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## No Light at the End of the Test Tube

By ANN FINKBEINER

Science has a cure for wishful thinking. It goes like this: You have an elegant idea, you do the experiment, it seems to work. Colleagues and competitors repeat or refine your experiment,

and now it doesn't work. You really want it to work so you do it again, differently, and then so do they, and it still doesn't work. After enough of this, and sometimes years of it, you admit it doesn't work and everybody quits.

But sometimes wishful thinking is incurable: the poster child is nuclear fusion, the subject of Charles Seife's substantive and lively new book, "Sun in a Bottle." Fusion — the process by which hydrogen bombs explode and stars shine — could potentially mine cheap, limitless energy from atomic nuclei, but after decades of experiments and numberless careers, it still doesn't work and still nobody quits. "There's something about fusion that is a little different," Seife writes, "that makes generation after generation of scientists deceive themselves."

Fusion occurs only in charged gases at extraordinary temperatures and pressures that happen in bombs only for fractional seconds and that only stars can maintain. Every time scientists try to confine a charged gas, and heat and compress it until its nuclei fuse, the gas squirts out of its confinement, cools off and generally declines to light our light bulbs.

Still, as Seife shows, fusion's grand promise has led to some dubious experiments. In 1989, Martin Fleischmann and Stanley Pons claimed to have achieved fusion at low temperatures (so-called cold fusion), effectively bottling a star on a table top. But no one else could repeat their results, and when the researchers wouldn't back off their claims, they were effectively excommunicated. In 2002, another team of scientists claimed that sound waves in liquid could create hot little bubbles that imploded and caused fusion. But this effort — recounted vividly by Seife, who originally covered it for Science magazine, which published the controversial paper — couldn't be repeated either and likewise ended in disgrace.

These experiments make good stories, but they occurred on fusion science's margins — something Seife doesn't make clear enough. Most fusion experiments are reputable and repeatable: they're real science. They're done by large international collaborations building machines that have been in the process of improvement since 1951 and have grown to more than 50 feet across, or by well-financed national teams

### SUN IN A BOTTLE

#### The Strange History of Fusion and the Science of Wishful Thinking

By Charles Seife

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using lasers powerful enough to be classified. But the state of the art is still what it has always been: fusion can't be sustained, and the energy released is less than the energy required to produce it in the first place. The decades-old mantra — “fusion is only 20 (or 30, or 50) years away” — remains wishful thinking at its best.

Seife writes with effortless clarity, taking readers through the complex physics and engineering. That means the reader can not only understand but, even better, evaluate Seife's message: fusion scientists should just cut bait. By analogy to your closet, if you haven't worn it, throw it out. If you've been trying it for the last half-century and it hasn't worked, then enough already.

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