

to commercial exploitation to the author — something that is traditionally anathema to the free-software movement.

Lessig approves of sharing activities that fall beneath a corporate umbrella, as long as they are in touch with their volunteer communities, and he sketches what can make them work. In one quietly controversial paragraph, he advocates that the current allocation of copyright infringement liability in these situations should be reversed. For example, YouTube ought to answer more for the copyright infringement of its users because it profits from such transgressions, whereas the infringing users should be protected because their activities amount to non-commercial sharing.

Successful hybrid enterprises abound. Yahoo! Answers is a web-based service to which people post questions and others answer them for payment in the form of non-monetary points. Interestingly, the similar service Google Answers sought to pay contributors outright, and it folded. One wonders what would have happened in the late 1990s if Microsoft's Encarta encyclopaedia had started paying for corrections and improvements from the world at large — would users of the nascent Wikipedia have felt they were doing for free what otherwise ought to be charged? Other hybrid phenomena — such as the classified-advertising network Craigslist, wiki-hosting service Wikia and even Google itself — will soon find themselves competing not only with pure community enterprises such as Wikipedia, but also with a new set of mercenary but distributed services. These include InnoCentive, which awards bounties to those who can solve particular problems, usually in exchange for transferring all rights to the solutions to those paying for them; Amazon's Mechanical Turk, a marketplace for people to do mind-numbing work that still only a human can do; and LiveOps, a 'virtual call centre' that creates communities of independent contractors, each in their own homes, who might take pizza orders one moment and staff a hotline for hurricane survivors the next.

Ultimately, Lessig seeks to shed his copyright-fighter's reputation, acquired in part through his challenge — for which I was a co-counsel — to the Sonny Bono Copyright Term Extension Act in the United States. The case was lost in 2003 at the US Supreme Court by a majority of 7–2. Lessig's goal is not to overthrow the current system so much as to temper its short-sighted excesses and to give a little something to everyone. *Remix* is dedicated both to L. Ray Patterson, a copyright historian who would no doubt have agreed with Lessig's prescriptions for copyright reform, and to Jack Valenti, the late president of the Motion Picture Association

of America. Lessig and Valenti debated several times, and agreed on nothing except the observation that our children's values are out of touch with read-only culture and the law that tilts so far in its favour. Lessig hopes to appeal to the Sousa within Valenti's successor and partners, yet as the founder of modern cyberlaw, he has a more ambitious agenda: dealing with what he sees as a more general corruption of the democratic political system originally intended to save us from our economic, legal and cultural

ruts. Perhaps Lessig's smaller battle is being won: in late December it was reported that the RIAA was abandoning new lawsuits against individual file sharers. But Joel Tenenbaum's trial continues. ■

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Fusion history beyond the fiascos

Sun in a Bottle: The Strange History of Fusion and the Science of Wishful Thinking

by Charles Seife

Viking: 2008. 304 pp. \$25.95

It is 50 years since the first international symposium on fusion energy research took place in Geneva, Switzerland, as part of the second United Nations 'Atoms for Peace' conference. There, the United Kingdom, the Soviet Union and the United States announced the declassification of controlled fusion research, raising the hope of clean and limitless energy for mankind.

In his new history of fusion research, journalist Charles Seife argues that such grand hopes push researchers to make unjustified claims of major advances. But in pursuing the controversies generated by a few isolated individuals, *Sun in a Bottle* neglects the more important story of the wider fusion community.

At the first Atoms for Peace conference in 1955, its chairman Homi Bhabha said: "I venture to predict that a method will be found for liberating fusion energy in a controlled manner within the next two decades." But the proceedings of the second conference in 1958 remind us that the scientific leaders of the main delegations were much less optimistic. Edward Teller from the United States said that the state of controlled fusion was "similar to the stage at which flying was about 100 years ago", and that the technical difficulties of fusion "are likely to make the released energy so costly that an economic exploitation of controlled thermonuclear reactions may not turn out to be possible before the end of the twentieth century". Similarly, reviewing work in the Soviet Union, Lev Artsimovich stressed that "world-wide collaboration is needed for progress".

Soon after, a network of collaborations under

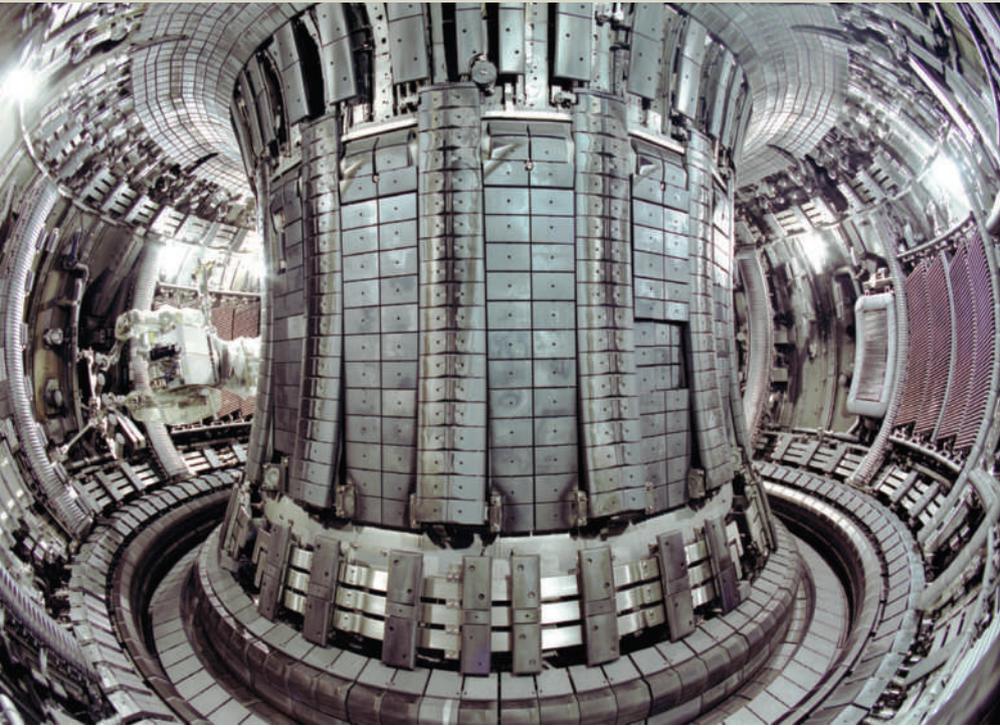
the auspices of the International Atomic Energy Agency, the International Energy Agency and Euratom (the European atomic-energy community) was established in the domain of magnetic fusion. Results were openly shared and, two decades later, a major European facility, the Joint European Torus (JET), was constructed at Culham, UK. Scientific progress since then has been impressive — the foundations of a new 'plasma science' have been established. We now have a fundamental understanding of the complex collective processes prevailing in the hot, electrically charged gases known as plasmas, and have made significant technological advances in magnets, materials and high-power electrical systems. Consequently, fusion machines have improved greatly in their performance, both in fusion power and plasma duration. The US Tokamak Fusion Test Reactor (TFTR) and its European competitor JET, both of which use deuterium and tritium fuels, demonstrated power exceeding 10 megawatts, but only for short periods set by the limits of the auxiliary systems, notably

the magnets. Other, smaller tokamaks and stellarator devices use superconducting magnets to confine the plasma and can be operated stably for much longer periods — 5 hours in the case of the Japanese tokamak TRIAM

1-M. Plasma science also provides industrial spin-offs. Plasmas are now common in low-consumption light bulbs, television screens and, through plasma processing, in nearly all electronic equipment.

Although JET and the TFTR have produced large amounts of power, these were less than the power consumed to heat the plasmas initially. A larger experiment, ITER — meaning 'the way' in Latin — was therefore designed with the aim of having a fusion power output that is ten times greater than the input power. ITER was originally designed by scientists

"Fusion scientists have not lived quiet lives."



Fusion force: inside the tokamak used to confine plasma at the Joint European Torus, Culham, UK.

EFDA JET

from Europe, Japan, Russia and the United States. Its dimensions were defined by scaling laws derived from data collected worldwide. In 2004 and 2005, these four partners were joined by China, South Korea and India. Soon after, the seven partners agreed to construct ITER at Cadarache in the south of France. The ITER international organization, which was established by treaty in 2006, is a collaboration of unprecedented scale. Its seven partners represent more than half of the world's population. The annual budget for ITER construction is about €0.5 billion (US\$0.7 billion). This may seem high, but it is a tiny investment compared with the annual worldwide cost of electricity, which stands at around €2 trillion based on the average cost per kilowatt hour in 2007 in the European Union.

The fiftieth anniversary of international fusion research was marked in October 2008 with many lectures on the history of fusion (see <http://fire.pppl.gov>), which showed that fusion scientists have not lived quiet lives during this time. Teller and Artsimovich were right — the physics and technology of fusion are challenging, but the fusion community can be proud of its progress.

Yet this community will not recognize its own history in Seife's book. As admitted in the title, it is a rather strange history. After relating at length the early years of fusion research, it concentrates disproportionately on two table-top fusion fiascos — cold fusion and bubble fusion — generated by isolated individuals.

The book leads without proof to the dubious conclusion that "Over and over again, desperate scientists have deceived themselves and their peers — and cheated — in hopes to keep their fusion quest alive". Yet it focuses on outsiders to the field, who thought they had made a

major discovery and who, after having been proven wrong when their results could not be repeated by others, did not have the courage to admit their errors. Thankfully, the book does not identify any scandal within magnetic fusion research, the main line for fusion energy. But as a result, it pays too little attention to this large international community. Whereas the dream of limitless energy may afflict isolated scientists, it is certainly not applicable to all

fusion researchers as the author suggests.

The book identifies correctly that peer review is a necessary prerequisite for preventing fiascos. Scientists who call on journalists to make announcements without having had the traditional discussions with colleagues followed by publication in a peer-reviewed journal are in danger of damaging their reputation. Yet peer review may not always be sufficient. In addition to internal reviewing, in the late 1980s JET set up an internal database on which its experimental data were made available. Researchers within the organization can easily cross-check a scientific claim made by their colleagues. An open, international, multidevice database followed in the early 1990s, which has proven to be a sound basis for progress in fusion research. Such a system protects scientists from the insidious distortion of reality that can be provoked when they remain too isolated. Maybe Seife himself is a victim of 'wishful thinking' and should have sought peer review before publishing such a strange thesis. ■

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Our culture of obsession

Obsession: A History

by Lennard J. Davis

University of Chicago Press: 2008. 296 pp.
\$27.50, £16

A battle for the public good has been waged for centuries between qualified doctors of medicine with formal training and their 'quack' counterparts. As scientific analysis has come to be accepted, we have demanded more evidence from our physicians. Despite a lingering love-affair with alternative medicines such as homeopathy, patient-consumers today expect more than snake oil and bedside charm. Into this market lands Lennard Davis's latest book, *Obsession*.

The stereotypical view of a scientist, which rings true of many, is of an obsessive individual working long hours, worrying about minutiae and trying to replicate experiments against an approaching deadline. Davis looks at this form of obsession and others. He discusses the mania of novel writing in the nineteenth century, when prolific authors such as Émile Zola

would write for days and nights at a time. The obsessive Zola became a subject of obsessive study by his contemporaries, and Davis guides us through the sociocultural evolution of the disease now known as obsessive-compulsive disorder. There are fascinating examples throughout the book, not least in his discussion of obsessive love and sex.

Davis tries to untangle the central question of what constitutes obsession. If I check my car doors are locked a couple of times before I leave it parked each morning, am I being obsessive? What about washing my hands repeatedly? Where is the line between obsession as a harmless fact of life, and when it becomes a mental illness? It is far from normal to wash one's hands so often one develops skin diseases, or to be unable to leave the house because of fears one has left the doors unlocked.

Obsession provides an insightful and nuanced review of the history of this tragic illness by exposing obsessive behaviour and contrasting it with the common, mildly obsessive behaviours we all engage in. The question of difference, and thus definition, is a recurring