critical reflections—one of which revealed that Ptolemy's lunar theory required the apparent diameter of the moon to vary in length much more than it really does. This passage (book V, proposition 22) in the *Epitome*, which was printed in Venice, attracted the attention of Copernicus, then a student at the University of Bologna. Struck by this error in Ptolemy's astronomical system, which had prevailed for over 1,300 years, Copernicus went on to lay the foundations of modern astronomy and thus overthrow the Ptolemaic system.

Ptolemy was not only the foremost astronomer of antiquity but also its leading geographer; and Jacopo Angeli's widely used Latin translation (1406–1410)[6] of Ptolemy's *Geography* was condemned by Regiomontanus because the translator "had an inadequate knowledge of the Greek language and of mathematics."[7] Many of the obscure passages in Angell's translation could not be explained by Peuerbach, who, as noted above, had not learned Greek. Hence Regiomontanus determined to master the language of Ptolemy. He acquired a remarkable fluency in Greek from his close association with Bessarion, and armed with a thorough comprehension of Ptolemy's language, he announced his intention to print an attack on Angeli's translation. But he died before completing this work. Nevertheless, "Johannes Regiomontanus' Notes on the Errors Committed by Jacopo Angeli in His Translation" formed the appendix (sig. Plr-Q8r) to a new version of Ptolemy's *Geography* (Strasbourg, 1525) by a scholar who had access to Regiomontanus' literary remains.

In a letter written not long after 11 February 1464 to the Italian mathematician Giovanni Bianchini, Regiomontanus reported that he had found an incomplete manuscript of Diophantus and, if he had the whole work, he would undertake to translate it into Latin—"since for this purpose the Greek I have learned in the home of my most revered master would be adequate."[8] Regiomontanus never translated Diophantus nor did he ever find a complete manuscript; nor did anyone else. Nevertheless, the recovery of Diophantus in modern times began with Regiomontanus' discovery of the incomplete manuscript.

When Bessarion was designated papal legate to the Venetian Republic, Regiomontanus left Rome with him on 5 July 1463.[9] In the spring of 1464[10] at the University of Padua, then under Venetian control, Regiomontanus lectured on the ninth-century Muslim scientist al-Farghani. Although the main body of these lectures has not survived, "Johannes Regiomontanus'

Introductory Discourse on All the Mathematical Disciplines, Delivered at Padua When He was Publicly Expounding al-Farghani" was later published in *Continentur in hoc libro Rudimenta astnmomica Alfragani* …, whose first item was John of Seville's twelfth-century Latin translation of al-Farghani's *Elements of Astronomy* (Nuremberg, 1537).

Also included in this volume was Plato of Tivoli's twelfth-century Latin version, "together with geometrical proofs and additions by Johannes Regiomontanus," of al-Battani's *The Motions of the Stars*. One such addition (to al-Battani's chapter 11, although the printed edition misplaced it in the middle of chapter 12) may have been the germ from which Regiomontanus subsequently developed the earliest statement of the cosine law for spherical triangles. Although he employed the versed sine (1 —cos) rather than the cosine itself and used the law only once, he was the first to formulate this fundamental proposition of spherical trigonometry. He enunciated it as theorem 2 in book V of his treatise On *All Classes of Triangles (De triangulis omnimodis*).

The urgent need for a compact and systematic treatment of the rules governing the ratios of the sides and angles in both plane and spherical triangles had become apparent to Peuerbach and Regiomontanus while they were working on the *Epitome*. At the close of the dedication of that work Regiomontanus stated that he would write a treatise on trigonometry. The manuscript of the last four books contains many blank spaces, which, despite Regiomontanus' intentions, were never completed. Part of the volume had been written before he left Rome on 5 July 1463. At the end of that year or at the beginning of 1464 he told a correspondent: "I do not have with me the books which 1 have written about triangles, but they will soon be brought from Rome."[11] It may have been in Rome that Regiomontanus propounded, in theorem 1 of book II, the proportionality of the sides of a plane triangle to the sides of the opposite angles (or, in modern notation a/sin *A = b/sin B = c/sin C, the sine law*). The corresponding proposition for spherical triangles appears in book IV, theorem 17. Theorem 23 in book II solves, for the first time in the Latin West, a trigonometric problem by means of algebra (here called the *ars ret et census)*. Regiomontanus' monumental work on *Triangles*, the first publication of which was delayed until 12 August 1533, attracted many important readers and thereby exerted an enormous influence on the later development of trigonometry because it was the first printed systematization of that subject as a branch of mathematics independent of astronomy.

Regiomontanus dedicated his *Triangles* to Bessarion. whom Pius II, in 1463, had named titular Patriarch of Constantinople. When the pope died, Bessarion returned to Rome in August 1464 to take part in the election of a successor. Regiomontanus accompanied him and while in Rome composed a dialogue between a Viennese named Johannes (evidently himself) and an unnamed scholar from Cracow. The subject of their conversation was a thirteenth-century planetary theory that was still very popular. Some of its defects were discussed in the dialogue, which was printed by Regiomontanus when he later acquired his own press. Although he published the dialogue without a title, it was often reprinted under some such heading as *Johannes Regiomontanus' Attack on the Absurdities in the Planetary Theory of Gerard of Cremona* (Gerard's pupils did not list this *Theorica planetarum* in the catalog of their teacher's productions).[12]

After an observation on 19 June 1465,[13] presumably in Viterbo, a favorite resort of Bessarion's, Regiomontanus' activities during the next two years are not known. In 1467, however, he was firmly established in Hungary, where the post of astronomer royal was held by Martin Bylica of Olkusz (1433–1493), who was also present in Rome during the papal election and in all likelihood is the unnamed interlocutor in Regiomontanus' dialogue on planetary theory.

In 1467, with Bylica's assistance, Regiomontanus computed his *Tables of Directions*, which consisted of the longitudes of the celestial bodies in relation to the apparent daily rotation of the heavens. These *Tables*, computed for observers as far north of the equator as 60°, were first published in 1490 and very frequently thereafter.[14] Regiomontanus wrote accompanying problems and in problem 10 he indicated the desirability of abandoning the sexagesimal character of the table of sides by putting sin 90° = 100,000 (10^5) instead of 60,000 (6 x 10^4, the base he had used in *Triangles* (book IV, theorem 25). In that work he had not employed the tangent function; but in *Tables of Directions* he included a table of tangents (although he did not use this term) for angles up to 90°, the interval being 1° and tan 45° = 100,000, thereby providing the model for our modern tables.

In 1468 in Buda, then the capital of the kingdom of Hungary, Regiomontanus computed a table of sides with sin 90° = 10,000,000 (10^7). But before he realized the advantage of the decimal base, he had prepared a sexagesimal sine table, to which he had referred in the dedication of his *Triangles* and which he had used in computing his *Tables of Directions*, with sin 90° = 6,000,000 (6 x 10^6), the interval being 1' and the seconds being found by an auxiliary table of proportional parts. Both of Regiomontanus' major sine tables, the sexagesimal and the decimal, were first published at Nuremberg in 1541, together with his essay on the *Construction of Sine Tables*.

While still in Italy, Regiomontanus began to compute his *Table of the First Movable [Sphere]*, or of the apparent daily rotation of the heavens. He completed this work, together with an explanation of its use, in Hungary and dedicated it to his friend King Matthias I Corvinus. He also expounded the geometrical basis of this *Table*, These three related works constituted an item in the list of his own writings that Regiomontanus intended to print on his own press, an intention he could not carry out. Of these three works, the first two were published in Vienna in 1514, and the third in Neuburg in 1557. Regiomontanus wrote each of these works for the purpose of facilitating astronomical computations. But whatever use was made of them ended with the advent of logarithms.

In 1471 Regiomontanus left Hungary. "Quite recently 1 have made [observations] in the city of Nuremberg … for I have chosen it as my permanent home," he informed a correspondent on 4 July 1471, "not only on account of the availability of instruments, particularly the astronomical instruments on which the entire science of the heavens is based, but also on account of the very great ease of all sorts of communication with learned men living everywhere, since this place is regarded as the center of Europe because of the journeys of the merchants."[15] On 29 November 1471 the City Council of Nuremberg granted Regiomontanus residence in the city until Christmas of the following year. He installed a printing press in his own house in order to publish scientific writings, a class of books in which the existing establishments were reluctant to invest their capital, partly because the necessary diagrams required special craftsmen and additional expense.

Regiomontanus was the first publisher of astronomical and mathematical literature, and he sought to advance the work of scientists by providing them with texts free of scribal and typographical errors, unlike the publications then in circulation. His emphasis on correct texts was aided by his introduction into Nuremberg printing of the Latin alphabet and, for writings in the German language, rounded and simplified letters that approached the Latin alphabet in legibility.

Regiomontanus' first publication, a mark of his deep affection for his former teacher, colleague, and collaborator, was Peuerbach's *New Theory of the Planets*. This work was the first item in the catalog which Regiomontanus sent out in the form of a broadside, listing his publications, issued or projected, written by himself or others. The second item in the list of his own publications was the *Ephemerides*, which he issued in 1474 and which was the first such work to be printed. It gave the positions of the heavenly bodies for every day from 1475 to 1506. Of all the books written and published by Regiomontanus, this is perhaps the most interesting from the standpoint of general history: Columbus took a copy on his fourth voyage and used its prediction of the lunar eclipse of 29 February 1504 to frighten the hostile Indians in Jamaica into submission.[16]

The geographer Martin Behaim "boasted that he was a pupil of Regiomontanus"[17] in Nuremberg. More credit is given to the statement that Regiomontanus attracted Bernhard Walther as a pupil. Walther, who was born in Memmingen, in 1467 became a citizen of Nuremberg, where he helped Regiomontanus with his observations and continued them after his teacher left for Rome in the summer of 1475. Regiomontanus' last observation in Nuremberg is dated 28 July 1475 and Walther's observations begin five days later.[18]

According to a Nuremberg chronicler, Regiomontanus went to Rome in response to a papal invitation to emend the notoriously incorrect ecclesiastical calendar. If this report is true, nothing positive resulted from his trip, for he died in less than a year.

In all probability Regiomontanus fell victim to the plague that spread through Rome after the Tiber overflowed its banks in January 1476. But a more sensational rumor concerning the cause of his death surfaced in a laudatory poem that served as the title page of a posthumous edition of his *Latin Calendar* (Venice, 1482). The rumor gained currency by being repeated in 1549 in Reinhold's commemorative eulogy of Regiomontanus and again in 1654 [19] in Gassendi's biography of the astronomer. In his catalog Regiomontanus had announced his intention to publish an extensive polemic against George of Trehizond, whose "commentary on the *Syntaxis* he will show with the utmost clarity to be worthless and his translation of Ptolemy's work not to be free of faults." Although Regiomontanus never actually published his attack, which still remains in manuscript in Leningrad, George's sons poisoned him, according to the rumor. Yet Bessarion died unmolested on 18 November 1472, three years after his own devastating attack on George of Trebizond as a *Calumniator of Plato* was published in Rome (1469).

"The motion of the stars must vary a tiny bit on account of the motion of the earth." This portentous statement in the handwriting of Regiomontanus was excerpted from one of his letters by Georg Hartmann, the discoverer of the vertical dip of the magnetic needle and an early supporter of the Copernican cosmology. Hartmann regarded the excerpt as a treasure, undoubtedly because to his mind it provided clear proof that Regiomontanus, the greatest astronomer of the fifteenth century, had accepted the concept of the moving earth and realized one of its numerous implications; Regiomontanus was therefore a Copernican before Copernicus.

The letter from which Hartmann took this excerpt has not survived, nor has the excerpt itself. But it was copied by a professor onto the margin of his unpublished lecture in 1613 on Copernicus' planetary theory, with the explanation that Hartmann "recognized Regiomontanus' handwriting because he was also familiar with his features."Yet Hartmann was not even born until 1489, thirteen years after the death of Regiomontanus.

Nevertheless, it has been suggested that the letter in question may have been sent by Regiomontanus to Novara, who, in an unpublished essay on the duration of pregnancy, called Regiomontanus his teacher. Novara in turn became the teacher of Copernicus. Thus it can be inferred that the concept of the revolutionary geokinetic doctrine was first conceived by Regiomontanus and communicated to Novara, who then passed it to Copernicus. Nevertheless, in the voluminous published and unpublished writings of Regiomontanus, no other reference to the earth in motion has ever been found.

NOTES

1.*Die Matrikel der University Wien*,**I** (Graz-Cologne, 1954), 275. The Johannes Molitoris who entered the University of Leipzig on 15 October 1447 has been identified with Regiomontanus by *Zinner, Leben und Wirken des … Regiomontanus*. 13. The Leipzig rector, however, did not associate this namesake with any particular place and Molitoris, as a Latinized form of the surname Muller, was extremely common.

2. Ludwig Mohler, *Kardinal Bessarionals Theologe, Humanist und Staatsmuan* Qucllcn und Forschungen aus dem Gebiete der Gesehichtc, no. 20 (Paderborn, 1923), 298.

3. Joseph Aschbach, *Geschichte der Wiener Universittit im ersten Jahrhunderte ihres Bestehens* (Farnborough, 1967; repr. of Vienna, 1865), 539.

4. Mohler; *op. cit*., 303.

5. Conrad Eubei, *Hicranhia catholica medii aevi*, II (Padua. I960; repr. of 2nd ed., Münster. 1913–1923). 150. Bessarion's elevation is dated in April 1463, but the exact day is marked as unknown. However, Bessarion's predecessor, Isidore or Kiev, died on 27 April 1463 (Eubei. II. 36, n. 199).

6. Robert Weiss, "Jacopo Angeli da Scarperia," in *Medioevo e rinascimento. Studi in onore di Bruno Nardi* Pubbiicazioni dcHMsiitulo di filosofia deirUniversitii di Roma (Florence, 1955), 824.

7. Regiomontanus' catalog of the books to be printed on his press; reproduced by Zinner, "Die wissenschaftltchen Bcstrebungen Regiomontans," in *Beitrdge zur Inkunabet-kunde*, **2** (1938), 92.

8. Silvio Magrini, "Joannes de Blanchinis Ferrariensis e il suo carteggio scientifico col Regiomonta.no (1463–64)," in *Atti e memorie della deputazione ferrarese di storia patria 22*, fasc. 3, no. 2, (1915–1917), lvii.

9. Mohlcr, *op.cit*., 312,

10. The total eclipse of the moon on 21 April 1464 was observed by Regiomontanus in Padua; sec *Scripta clarissimi itiathe-matiei M. Ioannis Regiomontani* (Nuremberg. 1544), fol. 41v-42r; or Willebrord Snell, *Coeli et siderum … observa-tiones Hassiacae* (Leiden, 1618), Ioannis de Montercgio … observationes, fol. 20v.

11. Maximilian Curtze, "Der Briefwechsel Regiomontan's mil Giovanni Bianchini, Jacob von Speier und Christian Roder," in *Abhandhmgen zur Geschichte der Mathematik*, **12** (1902), 214.

12. Olaf Pedersen, "The Theorica Planetarum Literature of the Middle Ages," in *Ithaca, Proceedings of the Tenth International Congress of History of Science* (Paris, 1964), 617.

13.*Scripta … Regiomontani* fol. 42r; Snell, fol. 21v.

14. The manuscript of Regiomontanus' *Tables of Directions* that Bylica presented to Cracow University is still preserved there; see Wladyslaw Wislocki, *Katulog rekopisow biblioteki jagiellonskiej* (Cracow, 1877–1881), 188; and Jerzy Zathey *et al., Historia biblioteki jagiellonskiej* (Cracow, 1966), 154, n. 64.

15. Curtze, op. c/7., 327. The lunar eclipse on 2 June 1471 was observed by Regiomontanus in Nuremberg—*Scripta*, fol. 42v; Snell, fol. 22r.

16. Samuel Eliot Morison, *Admiral of the Ocean Sea*, II (Boston, 1942), 400 403.

17. Jāilo de Barros, *Asia*, I, decade I, bk. 4, ch. 2 (Lisbon, 1945), 135. If BehainVs claim was correct, he was at most 16 years old when Regiomontanus left Nuremberg; see Richard Hennig, Terrae incognitae, 2nd ed., IV, (Leiden, 1944–1956), 434.

18.*Scripta*, fol. 27v; Snell, fol. lv; Donald Beaver, "Bernard Walther: Innovator in Astronomical Observation," in *Journal for the History of Astronomy*, **1** (1970), 39–43.

19. Gassendi, *Tychonis Brahei … vita … accessit … Re-giomontani … vita* (Paris, 1654), app., 92; and *Opera omnia*, V (Stuttgart-Bad Cannstatt, 1964; repr. of Lyons, 1658 ed), 532.

BIBLIOGRAPHY

Regiomontanus' works were reprinted in *Joannis Rt'giomontari opera collectanea* (Osnabriick, 1972) with a biography by the ed. Felix Schmeidler. An older work is Ernst Zinner, *Leben und Wirken des Johannes Midler von Kdnigsberg genannt Regiomontanus*, 2nd ed., rev. and enl. (Osnabriick, 1968). A recent trans, of Regiomontanus' *De triangiclis omnimodis* is Barnabas Hughes, Regiomontanus on Triangles (Madison, Wis., 1967).

On Regiomontanus and his work, see the anonymous “Regiomontanus’s Astrolabe at the National Maritime Museum,” in *Nature*. **183** (1959), 508–509; and Edward Rosen, “Regiomontanus’s Breviarium,” in *Medievalia et Humanistica*, **15** (1963), 95–96.

Edward Rosen