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In the 1970s, Jack Sarfatti, Saul-Paul Sirag, Fred Alan Wolf and others in the Fundamental Fysiks Group opened up discussions of quantum mechanics.

PHYSICS

Quantum outsiders

Hugh Gusterson enjoys a history of the quirky group that pursued quantum physics when it was unfashionable.

It is hard to write a book about quantum mechanics that is at once intellectually serious and a page-turner. But David Kaiser succeeds in his account of a neglected but important group of physicists who brought together quantum mechanics, Eastern religion, parapsychology and the hallucinogen LSD.

Kaiser, a historian of science at the Massachusetts Institute of Technology in Cambridge, seeks to understand why a set of mind-bending ideas developed in the 1920s and 1930s by European physicists — including Werner Heisenberg, Niels Bohr, Max Born and Wolfgang Pauli — were largely barred from discussion in mainstream US physics after the Second World War. At the heart of quantum mechanics lie these challenging ideas: that electrons behave like waves and particles; that one can know a particle's precise location or momentum but not both; that the act of observing a particle changes its behaviour; and that particles seem to communicate with one another across great distances — the phenomena of nonlocality and entanglement that Albert Einstein derided as “spooky action at a distance”.

These radical concepts led to the field of quantum information science and the

emergence of ultra-secure technologies, based on quantum encryption, for transferring money or electronic votes. Such concepts were also, in ways that Kaiser does not explore, influential beyond physics. Their critique of reductionism and emphasis on the effects of observers led to the rise of ‘post-structuralist’ thinking in the humanities. But during the cold war, the profound philosophical issues raised by quantum mechanics were seen by many in physics as an unnecessary distraction.

Tracing shifts in university lecture notes and textbooks after the Second World War, Kaiser argues that the fundamental strangeness of quantum reality was drained out of academic physics by the “high-throughput pedagogy” that accompanied a sixfold increase in PhD student numbers. Pressure to produce gadgets to change the course of

the cold war left little time for philosophizing.

This meant that some of the key work in quantum mechanics in the 1970s and 1980s was done by a motley crew of young physicists, who worked largely outside universities and published in obscure journals such as *Epistemological Letters* — “a hand-typed, mimeographed newsletter”. They included Elizabeth Rauscher, Jack Sarfatti, Fred Alan Wolf, Saul-Paul Sirag, John Clauser and Fritjof Capra. The centre of their intellectual universe was the San Francisco Bay area. Many were associated with the Fundamental Fysiks Group, an open discussion group about quantum mechanics that started meeting in 1975 at the Lawrence Berkeley Laboratory in California.

Unable to secure professorships in the shrunken job market of the time, some of the group lived on the edge of destitution. The luckiest was Fritjof Capra, whose book *The Tao of Physics* (Wildwood House, 1975) was translated into 23 languages and brought him financial security. Other Fysiks members cobbled together eccentric funding sources: George Weissmann founded a company selling a Tibetan herbal remedy until the US Food and Drug Administration banned his product. And others secured funding through the Pentagon to see whether quantum mechanics might explain the apparent spoon-bending abilities of psychics such as Uri Geller and to investigate telepathy.

Three New Age guru-entrepreneurs were even more colourful. Werner Erhard, founder of the Est movement for self-transformation, sponsored opulent



How the Hippies Saved Physics: Science, Counterculture, and the Quantum Revival

DAVID KAISER
W. W. Norton: 2011.
372 pp. \$26.95,
£19.99

[NATURE.COM](https://www.nature.com)
David Kaiser on
university funding:
go.nature.com/oflvik

conferences on quantum mechanics at his San Francisco mansion. Members of the Fundamental Fysics Group rubbed shoulders with Nobel laureates until the arrangement with Erhard fell apart in the face of growing concerns that Est was a cult. Michael Murphy, founder of the Esalen retreat on the California coast, sponsored workshops at which physicists alternated their hot-tub discussions of quantum mechanics with massages and, in some cases, LSD trips.

A third New Age activist and impresario, Ira Einhorn, somehow persuaded senior executives at Bell Telephone that the company should copy and mail the latest papers on quantum mechanics to some 300 people — an early postal version of an e-mail distribution list. This arrangement came to an abrupt end when the police discovered the decomposing body of Einhorn's girlfriend in a trunk in his apartment.

Interspersing entertaining anecdotes with explanations of concepts in quantum physics, Kaiser's book can be read on many levels. At its most challenging, it is an intellectual history of quantum mechanics. But it is also a yarn about an eccentric group of physicists who refused to be defeated by their marginalization within their own discipline. And, as social history, it offers a window onto one of the most colourful periods of twentieth-century US history.

The book makes important observations about the social dynamics of physics in the United States during the cold war. Kaiser argues that, even as military patronage pumped massive financial resources into physics, the discipline's horizons shrank. University physicists disdained the philosophical questions that had enlivened pre-war European physics and developed a narrowly instrumentalist pedagogy that sometimes became a straitjacket.

Kaiser describes some students holding secret meetings to discuss quantum mechanics behind their advisers' backs, having been warned that "thinking seriously about foundations was a waste of time and a detriment to one's career". He also notes that the editor of *Physical Review* banned articles discussing interpretations of quantum mechanics; a brilliant experiment on Bell's theorem by John Clauser was scarcely cited because of the prevailing orthodoxy. Clauser was told that his experiment was not "real physics", and he had a terrible time on the job market. By contrast, the heroes of Kaiser's story "strove to expand the physics profession's collective mental space". This is an equally apt description of Kaiser's approach in this illuminating book. ■

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EVOLUTION

The long trek to domesticated bliss

Our fondness for fauna comes from an evolved human need to nurture, argues **Juliet Clutton-Brock**.

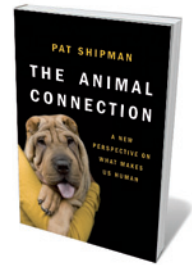
In *The Animal Connection*, palaeo-anthropologist Pat Shipman describes how humans have been connected with animals for the past 2.6 million years, and how this relationship distinguishes us from other animals. She argues that the evolution of human behaviour was driven by this connection in three stages: toolmaking, language and domestication of animals and plants. But Shipman's book is more a review of what has long been known than the "New Perspective" promised by its subtitle.

Shipman starts by outlining the characteristics that separate the fossil hominin *Ardipithecus ramidus* — found in Ethiopia and dated to around 4.2 million years ago — from other primates. Continuing on through the australopithecines, she describes how, from 2.6 million years ago, "Hominids transformed rocks into stone tools and stone tools transformed hominids from bipedal apes that are [*sic*] basically herbivorous into predators". This was the beginning of the animal connection, accompanying the evolution of *Homo erectus* and its expansion out of Africa.

Shipman goes on to discuss the

evolution of human language, the origin of symbolism and the theory of mind. She proposes that language followed from the need for humans to communicate animal-related information in their quest for food. Language "allowed humans to talk about animals and in time, with animals", she says.

Towards the end of the Pleistocene, around 32,000 years ago, came the first domestic dogs. The cultivation of plants and the domestication of livestock in many parts of the world followed in the early Holocene. Shipman describes what is known about this process, including arguments around the outdated view that the primary motive for domestication was the provision of meat. She also explores 'self-domestication' — the theory that, from



The Animal Connection: A New Perspective on What Makes us Human

PAT SHIPMAN
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Domesticated 32,000 years ago, dogs remain central to many societies, including the Inuit.

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