upper-class adult characters. To have Betsey's grandmother voice her pretensions in the same dialect as the dark-skinned characters she despises is to make her into an object of fun, if not outright contempt; and while she is snobbish, she's meant, I think, to be a likable character. Shange proves over and over again in the novel that she is able to approximate the rhythms and reproduce the idioms of vernacular black speech without resorting to what is, in this case, the literary equivalent of black-face minstrelsy.

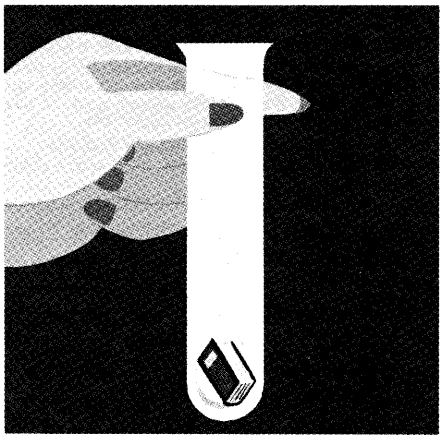
It is noteworthy that three important young black women novelists have chosen to write about the black middle class, but, with the possible exception of the disappointing *Betsey Brown*, these books do not revise the literary image of the black bourgeoisie. On the contrary, they go a long way toward confirming that the colored gentry are just as trifling now as they were said to have been 60 years ago.

Sherley Anne Williams is the author of a critical study of black literature, "Give Birth to Brightness" (Dial Press), and two volumes of poetry, "The Peacock Poems" (Wesleyan University Press) and "Some One Sweet Angel Chile" (William Morrow). Her first novel will be published by Morrow next year.

SUPERFORCE, PLANIVERSE, TIME'S ARROWS,

And Other Adventures in Science

BY PAMELA WEINTRAUB



Female Strategies, by Evelyn Shaw and Joan Darling (Walker & Co., $14.95). Just a decade ago, say Shaw and Darling, biologists studying sexuality in species from Homo sapiens down through the water flea Daphnia focused almost exclusively on the male. Sexual behavior, notion had it, was the male mandate; "he sought out the female, courted and copulated at the time of his choosing, and then, having satisfied his sexual desires . . . *he* crept, swam, or flew away."

But Shaw and Darling show how dozens of recent experiments have turned such bias on its head. One study striking "at the very roots of biological assumptions" involves baboon society, long thought to be a patriarchy ruled by the dominant male. New research proves that the dominant *female* is the leader; matriarchy, not patriarchy, is the social rule. And despite the fact that promiscuity has long been considered the prerogative of the male, it is apparently practiced by female species "running the gamut from butterflies to salamanders, from ground squirrels to swordtail fish, from mosquitoes to . . . chimpanzees."

How does all this apply to the human female, mummified in layers of culturally fabricated taboos, rites, distortions, and superstitions? According to the authors, she must become aware of the freedom endowed by her biology, "the freedom lying dormant within her." Shaw and Darling are experts in animal—not human—biology, and their extrapolations are likely to get them in trouble with their academic peers. But their conclusion rings true: "as women experiment with new roles, perhaps as the limits to the possible are tested by both sexes, perhaps then freedom of choice in our reproductive strategies will not make people so troubled and anxious . . . . Humans should not feel that different sets of reproductive strategies are wrong or unnatural."

The Planiverse: Computer Contact with a Two-Dimensional World, by A.K. Dewdney (Poseidon Press, $9.95). A few years back, computer science professor Alexander Dewdney began to ponder the oddities of life on a two-dimensional world. He postulated the existence of a 2-D planet named Astria, and invented for it a peculiar chemistry, biology, and physics. Dewdney then took all the data to his lab at the University of Western Ontario, where he spent countless free hours developing a computer program that could teach him even more.

Out of that program comes *The Planiverse,* Dewdney's wondrous first novel, about a professor—also named Dewdney—whose computer program is potent enough to tap into a *real* 2-D planet named Arde. Dewdney's prime contact on Arde is Yendred, a fervent youth in search of his planet's deepest truth, "the knowledge of beyond." Viewing Yendred's death-defying journey through Arde from the expanse of his computer screen, Dewdney chronicles 2-D cities and factories, airplanes and ocean liners, floods and storms. He learns how the Ardeans build their homes (underground), how they make art (each painting is but a single, infinitely varied line), and how they fight a war (with a succession of single combats between whichever two soldiers stand at the head of their respective armies).

Dewdney's tour of the planiverse is delightful, an eerie work of fiction framing a sweeping body of thought. This book, which takes into account the whole of 20th-century science, dwarfs Edwin Abbott's 1884 classic *Flatland,* about life on another 2-D world.

Time's Arrows: Scientific Attitudes Toward Time, by Richard Morris (Simon & Schuster, $17.95). Some questions seem too trivial to merit serious consideration, comments author and physicist Richard Morris, but often these are the very questions that become puzzling when examined in detail. And the question "What is time?" falls into this category. Is time what a clock measures? Is it like a flowing river, or is it the moment we think of as "now" moving from the present to the future? Could the flow of time be arrested or reversed? Did time have a beginning and will it have an end?

Though many of the answers are still beyond reach, the concept of time has in fact been redefined by bold new discoveries in biology, geology, physics, and cosmology. Writing about the ramifications of Einstein's special theory of relativity, Morris says that time "is not a substance that 'flows' at an even rate throughout the universe." Instead it is "dependent on the state of motion of the observer." Writing about black holes, he asks us to imagine an astronaut approaching the border of one while "singing an aria (perhaps from Wagner's *Götterdämmerung*)." To observers in the outside universe, says Morris, "it would seem that he was holding the same note for all eternity." And writing about the cosmos, he says that time may eventually end. "As the universe becomes emptier and emptier, as it evaporates into nothing, events will cease to take place. Without events to mark its passing, time cannot be measured, or even defined."

This magical book doesn't answer

all the questions, but it does question our notions of reality, recasting our usual concept of matter, energy, space, and time.

Cry of the Kalahari, by Mark and Delia Owens (Houghton Mifflin, $19.95). Late in 1973, Mark and Delia Owens piled everything they owned into their small station wagon and drove to a local stone quarry just as the men were finishing the night shift. Mark stood on top of the car and auctioned off everything—including the car. A few weeks later they boarded a plane with two backpacks, two sleeping bags, one pup tent, a small cooking kit, and one change of clothes each. Their destination: the Kalahari, a tract of desert wilderness in Africa so remote that, when they arrived, they would be virtually alone in an area larger than Ireland.

Mark and Delia Owens lived in the "Great Thirst" for the next seven years. During their stay, they studied lions, giraffes, brown hyenas, becoming intimately acquainted with one of the last wild regions on earth. They were stranded without water, battered by storms, burned by droughts, and they witnessed one of the largest wildebeest migrations in history, documenting mass starvation caused by hundreds of miles of wire fence.

Cry of the Kalahari, about the Owenses' odyssey, is a lyrical testament to bravery. This is a wonderfully written and important story about the earth's threatened wilderness; it may also be one of the last true adventures of the modern age.

Reflections on Gender and Science, by Evelyn Fox Keller (Yale University Press, $17.95.) Ten years ago, Evelyn Fox Keller was deeply engaged in her work as a mathematical biophysicist. She "believed wholeheartedly in the laws of physics, and in their place at the apex of knowledge." But sometime during the mid-1970s, another kind of question took precedence, one which overturned her entire intellectual hierarchy: "How much of the nature of science is bound up with the idea of masculinity, and what would it mean for science if it were otherwise?"

The nine essays in *Gender and Science* constitute Keller's effort to answer these questions. Her conclusions cast a pall on science and its glorified priesthood, whose powerful political bias affects the "description of nature" emerging from the lab.

Keller traces much of that bias to the birth of modern science, defined by its founders in terms of power and control. With the central metaphor of science as "a force virile enough to penetrate and subdue nature," she notes, in the 17th century, "male potency was confirmed." And the need for that confirmation in the centuries to come rendered science peculiarly subjective, reflecting the "special arrogance, even bravura," of man.

That sort of narcissism, Keller argues, undermines objectivity, closing off whole areas of inquiry to researchers who must "conquer" their material. It prohibits the scientific ideal—work "premised on order rather than law, on respect rather than domination."

The Body Electric: Electromagnetism and the Foundation of Life, by Robert O. Becker and Gary Seldon (William Morrow, $17.95). In 1958 Robert O. Becker, a crack young orthopedic surgeon at the V.A. hospital in Syracuse, New York, read a startling account: Moscow scientist A.M. Sinyukhin had applied an electric current to wounded tomato plants, causing them to heal up to *three* times faster than expected.

This unusual story helped set Becker on a course he would follow for the next 25 years. He started by applying electric currents to biological systems, and soon learned that electricity could promote healing in animals as well as plants. In 1972, after a decade of research, he was ready to pioneer his ground-breaking discovery on humans, using the magical current to eradicate infection and heal hopelessly broken bones. But as Becker writes in *The Body Electric,* that's just the beginning. Sometime in the future, he contends, such currents may help restore cartilage, abdominal organs, and muscle, including the body's fragile powerhouse, the heart.

If Becker sees the healing power of electromagnetic energy, though, he also perceives its capacity for devastation. Devices emitting low frequency electromagnetic radiation (VDTs, radios, microwave ovens, for instance) may induce heart disease, nerve damage, reproductive problems, depression, even cancer. Moreover, Becker alleges, the Soviet and American military machines, aware of the potential for damage, may be beaming electromagnetic weapons at each other even now. Becker's terrifying claims are punctuated by a footnote: not long after he began to speak out against the impact of what he calls "electropollution," he lost his funding and his lab was shut down.

The Body Electric is a gripping account of science at the cutting edge. The

writing is clear and vivid, and the story—about one man's quest for knowledge in the face of government resistance—is sure to chill.

The Chip: How Two Americans Invented the Microchip and Launched a Revolution, by T.R. Reid (Simon & Schuster, $15.95). "The idea occurred to Jack Kilby at the height of summer, when everyone else was on vacation and he had the lab to himself. It was an idea, as events would prove, of literally cosmic dimensions, an idea that would change the daily life of the world and be honored in the textbooks with a name of its own: the Monolithic Idea. But at the time—it was July of 1958—Kilby only hoped that his boss would let him build a model and give the new idea a try."

So begins *The Chip,* probably the most thorough and readable account of the microelectronics revolution to date. In 1958, when Kilby dreamed up his idea, computers were bulky machines with complex circuit boards, each containing hundreds of separate transistors, diodes, capacitors, and resistors. Kilby's brainstorm: to etch *thousands* of these components into a *single* semiconductor chip, much as an artist etches images in stone. This simple innovation, developed independently by Kilby and one of his peers, a young entrepreneur/engineer named Robert Noyce, reduced computer size and multiplied its speed, launching the high-tech era of today.

Reid's book is fast-paced and exciting, tracing the evolution of the computer from the earliest vacuum tube models through the thinking machines envisioned by the futurists of Japan. And those who didn't quite comprehend the technical details in the best-selling *Soul of a New Machine* will be thrilled with *The Chip.* Reid's particular talent—clarifying, even dramatizing, complex concepts without diluting them—makes reading about computers a joy.

Superforce: The Search for a Grand Unified Theory of Nature, by Paul Davies (Simon & Schuster, $16.95). In the sixth century B.C., Thales posited that water was the primary element of all things. Later theorists proposed four terrestrial elements—water, fire, earth, and air. Ever since the days of the ancient Greeks, scientists have been searching for a unified theory of the universe. Now, for the first time in history, says physicist Paul Davies, we may have just that.

The breakthrough Davies is talking about posits a single force controlling all of nature—the "superforce" that could bring a universe into being and furnish it with energy, matter, and structure, and herald the universe's end.

In *Superforce,* his lucid account of physics' search for the ultimate truth, Davies takes us back to the founding of quantum mechanics in the early part of the century. He explains the notion of the big bang, describing how scientists like Alan Guth have begun to recreate time zero—the moment of creation itself. He details the desperate search for proton decay, a phenomenon that could prove the superforce theory true. And he presents the theory's most startling implication: that the universe has not three dimensions, but eleven, wrapping us in a geometry we can never perceive.

According to Davies, verification of the superforce theory might mean the culmination of physical science itself. "With the superforce unleashed," he writes, "we could change the structure of space and time, build matter to order.... We might even begin to manipulate the dimensionality of space itself, creating bizarre artificial worlds with unimaginable properties."

Pamela Weintraub is a senior editor at "Omni" magazine.

IN AN UPCOMING ISSUE:
THE BEST OF THE SUMMER PAPERBACKS.