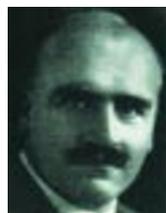


match the fluidity of human thought. This gives him the opportunity of writing with great clarity on logic and its useful but limited role in computation. Devlin concludes that a 'soft' form of mathematics might do the trick. Unfortunately we never find out much about it: as Devlin himself admits, he is only hoping this might be so.

Despite the qualities of these books, they may be too ready to accept the lack of progress on the 'thinking machine' question posed by Turing more than 60 years ago. Are



Haldane.

the hurdles better understood now? The first barrier to progress comes from the word 'machine' in the context of 'thinking'. It is generally assumed that such a machine would be a conventional computer which, when given an appropriate program, would behave in a way akin to a thinking human. Unfortunately much of the argument comes to a halt with the functional emptiness of this model: the computer itself does nothing; some programmer must work out every step of what the machine is to do.



Schrödinger.

By contrast, the brain is clearly a functional machine of a kind, as it does not rely on anything like a program. It is beautifully structured to be driven by both evolved structure and learned function, neither of which may be available to a programmer. Understanding how this mechanism contributes to the experience of sensation and thought is top of the current agenda.

It helps that evolution and learning can be modelled and analysed in an appropriate artificial domain: that of neural systems. Parallelism, adaptation and modularity are needed to make real machines work in emergent, seemingly intelligent ways. Models need these self-organizing features. That the modelling is often done on a conventional computer is a red herring; the appropriateness of the model is important, not its box.



Turing.

Another hurdle is the assumption that thinking machines will work by performing endless manipulations of simple symbols at ever-increasing speeds. The symbols of a neural machine, whether real or artificial, are neural firing patterns which are wonderfully extravagant, rich, diverse and sufficiently expressive to be capable of directly supporting subtle sensations that could distinguish between the thought of a good Burgundy and plonk, or between loving and liking. The

notion of the brain as a manipulator of parsimonious symbols or, indeed, as some kind of data-processing machine is a customary but sterile starting point for a science of the mechanics of thought.

Although both Casti and Devlin hint at the possibility of evolving and adaptive machines, they largely avoid the topic. Perhaps they do not wish to offend the many who, over the past half century, have believed in the supremacy of an empty computing box that begs for someone to tell it what thinking is. □

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Change of mind

Molecules of Emotion: Why You Feel the Way You Feel

by Candace B. Pert
Scribner: 1997. Pp. 368. \$25

Samuel H. Barondes

In 1970 Candace Pert was admitted to Johns Hopkins University as a graduate student in pharmacology, and soon began doctoral research in the laboratory of Solomon Snyder. By autumn 1972 she had helped to develop the first practical binding assay for opiate receptors in brain homogenates, and this became the basis for studying the

interaction of these receptors with drugs and natural ligands.

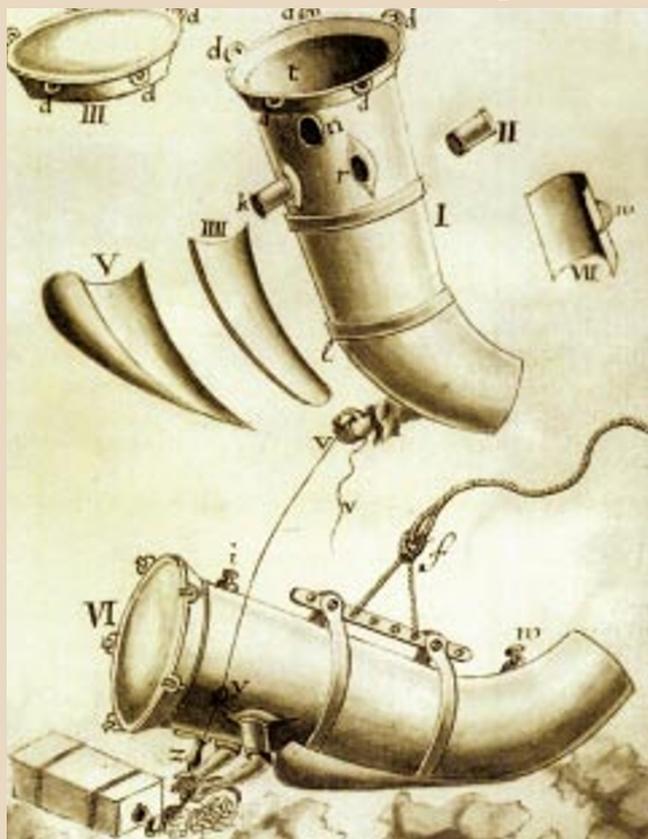
Three years later her work with Snyder had earned her an independent position at the "Palace" (her name for the National Institutes of Health in Bethesda, Maryland), where she remained until 1987, publishing more than 200 scientific papers, many of which were very widely cited.

In 1978 Pert faced a great personal crisis when she learned that Snyder would receive the Lasker Award for work on opiate receptors, along with John Hughes and Hans Kosterlitz, who had determined the structures of two endogenous opiate peptides, the enkephalins. Believing she should have been included among the winners, Pert made a formal protest that became public and was recounted in many places, including Robert Kanigel's *Apprentice to Genius* (1986) and Jeff Goldberg's *Anatomy of a Scientific Discovery* (1988). Now, in *Molecules of Emotion*, Pert retells the story from her point of view, and lets us know what she has been doing since then.

Despite its subtitle, this book is essentially a memoir. Interspersed throughout the first half are some discussions about neuro-peptides (Pert's "molecules of emotion"), though even the endogenous opiate peptides are considered in only a cursory way, and there is no mention of a multitude of discoveries about the structure and biology of opiate receptors that followed from Pert's

Hidden depths of underwater salvage

Captain Jacob Rowe's patented diving engine was the highlight of a remarkable salvage operation to recover 17 chests of specie from the Dutch East Indiaman *Adelaar*, wrecked off Barra in the Outer Hebrides, Scotland, in 1728. The machine could be used — albeit with great discomfort — at depths of up to 18 metres. The *Encyclopedia of Underwater and Maritime Archaeology* edited by James P. Delgado (Yale University Press, \$55) is a treasure-trove of information about the submerged past. Its 500 pages describe sites around the world, the techniques and tools of underwater archaeologists, ethical and legal aspects, and important institutions and individuals.



seminal work.

Molecules of Emotion is mostly about Pert's life in science, which she often discusses with startling candour. She recounts, for example, how, late in 1975, she and a collaborator betrayed a confidence by obtaining the then unpublished structure of enkephalin "from a secret source", made the synthetic peptide, and showed that it had an analgesic effect when injected in the brain, aiming "to get it printed as close on the heels of Hughes's paper as possible". With remarkable openness she traces her hunt for a treatment for AIDS to a voice she heard in 1985 "echoing inside my own head! It was a strong male voice that commanded: 'You should do this!'".

Following "the direction [that] had been dictated by a voice in my head while I stood at a podium in Maui", Pert enlisted others to help her to design peptides that might block the attachment of an HIV envelope protein to a receptor on T cells using a receptor-binding assay.

She quickly found a synthetic peptide — peptide T (for threonine) — that seemed to work. It so interested the "Second Biggest Drug Company on the Planet" that its representatives persuaded her to give up her tenured position at the National Institutes of Health for a new laboratory they built for her, called "Peptide Design". But in little more than a year their support for this laboratory was terminated, and "Peptide Design became Peptide Demise".

Devastated by this turn of events, and disheartened by the hostility with which her work on peptide T was received by others studying HIV, Pert decided to withdraw from the intensely competitive arena of science, and to devote herself to the "new modalities of personal healing". She was soon "earning a reputation... as a 'body-mind' scientist", and the warm welcome she received when she spoke at the 1991 meeting of the American Association of Holistic Medicine made her "feel totally at home with the new-paradigm crowd".

Towards the end of the book she offers opinions and advice based on what she has learned about holistic medicine, in a section called "Lifestyles of the Healthy, Whole and Conscious: an Eight-Part Program". There is also an appendix: "Prevention-Oriented Tips for Healthful, Blissful Living".

This is not a run-of-the-mill autobiography of a scientist. As Pert says at the outset: "Perhaps my journey, intellectual as well as spiritual, can help other people on their paths". *Molecules of Emotion* can certainly serve that purpose, but the lessons drawn from it by many readers may be rather different from those drawn by Pert herself. □

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Worried to death?

Culture of Fear

by Frank Furedi

Cassell: 1997. Pp. 224. £45, \$70 (hbk); £11.99, \$19.95 (pbk)

Haunted Housing: How Toxic Scare Stories Are Spooking the Public Out of House and Home

by Cassandra Chrones Moore

Cato Institute: 1997. Pp. 274. \$21.95 (hbk); \$11.95 (pbk)

John Galloway

"All life," Sam the Gonoph concluded in *A Nice Price* by Damon Runyon, "is six to five against". Of course, in the end we will all be dead. However, in the meantime we would like the odds stacked as much as possible in our favour. The authorities do their best by making, or trying to make, us anxious.

These two books attempt to describe what happens when the "anxiety promoting" machinery takes on a life of its own. But their styles and standpoints are very different. In *Culture of Fear*, Frank Furedi's thesis is that anxiety has become the defining spirit of the age. The *Zeitgeist* fastens itself to any natural disaster, accident, technological development, research finding or crime. No matter how slight a risk is involved or how few people are affected, it turns them into causes. This brings them into the realm of public policy and, worse, to the attention of do-gooders and bureaucratic busybodies.

The book's theme ambitiously suggests that the traditional moral forces in society are being replaced by ethical codes based on, or masquerading as, safety. And finally, a reluctance to take risks leads to the blunting of ambition. A fear of falling kills the desire to climb. It is an interesting although overstated idea, and is rhetorical where it should be analytical.

For instance, Furedi seems angered by the fact that small events use up more of people's emotional energy than large ones that are to him at least more worthy. A single teenage death from the drug Ecstasy matters more to us than the 100,000 deaths in the United Kingdom each year from tobacco-related illnesses, or an outbreak of Ebola virus counts more than pandemic diarrhoea.

Scientists traditionally find this incomprehensible and call for the public to be better educated about the statistics of risk. Playwrights and novelists, of course, understand it perfectly well as the essence of dramatic art. Certainly we in Britain prefer theatre to science. Look at our institutions, parliament, the monarchy, courts of law: all pure theatre. How else can you account for the BSE/CJD phenomenon? A disease affecting a handful of people has led to the decimation of a major industry and international

squabbling, based on evidence that is comprehensible to virtually no one.

All this begs the question of whether the public are really consumed with anxiety about the state of the world. Or are we merely entertained by the passing show, experiencing emotion briefly and superficially? Public concern is often a creation of the media. Good news is no news. Are we really worried about issues unless they have a direct impact on us? Jane Austen said it all about the Battle of Waterloo: "How dreadful that so many poor fellows have been killed and what a blessing one cares for none of them."

In this respect it has been said that the success of one British newspaper can be ascribed to its ability to relate any story anywhere in the world to its effect on the price of your house. This is Cassandra Chrones Moore's tactic in *Haunted Housing*, in which she chooses a series of scare stories connected with health — asbestos, radon, lead and electromagnetic fields — which make the buying and selling of houses more difficult and sometimes impossible. She uses this as a device to explore the interplay between the science, politics and economics of these public health issues and as a stick to beat the US regulatory agencies, such as the Environmental Protection Agency, for their failure to deploy rational evidence-based policies.

Haunted Housing is both scholarly — well researched and argued — and well written. One of the insights it provides is an answer to the question of how scientists know how great is the health risk in our homes. The author puts forward a convincing case that they do not, exposing the difficulties in extrapolating from one set of circumstances to another, and shows the folly of using such extrapolations as any more than the most tentative basis for public policy.

An underlying theme in both books is that science is always telling us more than we want to know, and less than we need to know to take effective action. Richard Feynman's remark that science does not come with instructions about how to use it has never been more apt. Science has lit the fuse for the information explosion, which often prevents rational argument because it becomes impossible, even for experts, to be entirely certain of their subject.

One of Furedi's lines of argument is presumably that we have given up the certainty of faith for the uncertainty of science. As a counter, Moore points out the folly of faith in scientific findings that do not warrant it. Governments and their agencies are in the same psychological bind as parents over-anxious to protect their children from the pitfalls of life rather than letting them find out for themselves. The only thing worse politically than doing something is doing nothing. □

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