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Quirks and Quarks

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STRANGE BEAUTY

Murray Gell-Mann and the Revolution

In Twentieth-Century Physics

By George Johnson

Knopf. 434 pp. $ 30

Reviewed by Marcia Bartusiak

The revelation that Nature uses a mathematical treatise as its playbook was first made by Sir Isaac Newton, but that knowledge harvested its greatest riches in the last half of this century. With Strange Beauty, an insightful biography of physicist Murray Gell-Mann, George Johnson, a writer for the New York Times, splendidly captures the energetic spirit of this golden age of theoretical physics. Between Gell-Mann's undeniable brilliance and his irascible personality, he is the perfect subject for examining the heady, competitive atmosphere of physics over the last few decades. With the very problems that Gell-Mann tackles, his search for an aesthetic order within the vast zoo of elementary particles, we gain a front-row seat at an exhilarating intellectual demonstration.

The son of Austrian immigrants, Gell-Mann was a child prodigy in the 1930s (which we learn had deep and poignant repercussions). He was multiplying by age 3, winning spelling contests at 7, and graduated valedictorian of his New York City high school at 14. He was the class know-it-all. His incessant need to be right was a trait he never outgrew. Many have withered when faced with his judgmental glares or his legendary put-downs. Physics was not his first choice of study; a boy of widespread interests, he was initially attracted to such fields as archaeology and linguistics. But his father, an aspiring scholar whose plans were demolished by the Depression, counseled him to be more practical. The

lasting imprint of his father's influence looms large in this biography.

Not until graduate school at MIT was Gell-Mann at last convinced that physics was going to be fun. His apprenticeship was a walk through the history of physics. This "Tony Curtis with horn-rimmed glasses," as he was once described, first worked at the Institute for Advanced Study in Princeton, home to Einstein and J. Robert Oppenheimer, father of the atomic bomb. Then he was off to the University of Chicago, the abode of Enrico Fermi, where he became enamored of the strong force, the force that holds the atomic nucleus together. At that time in the 1950s, physicists had uncovered a dizzying array of particles, an unruly menagerie hard to corral. To start the process of ordering them, Gell-Mann invoked a new property of matter, along with mass, charge, and spin. He called it "strangeness," quoting the 17th-century philosopher Francis Bacon: "There is no excellent beauty that hath not some strangeness in the proportion."

It was an inspired first step. Johnson expertly details the subsequent series of breakthroughs that ultimately led Gell-Mann, soon tenured at his longtime professional home, Caltech, to realize that all those varied members of the particle zoo were actually constructed from a simple set of building blocks. The realization arrived in 1963, when certain "quirks" appeared in his mathematics. Gell-Mann, an expert linguist, playfully called them his "kworks." He liked the sound. The spelling was changed when he later chanced upon a line from James Joyce's Finnegans Wake: "Three quarks for Muster Mark!" It's interesting to see this idea take hold so slowly. Physicists accepted it kicking and screaming, including Gell-Mann himself, who had a gnawing reluctance to state that quarks were real entities (as later proved by experimentalists) and not just a mathematical convenience. Faced with the possible triumph of a competing theory, popular at the time, he hedged his bets.

Johnson shows how physics at these ethereal levels is often played like a game of musical chairs. Hazy ideas circulate for a while within the theoretical community, until someone clarifies them, publishes, and stakes a claim. Despite an excruciating, lifelong writer's block, Gell-Mann played this game well enough to earn a rare honor: a Nobel prize in physics shared with no one.

The elegance of Johnson's writing matches the beauty of Gell-Mann's discoveries, but make no mistake. This is a challenging read, chock full of references to parity violations, renormalizations, axial currents, and gauge symmetries. I applaud his decision to not settle for mere hand-waving. Analogies alone (although there is a good supply) could not evoke a visceral feel for the awesome scientific challenges that theorists like Gell-Mann faced. Yet Johnson also provides enough "gossip" -- Gell-Mann's sparrings with Richard Feynman, his petty grudges against colleagues, his nightmare in publishing his memoirs -- to keep the narrative moving sprightly.

If this biography has any weakness, it is Johnson's decision to focus primarily on Gell-Mann's career. An account of his life outside physics is relatively slim. We are told of his eclectic talents -- in the classics, ornithology, environmentalism, etymology -- but these are fleshed out only in the last 50 pages.

Now 70, Gell-Mann resides in New Mexico, working at the Santa Fe Institute that he helped establish to integrate any number of disciplines in solving research problems. Johnson confesses that in the course of his writing he "had come to like this brilliant, complicated, always fascinating, and often exasperating man." The reader will too.

Marcia Bartusiak regularly writes on physics and astronomy. Her next book, "Einstein's Unfinished Symphony," will be published this fall.

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