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Summary Article: **Brahe, Tycho (1546-1601)**

From *The Hutchinson Dictionary of Scientific Biography*

Place: Denmark

Subject: biography, astronomy

Danish astronomer, sometimes known by his first name only, who is most noted for his remarkably accurate measurements of the positions of stars and the movements of the planets.

Tycho was born of aristocratic parents in Knudstrup in 1546. He was brought up by his paternal uncle, from whom he learnt Latin, and in early life he studied law and philosophy. A political career was planned for him, but in 1560 Tycho observed a solar eclipse and was so fascinated by what he saw that he spent the rest of his life studying mathematics and astronomy.

Being of a noble family, Tycho did not need a university degree to establish himself in a profession, but he attended the University of Copenhagen and studied ethics, music, natural sciences, philosophy, and mathematics. From the beginning of his astronomical career he made a series of significant observations. Having seen the eclipse, he obtained a copy of *Stadius' Ephemerides*, which was based on the Copernican system. Observing a close approach of Jupiter and Saturn in 1563, Tycho noticed that it occurred a month earlier than predicted. He set about the preparation of his own tables. In 1564 he began observing with a radius, or cross-staff consisting of an arm along which could slide the centre of a crosspiece of half its length. Both arms were graduated and there was a fixed sight at the end of the larger arm that was held near the eye. To measure the angular distance between two objects, Tycho set the shorter arm at any gradation of the longer arm and moved a sight along the shorter arm until he saw the two objects through it and a sight at the centre of the transversal arm. The required angle was then obtained from the gradations and a table of tangents.

When his uncle died in 1565, Tycho travelled and studied in Germany - at Wittenburg and Rostock, where he graduated from the university in 1566. While he was at Rostock, it is said that he lost the greater part of his nose in a duel with another nobleman over a point of mathematics, and thereafter wore a false nose made of silver. After making a number of observations in Rostock, he moved to Basle before entering the intellectual life of Augsburg in 1569. Having returned home because of his father's ill-health, Tycho noticed one night in November 1572 a star in the constellation of Cassiopeia that was shining more brightly than all the others and which had not been there before. With a special sextant of his own making, Tycho observed the star until March 1574, when it ceased to be visible. His records of its variations in colour and magnitude identify it as a supernova.

In 1576 King Frederick II offered Tycho the island of Hven for the construction of an observatory. This was the first of its kind in history. Tycho's reputation grew and scholars from throughout Europe visited him.

Having observed a great comet in 1577, Tycho refuted Aristotle's theory of comets. He concluded that certain celestial bodies were supralunar, having no parallax and remaining stationary like fixed stars.

Many other scientists had abandoned the Aristotelian theory in favour of the belief that something new could be created in the heavens and not necessarily out of the substances of the Earth. Tycho claimed that Aristotle's 'proof' had been based on meditation, not mathematical observation or demonstration. Tycho's main objective became to determine the comet's distance from the Earth. He was also concerned with its physical appearance - colour, magnitude, and the direction of the tail. He came to the conclusion that the comet's orbit must be elongated, a controversial suggestion indeed since it meant that the comet must have passed through the various planetary spheres, and it could not do that unless the planetary spheres did not exist. This possibility went against Tycho's most cherished beliefs. He could not abandon the ideas of his Greek predecessors, although he was the last great astronomer to reject the heliocentric theory of Copernicus. He tried to compromise, suggesting that, with the exception of the Earth, all the planets revolved around the Sun.

He prepared tables of the motion of the Sun and determined the length of a year to within less than a second, making calendar reform inevitable. In 1582 ten days were dropped, the Julian year being longer than the true year. To prevent further accumulations, the Gregorian calendar was adopted thereafter.

Tycho lost his patronage on the death of the king and he left for Germany in 1597. He settled in Prague at the invitation of the emperor and found a new assistant, Johannes Kepler. Kepler loyally accepted and propounded Tycho's tables and data and continued his work with what were to be results of great importance. Many of Tycho's great contributions to science live on and he is remembered in particular for the improvements he made to almost every important astronomical measurement.

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