SAMPLE

Famous Astronomers: Jocelyn Bell Burnell

The Discoverer of Pulsars

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 proper way to begin Jocelyn Bell Burnell is with a length of paper, because her discovery was made on paper, by a reader, at a desk, in a shed on a muddy field outside Cambridge, and everything that followed the reading, the fame, the injustice, the grace, the medals, the fund that carries her name, was set in motion by a pen vibrating on a moving strip of chart. She was born Susan Jocelyn Bell in Belfast on the fifteenth of July, 1943, into a family that built things, her father an architect who helped design the Armagh Planetarium, and she grew up reading her father's books, failed the eleven-plus once and passed it the second time, walked into Lurgan College as the school's first science-stream girl after a fight with the headmaster, took a physics degree at Glasgow, and arrived at Cambridge in 1965 as a graduate student assigned to a radio array that did not yet exist, two years of hammering masts and soldering cable in the cold before a single observation, and then the routine labor of her doctorate, the analysis of the endless chart paper the array produced, and in that labor, in November 1967, she found a signal no one had imagined possible, a pulse of radio noise repeating every 1.337 seconds, steady as a lighthouse, from a place in the sky where nothing could be seen, and the signal was a spinning neutron star, the first pulsar, and the finding opened a new physics and an old argument, because the Nobel Prize for the discovery went to her supervisor and to another man, and the student whose eyes had done the finding stood in the doorway of the Stockholm ceremony's history, and her response to that exclusion, delivered over fifty years without a syllable of bitterness, is now as famous as the discovery, and both the pulse and the patience are the subject of this volume.

The paper deserves its paragraph at the threshold. The Cambridge array, four and a half acres of wire and poles tuned to the sky at 81.5 megahertz, was built to track quasars through interplanetary scintillation, the flicker of radio sources as their waves crossed the turbulent solar wind, and the receiver wrote its output onto strips of chart paper that a human had to read, and the human was the research student, and the volume was nearly a hundred feet of paper a day, week after week, month after month, a meter at a time between the eyes and the ink, and the whole modern physics of neutron stars, the densest matter a reader will ever hear about, was hidden in that paper like a signal in static, and was found because one reader was systematic, suspicious of small oddities, and unwilling to call anything noise until she understood it, and the reader is the introduction's second subject, because a biography of a discovery made by reading is a biography of a reader.

The reader should also be told, before the chapters begin, the two

commitments that organize the life. The first is to evidence, the discipline of the chart desk carried into every later office she held, and the second is to fairness, a conviction, rooted in her Quaker faith, that science belongs to everyone and that its doors must be opened wider than her generation found them, and the two commitments are not in tension but in series, since the woman who proved she could read the sky as well as anyone then spent her career making the reading room bigger, for women, for students from groups the profession had passed over, for anyone the chart desk had not yet reached, and the making-bigger has a name now, the Bell Burnell Graduate Scholarship Fund, funded by her own Breakthrough Prize money, three million dollars given away in an afternoon, and the fund is the introduction's last exhibit and the biography's destination, and the road to it runs through sixteen chapters, and the first chapter starts in Belfast, and Belfast is where the paper is.

The footing under this biography should be stated up front, so the reader knows what every quotation stands on. Bell Burnell has told the story of the discovery for fifty years in public, in lectures, essays, and recorded interviews, and the telling has been consistent against the surviving documents, the chart reels, the logs, the Nature paper, the newspaper record, and the testimony of the participants, and the consistency is this volume's foundation, since a life this examined either checks or it does not, and hers checks, and the checking means the chapters that follow can quote the record plainly, and the plainness is the method.

The biography also states its plan, since a series volume owes the reader a map: the chapters walk the fixed series road from the finding of her through the physics, the paper, the era, the scholarship, the odd facts, and the meaning, and the road suits the subject, since the life happened in almost exactly that order, doors, paper, pulse, fame, exclusion, testimony, and gift, and the reader who wants the end first may read the last chapter, and the reader who wants the story as it was lived starts here, and the choice is free, and the volume begins.

The introduction ends with the length of the story, since the reader should be told the scale before committing: the events at the center of the biography occupy eleven weeks of 1967, and their consequences occupy fifty years and counting, and the disproportion is the introduction's last exhibit, a season of paper and a lifetime of echo, and the exhibit is mounted, and the volume is open, and the reader is welcome, and the welcome is warm. The introduction also hands the reader the one fact that will do for a first telling of the whole book: in 1967 a graduate student read a radio telescope's output by eye and found a clock spinning in the sky, the prize went to her professor, and she

gave her own biggest prize away to widen the field's doors, and the fact is verified in every chapter that follows, and the handing is the introduction's final act of hospitality.

One threshold fact remains, the reason the volume exists at all, since the series is a shelf of astronomers and she stands on it as the reader's contemporary, the one figure in the whole series whose discoveries are within living memory and whose career is still adding chapters, and the contemporaneity is a gift, since the reader is not visiting a monument but standing beside a working colleague, and the standing is the introduction's final posture, and the posture is set, and the introduction is finished.

The chapter of understanding is next, and the introduction steps aside for it with the reader's gear already packed, the pulse, the paper, the doors, and the gift, and the packing is the introduction's honest summary of itself, since it has given the whole life in miniature and the chapters will now give it in full, and the full is the road, and the road begins at the first chapter's door, and the door is Belfast, and Belfast is already open.

Chapter 1: The Discovery of Jocelyn Bell Burnell

The discovery of Jocelyn Bell, in the biographical sense, was a sequence of doors opening onto rooms she was not expected to enter, and the rooms were all defended, and she entered them anyway. The first door was the eleven-plus, the examination that decided, at ten years old, which children in Northern Ireland would receive a grammar education, and she failed it, once, for reasons that had nothing to do with ability and everything to do with preparation, and the family got her coached, and she passed the second time, and the lesson was learned early and kept for life, that the doors of an unfair system can be walked through, with help, and that the help is worth passing on.

The second door was the science stream at Lurgan College, which had never admitted a girl, and the headmaster initially proposed domestic science, cookery and sewing, and her parents objected, backed by a new young physics teacher, and the school gave in, and the class of one girl studied physics among the boys, and the story is famous now because it is the biography of the whole gendered history of the subject in one anecdote, a girl, a school, a subject, and a door held shut and then opened.

The third door was Glasgow, where she took her bachelor's degree in physics, one woman among a handful in the lecture halls of the early nineteen-sixties, and the fourth was Cambridge, where she arrived in 1965 as a doctoral student of Anthony Hewish, the radio astronomer whose technique, interplanetary scintillation, she had helped test as an undergraduate project and whom she had impressed enough to be offered a studentship, and the

Cambridge door had a particular narrowness, the viva looming over every research student's first year, the conviction in her own memory of being an impostor among the brilliant men of the Cavendish, and the belief, which she has described honestly, that the University had made a mistake in admitting her, and the belief was wrong, and the proof of its wrongness was two years of field work, because the scintillation array her thesis required did not exist and had to be built, and the building was the leveling, since a muddy field does not care what class of degree anyone holds.

The array was a forest, four and a half acres of it, more than a thousand masts carrying some two thousand dipole antennas, all of it joined by miles of copper cable that had to be soldered, labeled, waterproofed, tested, and repaired by hand, and the research students did the work, and she did her share, sinking posts, hauling cable through Fen winters, learning the instrument from the

wire up, and the learning was the fifth door, because the person who builds the machine knows its noises, knows which wiggles are the receiver's moods and which are the sky's, and that knowledge, unteachable from a textbook, is what would let her later tell the difference between the scruff and the static.

The array switched on in the summer of 1967, and the chart recorders began to write, and the reading began, and the routine was brutal by any standard, one hundred feet of paper per day, each strip to be scanned, annotated, and indexed, the whole of the student's waking attention converted into a search for the flickering of quasars, and no flickering had been found yet when, in August, on a stretch of chart from late July that she had been ordered to keep for calibration, she noticed a mark she could not classify, a quarter-inch of wiggle, some scruff, as she called it, half a pulse-width of something that did not look like the interference she knew.

The discovery of Jocelyn Bell, in the scientific sense, began with that scruff, and the chapter closes on the moment the way she has always told it, modestly and exactly: the signal came back, on a faster chart speed, in November, as a train of pulses spaced 1.337 seconds apart, and the train kept its schedule to within a fraction of a second, and the finding of it is credited by every honest history to the woman who noticed, because the array would have found nothing without the reader, and the reader was her, and the reader had come through five doors to reach the paper, and the doors are the discovery's other meaning, and both meanings now stand in the record, and the record is the biography's ground.

The discovery chapter closes with the thing the reader should carry out of it, the relation between the two meanings, because the doors and the scruff are the same story told as a life and as a physics. A person who had been told at every previous stage that the room was not for her arrived at the chart desk, and the chart desk did not care about any of it, the paper's only demand was that the reader read, and the reading was rewarded with a star, and the reward is the argument the biography will make everywhere, that the unfair doors cost science every time they hold, and the proof is one woman, one field, one hundred feet of paper a day, and the proof is complete.

The discovery chapter closes its second meaning with the first one restated, since the doors and the scruff share a single hinge: every room she was told was not for her made the chart desk more remarkable, and the chart desk rewarded the only candidate the rooms could not keep out, and the hinge is the chapter's closing thought, and the thought is kept, and the chapter's record is closed.

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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.