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(*b.* Baltimore County, Maryland, 9 November 1731; *d.* Baltimore County, 9 October 1806)

observational astronomy, ephemerides, almanacs.

A tobacco farmer, and amateur astronomer, [Benjamin Banneker](#) was an inspiration for his mathematical achievements. He is frequently described as the first African American man of science.

Early Life. Banneker was born free in Baltimore County, Maryland, on 9 November 1731. He was the son of a freed slave from Guinea named Robert and of Mary Banneky, daughter of a formerly indentured English servant named Molly Welsh and her husband, Bannka, a slave whom she freed and who claimed to be the son of a [Gold Coast](#) tribal chief.

Banneker's early years were spent with his family, including three sisters, growing tobacco on his parents' 100-acre farm near the banks of the Patapsco River. In his early years he had been trained to read and write by his grandmother by means of a Bible she had purchased from England, but his only formal schooling was attendance for a week or two in a nearby Quaker one-room schoolhouse. Benjamin became a voracious reader, borrowing books from wherever he could, and developed considerable skill in mathematics. He enjoyed devising mathematical puzzles and solving those brought to him by others. At about the age of twenty-one he constructed a striking wall clock, without ever having seen one. It is said that it was based on his recollections of the mechanism of a pocket watch. Apparently, he visualized it as a mathematical puzzle, relating the numerous toothed wheels and gears, carving each carefully from seasoned hardwood with a pocket knife. For a bell, he utilized either part of a glass bottle or metal container. The timepiece appears to have been the first clock in the region and brought those who had heard about it to his cabin to observe it and listen to it strike. The clock continued to function successfully for more than fifty years, until his death.

Inheriting the family farm at his father's death, Banneker lived with his mother until her demise. Then living alone, he continued to grow and sell tobacco until about the age of fifty-nine, when rheumatism forced him to retire. His farm made him virtually self-sufficient, with a productive vegetable garden, thriving fruit orchards, and several hives of bees that he maintained. Banneker and his family had been among the first clients of the newly established Ellicott Store, in nearby Ellicott's Lower Mills, and during his leisure he continued to visit it frequently, purchasing small items he required, perusing the wealth of imported merchandise, occasionally purchasing an inexpensive book for his own small library. Most of all he enjoyed the opportunity to read newspapers from other cities that the store sold and that provided him with a link to the outer world.

Now, with the freedom of retirement from work, Banneker turned with new vigor to his astronomical studies, often whiling away the hours until dawn scanning the night skies with his telescope and recording notations for an ephemeris for an almanac he was compiling for the following year.

Work in Observational Astronomy. It was just at this time that fate sought him out for an important role to play in the nation's history. The surveyor Andrew Ellicott had recently been appointed by President [George Washington](#) to produce a survey of selected lands on which to establish a national capital. Ellicott urgently required an assistant with some knowledge of astronomy to work in the field observation tent during the night hours. He traveled to Ellicott's Lower Mills hoping to hire his cousin George Ellicott, Banneker's neighbor, who was an amateur astronomer. However, his cousin, being unable to leave his own work, instead recommended Banneker, whom he felt had become sufficiently informed on the subject to fulfill the position. Banneker was hired and, overwhelmed by the opportunity, he traveled together with Andrew Ellicott to the site that was to become the national capital, arriving early in the new year of 1791.

Banneker worked in the observatory tent for more than four months, from the beginning of February until the end of April 1791. It was grueling work, for he was forced to spend the long hours of the night lying on his back in order to use an instrument called a zenith sector. His assignment was to observe through the instrument's telescope as stars transited over the zenith, noting the exact moment of each star's transit and recording it for Ellicott's use when he arrived the next morning.

It was extremely tiring work for a man of Banneker's advanced years, but despite the discomfort, he derived considerable pleasure and pride from the knowledge that he was contributing to such an important project. Also, after taking a nap during the early daylight hours, Banneker had the privilege of using Ellicott's astronomical textbooks, which were maintained in the observatory tent. This enabled him to complete the ephemeris he was compiling for an almanac for the following year, 1792. For his participation on the survey, including travel, Banneker was paid a total of \$60.

Correspondence with Jefferson. Soon after returning home, Banneker sent a handwritten copy of his completed ephemeris to [Secretary of State Thomas Jefferson](#) because, as he wrote, Jefferson was considered to be "measurably friendly and well disposed towards us," referring to the African American race, "who have long laboured under the abuse and censure of the world. ... And have long been looked upon with an eye of contempt, and ... long have been considered rather as brutish than human, and scarcely able of mental endowments (1792)."

Submitting his calculations as evidence to the contrary, Banneker urged Jefferson to work toward bringing an end to slavery. Jefferson answered promptly:

No body wishes more than I do to see such proofs as you exhibit, that nature has given our black brethren, talents equal to those of other colors of men, and that the appearance of a want of them is owed merely to the degraded condition of their existence, both in Africa & in America. ... No body wishes more ardently to see a good system commenced for raising the condition of both their body & mind to what it ought to be, as fast as the imbecility of their present existence, and other circumstances which cannot be neglected, will admit. (Payne, 1862, pp. 168–171)

Jefferson was so impressed with Banneker's calculations that he sent a copy to the Marquis de Condorcet, secretary of the [French Academy](#) of Sciences in Paris, with an enthusiastic cover letter. No reply was forthcoming from Condorcet, however, because at just the time of the arrival of Jefferson's letter, the French diplomat had been forced to go into hiding for opposing the monarchy and for having supported a republican form of government. During the following year, the two letters, the one from Banneker to Jefferson and the statesman's reply, were published in the [United States](#) in a widely distributed pamphlet and in at least one periodical.

Publication of the Almanac. James McHenry, a senator from Maryland, had been so impressed with Banneker's almanac manuscript that he wrote an endorsement for it that was published together with the almanac by the Baltimore printer Goddard & Angell. The almanac bore the title *Benjamin Banneker's Pennsylvania, Delaware, Maryland, and Virginia Almanack and Ephemeris for the Year of Our Lord 1792*. In addition to its sales in Baltimore, the almanac was made available also by printers in Alexandria, Virginia, and in Philadelphia. It proved an immediate success, and Banneker's lifestyle soon changed somewhat, as he became acknowledged by neighbors and occasionally by others visiting the region.

During the next five years, Banneker continued to calculate ephemerides, which he sold and which were published in almanacs bearing his name in the title. Promoted by the abolitionist societies of both Pennsylvania and Maryland, Banneker's almanacs were published by several printers and sold widely in the [United States](#) and also in England. Twenty-eight separate editions of his almanacs are known to have been published.

Generally, in the production of an almanac, the astronomer provided only the ephemeris, and the remaining content was selected and furnished by the printer, who often selected random prose and poetry taken from the published press or journals. Frequently included were useful tables of [weights and measures](#), coinages, interest rates and scales of depreciation, measurements of roads, and distances of cities from the place of publication, a calendar of meetings of courts of law holding sessions where the almanacs would be sold, and so forth.

The remainder of the pages of these inexpensive and poorly printed pamphlets generally were filled with moral elevating scriptural quotations, proverbs, allegorical stories, and puritanical essays. By the beginning of the eighteenth century, however, the almanac's content changed distinctly in tone from its earlier religious bias to one of more practical considerations, with emphasis on education and literary and historical content. As a consequence, in time the almanac became more entertaining, with homely wisdom cast in contemporary language. By the end of the eighteenth century, the publication had become the most common printed item in the American republic, printed in every state, each vying with others in developing a new marketable item. In the period that Banneker was undertaking the preparation of an ephemeris, the century was drawing to a close and once more the almanac content was undergoing a change, with new emphasis on local causes and national events.

In a period when clocks and watches were luxuries and common timepieces consisted primarily of time glasses and sundials, information about the times of sunrise, noon, and sunset were of considerable importance to the prospective purchaser, as well as the phases of the moon, eclipses, and conjunction. Among the most desirable and useful features of Banneker's almanacs proved to be a tide table for the [Chesapeake Bay](#) region, which made his almanacs particularly desirable for river pilots, fishermen, and others living near and making their living on the water. It listed times for high water or high tide at Cape Charles, Point Lookout, Annapolis, and Baltimore. Why Banneker's competitors ignored this

feature is hard to understand, because it was simple enough to calculate the high tide at Annapolis, for instance, which was two hours later than at Point Lookout, while at Baltimore and Head-of-the-Bay the high tide was five hours later than at Point Lookout. The tide table was simplified considerably in Banneker's almanacs for the years 1795 and 1796, which provided data for determining tides in ports as distant north as Halifax and Boston. This feature was titled "Rule to find the Time of High Water in the following Places" and consisted simply of an additive for each of the places listed, to be combined with the day of the Moon's age.

It was Banneker himself and not his printer who compiled the tide tables for his almanacs. It was a simple matter to acquire the data, and no mathematical

achievement was involved. The changing of the tides had been associated with the motion of the Moon for centuries. Once the time of the highest or [spring tide](#) was known at a particular point at the age of the full or new moon, it was a simple matter to derive a table for each day of the month at the same place. Banneker applied the standard daily retardation of forty-eight minutes, or four-fifths of an hour. This determination of the highest tide waters or spring tides on the days of the full or new moon was known as "the establishment of the port" and generally was marked on the charts for the port in question.

From data in his published almanacs, it is evident that Banneker made his observations from a point of latitude 39°30' north and a longitude of 4 hours, 59 minutes west. In addition to recording in his manuscript astronomical journal the ephemerides for each of the years for which he calculated them, Banneker also included miscellaneous exercises in mathematics and astronomy.

In the pages of his manuscript astronomical journal as well as in his commonplace book, Banneker occasionally recorded miscellaneous items about unusual atmospheric phenomena he had observed. Typical of these random notes was an entry on the very first page of the journal, under the date of 23 December 1790. He noted, "About 3 o'clock A.M. I heard a Sound and felt the Shock like heavy thunder I went out but could not observe any Cloud above the Horizon. I therefore Conclude it must be a great Earth Quake in some part of the Globe." Another item, recorded on 4 May 1792, described how "In a Squall from the N.W. I observed the Lower regions of the Clouds to move Swiftly before the wind, and the upper region Slowly against it."

Even in his later years the weather continued to preoccupy him. On 2 February 1803, he noted,

in the morning part of the day, there arose a very dark Cloud, followed by Snow and haile a flash of lightning and loud thunder crack, and then the Storm abated untill after noon, when another cloud arose the Same point, viz, Northwest with a beautiful Shower of Snow but what beautyfyed the Snow was the brightness of the Sun, which was near Setting at the time.

A comparison of the contents of Banneker's published ephemerides made with those calculated and published by his contemporaries Ellicott, William Waring, and Mary Katherine Goddard, has revealed that Banneker's calculations consistently reflected an overall high degree of comparative accuracy. An error analysis of the astronomical data in Banneker's almanacs revealed that his data compared very favorably with that published by his contemporaries. There was no significant difference between Banneker's star data and that published by the two contemporary almanac makers. Although Banneker's planetary data may have appeared to be somewhat less accurate than that of Ellicott or Goddard, it was still quite usable by the ordinary purchaser of the almanac. Considering that the length and complexity of the calculations involved in determining the rising and setting of certain stars and planets, and realizing that this was only a small segment of the mathematics required for one year's almanac, one can have only the greatest respect for this self-taught man of science.

Although Banneker continued to calculate ephemerides every year through the year 1802, those after 1797 remained unpublished, but were carefully recorded in his manuscript journal and commonplace book, which survive as unique records of an eighteenth-century almanac maker.

Character. Banneker espoused no particular religion, but as an early biographer noted, "His life was one of constant worship in the great temples of nature and science." (Allen, 1921) As places of worship in his vicinity grew in number, Banneker visited each of them, but gave preference to the meetings of the Society of Friends, where "he presented a most dignified aspect as he leaned in quiet contemplation on a long staff, which he always carried after passing his seventieth year. And he worshipped, leaning on the top of his staff." (Allen, 1921)

A description of Banneker was provided by Martha Tyson, daughter of George Ellicott, who had seen him when she was a young woman. "The countenance of Banneker," she wrote,

had a most benign and thoughtful expression. A fine head of white hair surmounted his unusually broad and ample forehead, whilst the lower part of his face was slender and sloping towards the chin. His figure was perfectly erect, showing no inclination to stoop as he advanced in years. His rainment was always scrupulously neat; that for summer wear, being of unbleached linen, was beautifully washed and ironed by his sisters. ... In cold weather he dressed in light colored cloth, a fine drab broadcloth constituting his attire when he designed appearing in his best style.

No known portrait of Banneker exists. Lacking such, an image frequently used is a woodcut portrait bust of a young black man, imaginary and not based on life, wearing the typical Quaker garb of the period. Purported to be of Banneker, this image illustrated the cover of a 1797 edition of one of his almanacs. The most accurate representation known may be found on a modern mural painting by the late William H. Smith of the survey of the federal territory. It hangs in the Maryland House on the [John F. Kennedy](#) Highway in Aberdeen, Maryland. In 1980 the U.S. Postal Service issued a commemorative stamp honoring Banneker based on imagined features.

On 9 October 1806, during a nap following his usual morning walk, Banneker quietly died in his sleep, just one month short of his seventy-fifth birthday. In accordance with instructions he had left, immediately following his death all the items that had been borrowed from his neighbor George Ellicott, including the worktable, instruments, and books, had been returned to him by Banneker's nephew. Included also was Banneker's astronomical journal.

Banneker was buried two days later, on Tuesday, 11 October, in the family burial ground within sight of his house, a few yards away. During the services, as his body was being lowered into his grave, the mourners were startled as they looked up to see his house, a wooden building, suddenly burst into flame. Before help could be summoned, the entire structure burned to the ground. All its contents were totally destroyed, including Banneker's clothing and other personal possessions, a few bits of furniture, a sparse collection of books and printed copies of his almanacs, as well as the fabled well-worn striking clock. The only item known to have escaped destruction was his quarto Bible, which had been removed from his house after his death and before the funeral, probably by one of his sisters. The cause of the conflagration was never determined.

Banneker's death did not pass totally unnoticed. An obituary announcement appeared in the *Federal Gazette* on 28 October 1806, almost three weeks after his death. It provided a description of Banneker's way of life and concluded, "Mr. Banneker is a prominent instance to prove that a descendant of Africa is susceptible of as great mental improvement and deep knowledge into the mysteries of nature as that of any other nation."

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