SAMPLE

Famous Astronomers: Aryabhata

The Father of Indian Mathematics and Astronomy

Aira Astralis

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Conclusion

This free sample contains the Introduction and Chapter 1. The complete book contains the full contents above.

Introduction

The historian who wants to meet Aryabhata must do something no historian of Ptolemy or Copernicus ever has to do: read a poem, all of it, before meeting the man. The Aryabhatiya is a book of about one hundred and twenty verses, written in the compressed sutra style of ancient India, in which each line carries the weight of a paragraph and each syllable can be a number, and the whole of it fits comfortably in a jacket pocket, and yet this small book carried the sky, the calendar, the mathematics of sines, the rule for eclipses, and the arithmetic of daily commerce for a large part of the world for more than a thousand years. The book appeared in the year 499 of the Common Era, composed by a man of twenty-three who said so himself in a verse, a statement so audacious that scholars have spent centuries checking whether they have read the chronogram correctly, and the check keeps confirming it.

The man behind the book is almost entirely invisible. No biography survives from his own century, no portrait, no letter, no anecdote with a verifiable setting, and the biographical facts that can be stated with confidence fit on a small card: he was born in 476, he worked at Kusumapura, the great city near modern Patna where the Ganges makes its great turn east, and he wrote one short book that outlived every kingdom of his age. The book names its author and its date, and then, in the style of the sutra, it goes silent about its maker and speaks only of mathematics and the heavens, and the silence is the first thing a reader must accept about Aryabhata: the work stands for the man, and the man for the work, and nothing else has come down.

What the work contains is a world. The Aryabhatiya holds the place-value system of numeration explained with the confidence of a tool already in use, the closest any ancient text comes to stating that pi cannot be exactly named, a table of sines computed at intervals finer than any before it, rules for finding the areas and volumes that commerce needed, the lengths of the year and the month, the sizes and motions of the planets, a theory of eclipses that replaces the demon Rahu with the shadow of the Earth, and the claim, stated without fireworks, that the Earth turns on its axis once a day while the stars stand still. Any one of these would earn a mathematician a chapter in a general history. Together, in one short poem by one twenty-three-year-old, they form one of the great scientific debuts of any civilization, and this volume is the biography of that debut and of the silence around it.

The chapters that follow move in the order the series has established for its astronomers, from discovery to understanding to characteristics to science to measurement to features to context to the moderns, and the order suits this subject better than most, because for Aryabhata discovery and understanding

are the same act, and the characteristics of the man are the characteristics of the verse. The reader will finish knowing the book thoroughly and the man as thoroughly as fourteen and a half centuries allow, which is to say by his fingerprints, and the fingerprints are everywhere in the mathematics India and the Islamic world used for the next millennium, and the trail begins with a poem in Kusumapura, in the last year of the fifth century, by a young man who expected to be remembered, and was, and is.

One more orienting fact belongs in the opening, because it explains the tone of everything that follows: the Aryabhatiya is a professional's book. It was written for people who computed for a living, the calendarists, the astrologers whose charts the age demanded, the surveyors, the ritualists timing the sacrifices, and it holds nothing that does not serve the work, no hymn, no flourish, no apology, and the professional tone is why the book survived, because usefulness outlives beauty and dogma both, and this book was useful the way a hammer is useful, in every century that followed, to everyone who picked it up.

The reader should also be warned of a pleasure to come, the mathematics itself, which this biography refuses to hide: the recipe for pi, the table of sines, the algorithm called the pulverizer, and the verse about the rotating Earth are quoted here in plain arithmetic and plain English, and the quotations are the biography's exhibits, and the exhibits are the man. The volume follows the series' ordinary road through sixteen stations, and the stations are named for the questions a curious reader actually asks: who found him, what is he, what did he make, what did it rest on, what did he measure, what did he leave, who disagreed, what do the moderns say, what is still being learned, what did he truly discover, what remains mysterious, what comes next, what is fun, and what does it all mean.

The answers are given in the order the series has fixed for every astronomer in the library, so that Aryabhata can be read beside Ptolemy, beside Copernicus, beside the moderns, shelf by shelf, chapter by chapter, and the shelf is the point of the whole arrangement. The chapters are short enough for a sitting and long enough for the truth, and the truth, as the reader will see, is generous to its subject, because the subject earned it. One fact about the subject prepares the reader for everything: almost every number in this book, the dates, the cities, the values, the titles, comes from one hundred and twenty verses and their commentary, checked and rechecked by modern scholarship, and the biography is therefore unusually certain about its subject's work and unusually empty about its subject's life, and the certainty and the emptiness together give these chapters their particular music, the music of a strong record honestly read, and the reader who keeps the two

facts separate, the work known, the life unknown, will get Aryabhata exactly right, and getting him right is the only goal.

Chapter 1: The Discovery of Aryabhata

The word discovery means something unusual in the case of Aryabhata, because India never entirely lost him, and the West never had him to lose. The Aryabhatiya circulated in copies and commentaries from the moment it was written, because a book that useful is a book that gets recopied, and the Sanskrit tradition of commentary, in which each generation explains the terse verses of the last to the students of the next, kept the text alive the way a river keeps a boat afloat, not always gently but continuously. Bhaskara the First, writing in 629, about a century and a quarter after the original, produced a commentary that still survives, and his presence in the record is the earliest outside evidence that Aryabhata was read, taught, and argued over within living memory of the living tradition, and that is a kind of discovery in itself, the discovery of a book too much alive to need discovering.

The second act of survival came through disagreement. Brahmagupta, working in the 620s and 630s in Ujjain, took fierce issue with several of Aryabhata's positions, most famously the theory that eclipses are shadows, and the criticism was so thorough, verse by verse, that it functioned as an inadvertent preservation, since a position attacked in detail is a position quoted in detail, and historians of the next millennium would reconstruct Aryabhata partly from the writings of a man trying to refute him. In the ecology of ideas, an influential enemy is a storage device, and Brahmagupta stored Aryabhata with contempt and precision in equal measure, and the contempt evaporated centuries ago and the precision remains.

The third act carried him out of Sanskrit entirely. In the early 800s, at the House of Wisdom in Baghdad, the astronomers of the translation movement rendered Indian astronomical works into Arabic, and the resulting tables were known as the Zij al-Sindhind, the astronomical handbook of the Indians, and Indian astronomy, with Aryabhata at or near its root, entered the stream that would flow through Arabic into Latin Europe. The sine, which the Aryabhatiya had tabulated under the name ardha-jya, half-bow, traveled as the Arabic jayb, a word that later readers took to mean fold or bosom, and when the Latin translators rendered that word they chose sinus, and the sine on every schoolchild's calculator is a descendant of the bow Aryabhata drew in the sky, renamed twice on its way west, and the renaming is the discovery the West remembers, which is to say it remembers the river and not the source.

The fourth act is the modern one, scholarly and deliberate. European orientalists of the nineteenth century, working through the Sanskrit manuscripts that had survived in libraries and temple collections, brought the Aryabhatiya into the history of world science: the text was edited and

translated, the numeral cipher was cracked, the chronological verses were dated, and by the twentieth century the critical editions and studies of Kripa Shankar Shukla and others had given the world a reliable Aryabhata, fixed in the year 499, fixed at Kusumapura, and recognized as the earliest surviving complete work of the exact sciences from ancient India.

The discovery, in the end, was less a finding than a slow, cumulative recognition, spread across fourteen centuries and three languages, that a very short book by a very young man was one of the foundation stones of mathematics and astronomy, and the recognition is the story of this chapter, and the chapter ends where it began, with the poem that survived its author, its critics, its translators, and its empires, intact. The chapter closes by naming the discovery that matters most, which is not a manuscript but a standing: the Aryabhatiya is the earliest surviving complete treatise of the exact sciences in the Indian tradition, which means every earlier Indian astronomer and mathematician whose works are lost is now studied through it, and every later one is studied against it, and the book stands at the head of the record like the first legible page of a long archive.

Discovery, for this subject, is therefore not a single moment but the whole process this chapter has traced, from Bhaskara's commentary to Baghdad's translations to the critical editions of the twentieth century, and the process has one direction only, toward the verse, and the verse has held, and the holding is the chapter's verdict and the biography's foundation stone. And the discovery continues in the present tense, because the reading of Aryabhata is not finished in any sense that matters: new manuscript finds are catalogued, new commentaries are edited, new readings of the hard verses are proposed, and the discovery of the nineteenth and twentieth centuries, the frame and the text, has become the discovery of the twenty-first, the context and the influence, and the biography the reader holds is part of that continuing act, which is the pleasantest fact in the chapter, that a thousand five hundred years after the composition, meeting Aryabhata is still something that happens, in libraries, in classrooms, and in pages like these.

A detail of the discovery deserves its own line because it shows how fragile the transmission was and how sturdy the design proved: Sanskrit astronomical manuscripts survive in the dozens and hundreds rather than the thousands, copied slowly by hand on materials that age, and a lesser book, longer, less memorizable, less useful, could have slipped under the water of time entirely, and several did, and the Aryabhatiya floated on the three life rafts this chapter has described, the commentary, the enemy, and the translation, and the rafts were built into the book's own design, and the design is why the discovery never had to happen twice.

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ABOUT THE AUTHOR

Aira Astralis is a science writer specializing in astronomy and space exploration. Her work spans the full breadth of humanity's relationship with the cosmos -- from the earliest naked-eye observations to the engineering marvels of modern space missions.

Her books are built on a foundation of primary sources: peer-reviewed research, mission archives, and direct engagement with the scientific community. She writes for readers who want to understand not just what we know about the universe, but how we came to know it.

She believes that the most important frontier is not out there but in the gap between what scientists discover and what the public understands. Her books exist to close that gap.