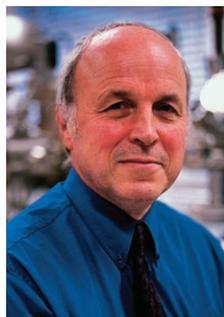


MAGNETISM AND MESMERISM



David Vaughan

Magnetism, the subject of this issue of *Elements*, was probably the first 'invisible' physical force to be investigated by humankind (with the obvious exception of gravity). Indeed it was the subject of the first major scientific treatise written in the English-speaking world (*De Magnete*, by William Gilbert, published in 1600). From the ancients' use of lodestone in the first

primitive compass to modern industrial applications in electronics and computing, magnetism is a force which has fascinated and, at times, bemused those seeking to understand it. Although the essential principles and laws of electromagnetism were laid down in the 19th century and their application made a major contribution to the industrial revolution, a unified theory embracing the electromagnetic, gravitational, and weak and strong nuclear forces continues to elude physicists. Such a theory remains the holy grail for theoreticians.

The role played by magnetism in many branches of science – not least in the geosciences – has been extraordinarily important. It was the magnetic record held in the rocks of the ocean floor that provided the key evidence for sea floor spreading and continental drift, and it was the subsequent use of palaeomagnetic data to reconstruct the movement of the rocks of the Earth's crust that led to the development of plate tectonics. As the articles in this issue eloquently attest, the magnetism of minerals, rocks and bio-mineral materials continues to produce surprises that challenge existing theories.

The history of research on magnetism is itself a fascinating subject and one from which lessons can be drawn. In the late 1700s, it was widely believed that magnetism could be used to cure illness. Although there were many practitioners, the person most associated with this idea was Franz Anton Mesmer, who claimed that harnessing invisible streams of magnetic fluid passing through the body, what he termed 'animal magnetism', was the basis of a revolutionary new medicine. The early forms of treatment involved strapping magnets to diseased parts of the body, or having patients spend time in a room with, at its centre, a large oval oak tub filled with magnets and iron filings. Later, in more refined versions, the magnetic equipment was dispensed with and the magnetic operator ('therapist' in today's terminology) would gaze intently into the eyes of the patient whilst passing his hands over the affected parts of the body to control the 'magnetic effluvia' circulating between him and the patient. Most of Mesmer's patients were wealthy women who would swoon or pass into a trance-like state in

response to what became known as 'mesmerism' (effectively a precursor of modern hypnotism). Naturally, these treatments were associated with the charging of substantial fees, and small fortunes were made by those offering such treatments.

The approach of the scientist to claims of the kind made by Mesmer is to conduct an open-minded investigation. Much to the credit of Mesmer's contemporaries, exactly this was done by a royal committee, chaired by the then elderly and distinguished statesman and scientist Benjamin Franklin. This committee included amongst its members Antoine Lavoisier and Joseph Guillotin, whose invention was used in the execution of Lavoisier only ten years later. Reporting in 1784, the committee found that magnets have no curative effects and that Mesmer's claims were without basis. Such rationality should be at the heart of our approach today, but recent decades have seen a troubling return to widespread acceptance of the efficacy of 'alternative' therapies, many of which seem based on no more than superstition. Ironically, this also includes magnet therapies, which closely resemble those discredited in the eighteenth century; the modern magnetic therapy

industry reportedly has sales totaling many millions of dollars in the United States alone. This is an example of a gross misunderstanding of the value of science and reflects a modern trend towards challenging the scientific approach to an understanding of the natural world. There are other examples, the best known of which is the equating of creationism with Darwinian evolution by natural selection. There is even the belief that scientists are collectively involved in grand conspiracies, perhaps best exemplified by the ludicrous notion that the Apollo Moon landings were an elaborate hoax.

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If individuals wish to explore alternatives to conventional medicine, they should certainly be entitled to do so, and we should not close our minds to the unexpected or even the miraculous. But caution should be exercised where public funding of medical services is concerned, and vulnerable individuals, like Mesmer's patients, should not be misled by baseless claims. The development of nuclear magnetic resonance spectroscopy enabling imaging of internal human organs ('MRI scans') – now a key aid to medical diagnosis – would have been seen as 'miraculous magnetism' by the patients of Mesmer, and that is surely miracle enough for us all.

David J. Vaughan¹
david.vaughan@manchester.ac.uk

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490, rue de la Couronne
Québec (Québec) G1K 9A9 Canada
Tel.: 418-654-2606
Fax: 418-653-0777

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