

more, we can communicate more securely and efficiently if we pass quanta rather than bits over our networks.

These developments are admirably reviewed by the contributing authors to *Introduction to Quantum Computation and Information*. The book fills a gap between the turgid prose of the burgeoning research literature and the superficial accounts in the popular press.

Adriano Barenco lays out the basics of the factoring and searching quantum algorithms that captured the attention of much of the quantum-physics community. The first few chapters develop the basic language of quantum communication, and the unique features of the quantum state of separated quanta that we refer to as 'entanglement'. Michael Berry gives one of the most concise and correct definitions of quantum teleportation seen anywhere: "the dissolution of an object in one place in a way that enables it to be perfectly reconstituted elsewhere."

The theory of quantum cryptography and the extensive experiments and efforts at deployment in the field are also well surveyed. Other chapters deal with experimental efforts to implement quantum information processing in ion traps and in nuclear magnetic resonance spectroscopy.

Although the book's theoretical chapters will be useful for a long time, the experimental discussions may soon become obsolete in the face of entirely new approaches to quantum information processing, such as those provided by solid-state physics.

A striking feature of quantum information theory is that error correction is possible in quantum information processing. It was a great surprise that quantum error correction could be done even in principle, since the quantum phase is among the most fleeting, delicate and easily destroyed quantities in physics. The protocols that Andrew Steane and John Preskill helped to develop are not particularly simple or easy to understand, but their chapters are carefully constructed and very informative.

Preskill offers some of the most intriguing ideas in the book. There is a long-standing question of how the irreversible physics of black holes permits the quantum behaviour of our world to be apparently reversible to high precision. Preskill suggests that the true theory of gravity incorporates quantum error correction mechanisms that hide the irreversibility of gravity from our observations. If these ideas prove to be true, that most unphysical of quantities, pure information, may after all be capable of informing our understanding of the physical world in a most profound way. □

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## Science in culture



HULTON GETTY

### The Café Scientifique

[www.aesops.force9.co.uk/cs/index.htm](http://www.aesops.force9.co.uk/cs/index.htm)  
Duncan Dallas

The Café Scientifique started last May in Leeds. I happened to read the obituary of Marc Sautet, the founder of the French 'Cafés Philosophiques', where people meet to discuss philosophy in cafés on Sunday mornings. It occurred to me that the British would never take this up, as they don't take philosophy seriously enough, but they might be prepared to discuss science — a subject they respect.

So in a local wine bar, I advertised an evening "where, for the price of a cup of coffee or a glass of wine, anyone can come to discuss the scientific ideas and developments which are changing our lives". On the first evening, with a speaker on Darwinism, I had no idea whether the audience might consist only of myself and a few friends.

In the event, between 40 and 50 people turned up, virtually the capacity of the café, and this has been the average size of the audience since then. There are a few regulars, but many new faces appear each week. We meet fortnightly, and invite a speaker to talk for about half an hour. Then there is a break to replenish our glasses, followed by questions and answers for an hour. Interest has been such that another Café Scientifique has been set up in Nottingham, with a further one planned for Newcastle.

Nowadays it appears necessary to fund university chairs to study how to make the public understand science. So why has this format worked so well?

There is no agenda, hidden or overt, to defend or sell science. If people don't like what they hear, they object forcefully. The subjects, or speakers, are picked because they are what people want to hear and they are often controversial. The audience sets the agenda, not the scientists. Not surprisingly, the biosciences feature heavily, but the café has also tackled chemistry, physics, maths and IT. The venue, a café-bar, is where the audience feel comfortable. The atmosphere is friendly and convivial, rather than academic and competitive. This is not a 'self-improving' audience, in the way that Victorian scientific societies arose. People don't just want to listen. They want to participate and be heard on equal terms with the scientists.

Science discovers café society, once the domain of poets and writers.

It is also, as it turns out, an income-generating idea for the wine bar, so there are no start-up or organizational costs. Indeed, we pay the speakers' expenses by passing a hat, 'le chapeau scientifique', round the audience. Since the Café Scientifique works in a suburb of Leeds (not even the university suburb), it could work anywhere.

Although I didn't know it, at around the same time in France, other Cafés Scientifiques were appearing, no doubt also inspired by the *Cafés Philosophiques*, so it looks as though it is an idea of its time, possibly even a movement.

There may well be something of interest happening here, something of real importance to science, and I use an analogy from medicine. In the late 1970s, medicine was a successful, authoritarian profession, rather like much science today. By and large, patients gratefully accepted any treatment from doctors. During the 1980s all of this changed — the fitness movement started, alternative medicine became established, funding crises proliferated, AIDS became a problem, self-help groups and ethics committees grew up, anxiolytic drugs were found to be addictive, and so on. Today, medicine is a battleground of politics, economics and philosophy. This has not stopped the progress of orthodox medicine, but doctors now work in a very different environment, subject to different constraints and conditions.

Since the end of the Cold War, science has come to the centre of the agenda in environmental politics (global warming), economics (BSE), consumer choice (GMOs) and medicine (genetics).

Under these circumstances science can no longer be taken on its own terms. Many new ways of addressing science will be invented, not all of them rational or favourable. The Café Scientifique is just a harmless straw in what might become a cold wind. What is critical is that scientists don't repeat the early mistakes made by doctors, who often buried their heads in the sand and hoped the new attitudes would go away. Scientists can no longer define the terms of the debates about science. □

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