exhibits were donated and jerry-built such that a foot-pedal lathe became an electricity generator, or a traffic light became an optics lesson. Events included the dissection of a pig's eye. Children played truant to hang out there, teenagers got high there because of all the perceptual stimulation and adults found it exotic and magical.

Cole writes of her own interactions with Frank. Even simple encounters such as eating a meal could turn into an adventure: he once fashioned a gyroscope for her "out of pats of butter and a bread plate to explain precession". The book strings together many vignettes of Frank in action. It does not matter that his ruminations on life are of uneven value and varying coherence — it captures important parts of the man.

Cole charts the encroaching bureaucratization of the Exploratorium, and the final weeks of Frank's life as he died of cancer. The touching death scene is disrupted when, to the horror of his wife and children, Frank's mistress arrives to profess her devotion — just one of several irruptions of libidinal chaos.

The vividness of this scene whets our appetite for more insight into the 'royal family' itself. Robert married an alcoholic and was himself an adulterer; his daughter committed suicide. In her book, Cole tells us little of Frank's children, not even when they were born. The Oppenheimer family, we suspect, has yet to reveal all of its dark sides. But by shunning a traditional biographical tapestry, Cole successfully, and at times movingly, limits her focus to Frank's infectious passion for science. ■

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Howard's end at Perimeter

First Principles: The Crazy Business of Doing Serious Science
by Howard Burton
Key Porter Books: 2009. 288 pp.
Can$24.95

The goal of *First Principles* is good: Howard Burton, founding director of the Perimeter Institute for Theoretical Physics, relates the setting up of the institute in Waterloo, Ontario, Canada, following a donation exceeding Can$100 million by Mike Lazaridis, creator of the BlackBerry, in 1999. But the book's self-congratulatory tone is a major snag. As reality increasingly conflicts with hype, Burton's account evolves into a sad tale.

The institute's aim was to "make waves, big waves", and it got off to a promising start. Burton — a youthful outsider who had only just finished his physics PhD — went about his job with maverick flair, challenging the scientific establishment, attacking its tribalism and allergy to innovation. Here was an opportunity to do things differently: to promote originality, to flatten hierarchy and empower the young researchers actively driving the field. It sounded utopian, but it was worth a try.

Unfortunately, reality failed to comply with Burton's plan. The best days of this haven of free-thinking came while it was still a 'theoretical' theoretical physics institute — before the scientists arrived. The anecdotes Burton narrates in the chapter 'The Trouble with Physicists' ring hilariously true. But there was also a fatal flaw in Perimeter's concept — scientists tend to define 'originality' as what they personally do. Soon the institute's quest for novelty became hijacked by the agendas of the field's usual culprits, and Burton himself came under attack from them.

"You don't go into the woods to find a lumberjack to run a scientific institute," one senior Canadian physicist jibed, commenting on Burton's past as a 'failed' physicist. "Why did he hire all those losers?" asked another when faced with Burton's first batch of appointments. In some circles Perimeter became known as the 'institute of lost causes' in response to Burton's promotion of off-the-beaten-track research, and he and his staff were called cranks.

PERIMETER INSTITUTE

Howard Burton outside the Perimeter Institute.

Given Burton's intent of "poking the establishment in the eye", he might have expected some abuse. But in such cases the best strategy is to stick to one's guns. Alas, Burton is not so thick-skinned. He reveals himself as the insecure country cousin awed by the sophistication of established scientists and their fancy dinner parties. He swayed towards them, minutely measuring the distance between the riverbanks lest he offend the mainstream. Burton tried to replicate the US establishment in Canada, but he was often outbid and exploited by opportunists who used Perimeter as a trampoline to boost their US careers.

By the time Perimeter matured, five years later, the divide between the quixotic first hires and the new wave was painfully evident. The openness of the early days was replaced by Princeton-style hush-hush and invitation-only meetings. The idealists openly confessed that they wished they could find another benefactor, to "start anew and this time do it right". Something had gone wrong: the sought utopia had become a dystopia.

Scientific originality has become big business: being anti-establishment sounds great. Yet few want to take the risks necessary to achieve it. Originality is encouraged in public pronouncements only to be punished when practical decisions are made. Perhaps Perimeter's tale proves that there is no recipe for original science: it happens anarchically and by accident, in spite of, rather than because of, scientific institutions.

Burton had his heart in the right place at the outset and we should have some sympathy for him. And Perimeter was a success on many fronts: the building is gorgeous, its bistro is outstanding, the administrative staff enlightened. But the institute has failed to attract good students; its outreach activities have become uninspired; its rebellious streak is now all but gone. Our sympathy for the director dissipates when he fails to shoulder any blame. Add to this the book's purple prose and weak iconoclasm and *First Principles* is bound to irritate as much as disappoint.

Eventually Perimeter became a scientific institute just like any other. In 2007, Burton left. ■

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