# Introduction

On 15 October 1919, that venerable institution of British comic journalism, *Punch*, turned the focus of its regular commentaries on leading personalities of the day to Oliver Lodge, the ageing British physicist who had recently retired as Principal of Birmingham University. For "many years", the anonymous contributor explained, Lodge had

> harboured the ambition of achieving distinction as a serious man of science, and was so far successful that he attained to the position of the President of the British Association. It was only comparatively late in life that he discovered that the word Physics (a science to which he had devoted so many years of patient research) by a slight rearrangement of the letters composing it and the addition of another "c", could be resolved into Psychics; and transferred his attention to a more congenial field of study.[1]

*Punch* had, of course, deliberately misrepresented Lodge for satirical effect. He had not "transferred" to "Psychics" – the study of psychic or psychical phenomena – simply because the word closely resembled physics; the transfer had begun much earlier in his scientific career; and it had neither been complete nor always "congenial". Yet some aspects of *Punch*'s portrait were closer to the truth. Lodge had indeed achieved scientific "distinction", and not simply as president of a major British scientific institution (the British Association for the Advancement of Science) but as someone boasting a long career in scientific research, teaching and popularisation. Much of his scientific research and writing had explored the possible connections between what, in his later years, he termed "physics and psychics".[2] For decades he had been developing arguments that physics had the concepts, theories and practices that could illuminate the baffling psycho-physical phenomena of psychical research, and that such phenomena offered potentially fruitful directions

[1] [Anon.], 'Second Thoughts', *Punch*, vol. 157 (1919), p. 333. Throughout the main body of the text, I have used double quotation marks for quoted text and single quotation marks around words or phrases whose problematic nature I wish to emphasise.

[2] See, for example, Oliver Lodge, *Beyond Physics or the Idealisation of Mechanism* (London: George Allen & Unwin, 1930), pp. 19 and 114.

in which the scope of physics could be extended beyond its formal domains of matter and energy.

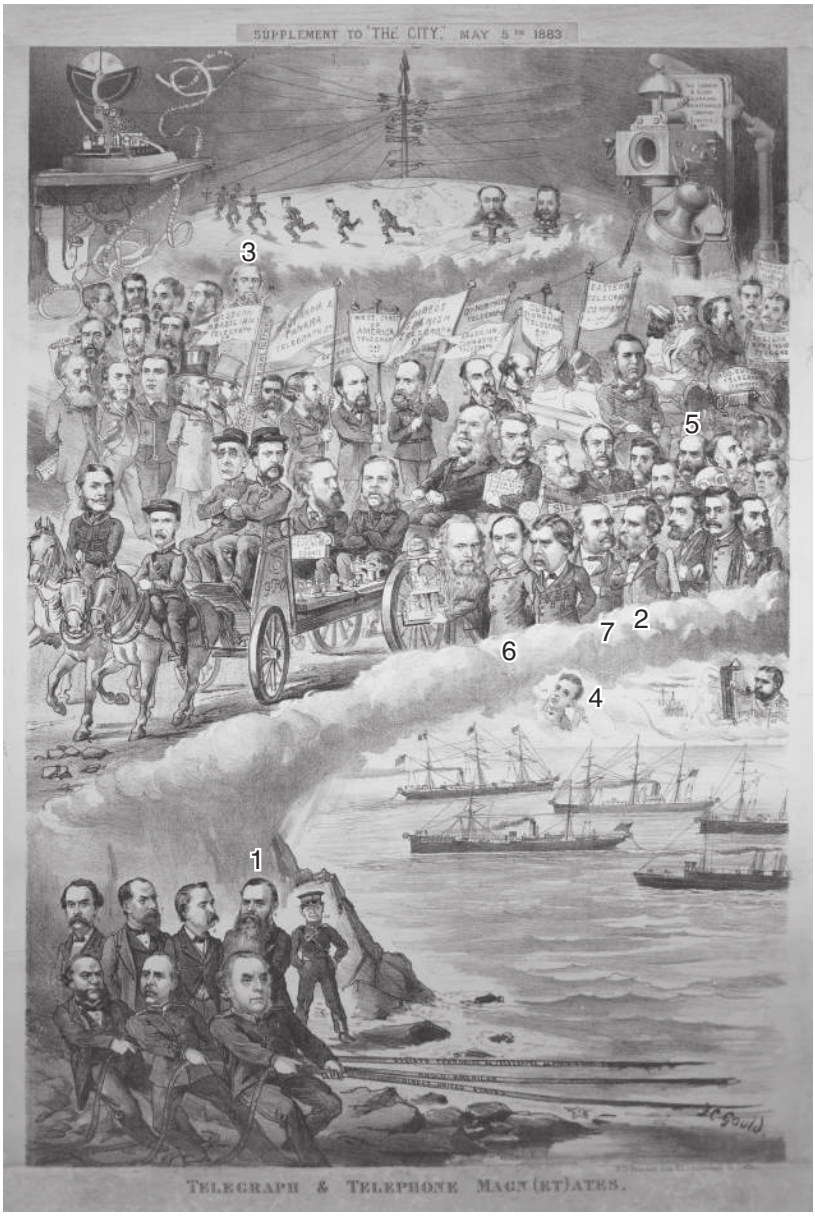
By 1919, Lodge was probably the only individual that most British reading audiences associated with connections between physics and psychics, mainly because of his staggering output of articles, books and public lectures. In the five decades before this, however, he was known as one of many eminent physicists with psychical 'connections', including four Nobel laureates, three presidents of the Royal Society of London and three other presidents of the British Association.[3] Some were well known for their role in one of the widest-reaching of all applications of the physical sciences: electrical communication (Figure 0.1). When, in the 1880s, Lodge's connection with psychical investigation started, his name jostled for attention alongside those of other, and mainly older, professional scientists in the published membership lists of an organisation that had played an important role in raising the intellectual profile of the study of psychical phenomena across the globe: the Society for Psychical Research (henceforth SPR). Founded in 1882, this predominantly British organisation aimed to subject a host of what it deemed "debatable", "remarkable" and seemingly "inexplicable" phenomena to the "exact and unimpassioned" methods of enquiry that had proven so successful in the sciences for hundreds of years.[4] The conspicuous absence of the word 'supernatural' from the SPR's manifesto was entirely consistent with this methodological ambition: like so many mesmerists and spiritualists before them, the SPR studied phenomena that it believed to be manifestations of obscure aspects of the natural order, even if they were still deemed supernatural in some quarters.

The phenomena that the SPR reclassified as 'psychical' all suggested obscure and startling powers of the human mind and body.[5] They included 'telepathy' or the capacity to communicate images, words and other impressions to other individuals independently of the known senses; the ability to

[3] The Nobel laureates were Marie and Pierre Curie, the Third Baron Rayleigh and J. J. Thomson; the Royal Society presidents were William Crookes, Rayleigh and Thomson; and the British Association presidents were Rayleigh, Thomson and Arthur Rücker.

[4] [Anon.], 'The Society for Psychical Research: Objects of the Society', *PSPR*, vol. 1 (1882–3), pp. 3–6, pp. 3–4.

[5] The *Oxford English Dictionary* suggests many alternatives to 'psychical' as collective terms relating to spiritualistic and related phenomena. 'Psychic' had been used to refer to such phenomena since the 1870s, while 'psychics' and 'psychic research' were used in the 1860s and 1880s respectively to refer to the *study* of such phenomena. 'Psychic science' came into common use as an alternative to 'psychical research' in the 1920s, partly to reflect the claimed scientific status of the enterprise. For the purposes of clarity this book will generally adopt the terms 'psychical' for the phenomena and 'psychical research' or 'psychical investigation' for the study of the phenomena.




0.1 A semi-satirical portrait of the late-nineteenth-century telegraph and telephone businesses. Some of the individuals shown here – Latimer Clark (1), William Crookes (2), Amos Dolbear (3), Thomas Alva Edison (4), Desmond Fitzgerald (5), Silvanus Thompson (6) and Cromwell Varley (7) – were also interested in psychical phenomena. From F[rancis] C[arruthers] Gould, 'Telegraph and Telephone Magnet(at)es', *The City*, 5 May 1883. Reproduced by permission of the Telegraph Museum, Porthcurno.

see or otherwise perceive ghosts of the dead or dying; the power to induce a trance state, effect medical cures and share the sensory experiences of individuals via 'mesmerism'; and the ability to commune with the dead, materialise inhabitants of the spirit world, move objects at a distance and display the other startling powers associated with spiritualist mediumship. Some of the individuals who produced and studied these phenomena would, in the mid-1870s, launch the Theosophical Society. Modernising the ancient study of theosophy or 'divine wisdom', this organisation encouraged the development of obscure psychological powers for elucidating esoteric truths underlying all philosophies, religions and sciences relating to the origin, development and fundamental nature of mankind and the cosmos.[6]

Many of the psychical phenomena studied by the SPR had been the preoccupation of the 'occult philosophies', 'occult sciences' and 'occultisms' that had flourished for centuries. However, the SPR sought to distance itself from such enterprises on the grounds that they seemed to represent approaches to obscure or 'occult' phenomena that were fanciful, secretive and morally dubious rather than what the organisation upheld as the empirical, open and morally sound approaches of the established sciences.[7] Most of the protagonists of this book shared this anxiety and were more likely to speak of unusual, residual and psychical phenomena than the more freighted 'occult' phenomena and certainly repudiated the idea that they were trying to apply science to 'supernatural' effects or a realm beyond the natural.[8] To further project an image of "exact and impassioned enquiry", the SPR also denied prior commitment to "any particular explanation of the phenomena", among which the most notorious was undoubtedly the core belief of spiritualists that the information conveyed by entranced mediums came from personalities in the afterlife.[9] The SPR's rising membership (which had reached over 900 by

[6] The historical literature on modern Theosophy is enormous but see Bruce F. Campbell, *Ancient Wisdom Revived: A History of the Theosophical Movement* (Berkeley, CA: University of California Press, 1980); Joscelyn Godwin, *The Theosophical Enlightenment* (Albany, NY: State University of New York Press, 1994); K. Paul Johnson, *The Masters Revealed: Madame Blavatsky and the Myth of the Great White Lodge* (Albany, NY: State University of New York Press, 1994).

[7] This is evident in Oliver Lodge, 'In Memory of F. H. W. Myers', *PSPR*, vol. 17 (1901–3), pp. 1–12, p. 4; Frederic W. H. Myers, 'The Subliminal Consciousness', *PSPR*, vol. 7 (1891–2), pp. 298–355 and vol. 8 (1892), pp. 436–535, on vol. 8, p. 465. For recent historical overviews of occultisms see Egil Asprem, 'Science and the Occult', in Christopher Partridge (ed.), *The Occult World* (Abingdon: Routledge, 2015), pp. 710–19; Wouter Hanegraaff, *Esotericism and the Academy: Rejected Knowledge in Western Culture* (Cambridge University Press, 2012), esp. chapter 3.

[8] For example, William F. Barrett, *Psychical Research* (London: Williams and Norgate, 1911), pp. 11–14; Oliver Lodge, *My Philosophy Representing My Views on the Many Functions of the Ether of Space* (London: Ernest Benn, 1933), pp. 300–1.

[9] [Anon.], 'Objects of the Society', pp. 4–5.

1900) suggests that this strategy clearly appealed to many Victorians looking for a more scientific approach to things ghostly and supernatural.

What sometimes surprised late-nineteenth- and early-twentieth-century commentators was that the SPR's members included many of the most distinguished scientific, literary, medical, political and religious figures of the period. Some, and especially those forging the academic discipline of psychology, were particularly baffled to find so many physicists and practitioners of other physical sciences in the SPR because the kinds of phenomena included in the organisation's remit were psychological to one degree or another and not the province of sciences that formally sidestepped questions of mind. In response, many physical scientists argued that since some psychical phenomena had *some* physical aspects then they were relevant and important to the physical sciences and should not be left solely in the hands of psychologists. By the time *Punch* was imagining his "transfer" from physics to psychics, Lodge was only one of a handful of professional physicists left willing to defend this argument. The scientific discipline to which psychical researchers now most closely associated their enterprise was psychology, although most professional psychologists – and, indeed, most professional scientists of the interwar period – denied that the methods and results of psychical research were robust enough to qualify the enterprise as a branch of *any* science. The situation would not change significantly over the course of the twentieth century, when most scientists, including many physicists, expressed grave doubts about the existence of psychical and paranormal effects and judged psychical research and its major offspring – parapsychology – as fields unworthy of their attention.[10]

This book is about the heyday of 'physics and psychics' which took place in the period circa 1870–1930 and was much more prominent in Britain than elsewhere. It argues that the study of psychical phenomena occupied a much more significant place among late-nineteenth- and early-twentieth-century physical scientists than we have assumed and that the encounters between physical and psychical enquiries stimulated a degree of theoretical, experimental and other types of scientific activity that has been largely overlooked. These activities were not limited to professional physicists, who until the late nineteenth century were rare individuals in the scientific landscape. Indeed, it is because psychical research was pursued by

[10] Examples of this attitude are in Georges Charpak and Henri Bloch, *Debunked! ESP, Telekinesis, other Pseudoscience* (Baltimore, MD: Johns Hopkins University Press, 2004); Robert Park, *Voodoo Science: The Road from Foolishness to Fraud* (Oxford University Press, 2000), and issues of *Skeptical Inquirer*, which publishes reports by professional scientific and other members of the American-based Committee for the Scientific Investigation of Claims of the Paranormal.

practitioners of a wider range of physical sciences that the phrase 'physics and psychics' is a handy but problematic shorthand.

The involvement of distinguished physicists and practitioners of other physical sciences in psychical research and ancestral occult enterprises has long stimulated, baffled and even titillated historians of psychical research, physics, and of nineteenth-century sciences and occultisms more generally.[11] The result is that we know a good deal about selected individuals and the links that they tried to forge between physical and psychical enterprises at conceptual and theoretical levels, but we still lack an understanding of the bigger picture.

[11] The most important studies are Egil Asprem, *The Problem of Disenchantment: Scientific Naturalism and Esoteric Discourse 1900–1939* (Leiden: Brill, 2014), pp. 208–25; Peter J. Bowler, *Reconciling Science and Religion: The Debate in Early-Twentieth-Century Britain* (Chicago University Press, 2001), pp. 89–101; William H. Brock, *William Crookes (1832–1919) and the Commercialization of Science* (Farnham: Ashgate, 2008), chapters 7–8 and 10–11; Geoffrey Cantor, *Michael Faraday: Sandemanian and Scientist* (London: Macmillan, 1991), pp. 146–54; Patrick Fuentès, 'Camille Flammarion et les force naturelles inconnues', in Bernadette Bensaude-Vincent and Christine Blondel (eds.), *Les savants face à l'occulte, 1870–1940* (Paris: Éditions la Découverte, 2002), pp. 105–21; Michael Gordin, *A Well-Ordered Thing: Dmitrii Mendeleev and the Shadow of the Periodic Table* (New York: Basic Books, 2004), chapter 4; Franz Ferzak, *Karl Freiherr von Reichenbach* (Munich: Franz Ferzak World and Space Publications, 1987), pp. 62–152; Jeff Hughes, 'Occultism and the Atom: The Curious Story of Isotopes', *Physics World*, September 2003, pp. 31–5; Mark S. Morrisson, *Modern Alchemy: Occultism and the Emergence of Atomic Theory* (New York: Oxford University Press, 2007); Albert E. Moyer, *A Scientist's Role in American Culture: Simon Newcomb and the Rhetoric of Scientific Method* (Berkeley, CA: University of California Press, 1992), chapter 10; Michael Nahm, 'The Sorcerer of Cobenzl and His Legacy: The Life of Baron Karl Ludwig von Reichenbach, His Work and Its Aftermath', *Journal of Scientific Exploration*, vol. 26 (2012), pp. 381–407; Richard Noakes, 'Telegraphy Is an Occult Art: Cromwell Fleetwood Varley and the Diffusion of Electricity to the Other World', *British Journal for the History of Science*, vol. 32 (1999), pp. 421–59; Richard Noakes, '"The Bridge Which Is Between Physical and Psychical Research": William Fletcher Barrett, Sensitive Flames and Spiritualism', *History of Science*, vol. 42 (2004), pp. 419–64; Richard Noakes, 'Cromwell Varley FRS, Electrical Discharge and Spiritualism', *Notes and Records of the Royal Society*, vol. 61 (2007), pp. 5–21; Richard Noakes, 'The "World of the Infinitely Little": Connecting Physical and Psychical Realities circa 1900', *Studies in History and Philosophy of Science*, vol. 39 (2008), pp. 323–34; Richard Noakes, 'Making Space for the Soul: Oliver Lodge, Maxwellian Psychics and the Etherial Body', in Jaume Navarro (ed.), *Ether and Modernity: The Recalcitrance of an Epistemic Object in the Early Twentieth Century* (Oxford University Press, 2018), pp. 88–106; Janet Oppenheim, *The Other World: Spiritualism and Psychical Research in Britain, 1850–1914* (Cambridge University Press, 1985), chapter 8; Courtenay Grean Raia, 'From Ether Theory to Ether Theology: Oliver Lodge and the Physics of Immortality', *Journal of the History of the Behavioural Sciences*, vol. 43 (2007), pp. 19–43; Klaus B. Staubermann, 'Tying the Knot: Skill, Judgement and Authority in the 1870s Leipzig Spiritistic Experiments', *British Journal for the History of Science*, vol. 34 (2001), pp. 67–79; David B. Wilson, 'The Thought of Late-Victorian Physicists: Oliver Lodge's Ethereal Body', *Victorian Studies*, vol. 15 (1971), pp. 29–48; Brian Wynne, 'Physics and Psychics: Science, Symbolic Action and Social Control in Late Victorian England', in Barry Barnes and Steven Shapin (eds.), *Natural Order: Historical Studies of Scientific Culture* (Beverly Hills, CA: Sage, 1979), pp. 167–87.

How widespread was the interest in psychical investigation among physical scientists? What did this interest amount to? To what extent were 'physics and psychics' linked on experimental as well as theoretical levels? Why did physical scientists think that their skills were relevant to and productive in psychical investigation? And why did some change their approaches to psychical investigation or abandon such enquiries altogether? This book attempts to answer these and many other questions.

The hostility of today's physicists to psychical research has invariably shaped their attempts to understand why so many of their nineteenth- and early-twentieth-century professional ancestors displayed a serious interest in the subject. Echoing nineteenth-century critics of psychical research and spiritualism, they attribute the embarrassing spiritualist beliefs of Lodge, the chemist William Crookes and others to temporary lapses in otherwise formidable powers of scientific judgement. Driven by strong religious, metaphysical or emotional attachment to the idea that we survive bodily death, these lapses, it is said, blinded them to the trickery of spiritualist mediums.[12] Radically alternative interpretations have been given by many contemporary spiritualists. For them, Victorian scientists lend weighty scientific support to the spiritual and psychical beliefs for which they have already gained conclusive evidence.[13]

For all their differences, today's physicists and spiritualists share an interest in the past as a resource for criticising or defending the beliefs and practices associated with psychical research, spiritualism, modern Theosophy and other so-called occult subjects. The approaches of most academic historians have long deviated from this. They generally abstain from evaluating the strengths and weaknesses of these beliefs and practices in favour of understanding their origin, development and significance. For this reason their work sidesteps the frequent and often sterile debates about whether 'occult' beliefs and practices meet some transhistorical criteria of 'pseudo-science' in favour of understanding the historical processes by which such things were eventually demarcated from 'established', 'mainstream' or 'orthodox' sciences.[14] This literature is correspondingly sensitive to historical actors' notions of the scientific

[12] Exemplary here is Victor Stenger, *Physics and Psychics: The Search for a World Beyond the Senses* (Buffalo, NY: Prometheus Books, 1990), chapter 7.

[13] See, for example, Gordon Smith, *Beyond Reasonable Doubt: The Case for Supernatural Phenomena in the Modern World* (London: Coronet, 2018), chapter 1; Lynn G. De Swarte, *Thorson's Principles of Spiritualism* (London: Thorson's, 1999), pp. 4 and 7.

[14] For critical historical studies of 'pseudo-science' see Roger Cooter, 'The Conservatism of "Pseudoscience"', in Patrick Grim (ed.), *Philosophy of Science and the Occult* (Albany, NY: State University of New York Press, 1990), pp. 156–69; David J. Hess, *Science in the New Age: The Paranormal, Its Defenders and Debunkers and American Culture* (Madison, WI:

character of 'occult' subjects, which often challenged the ways in which the established sciences were defined. This sensitivity is particularly clear in historians' terms of analysis. By referring to mesmerism, spiritualism, modern Theosophy and psychical research as 'alternative sciences' rather than the more pejorative 'pseudo', 'marginal' or 'occult' sciences, they have better captured the considerable scientific potential that these controversial subjects had for so many nineteenth-century individuals.[15] Although many of these subjects were pursued for philosophical, religious and moral as well as scientific reasons, 'alternative sciences' remains a useful collective term for them and will be adopted here.

The need for an alternative collective term to 'pseudo-sciences' is especially pressing in the nineteenth century because it was a period when the boundaries of scientific orthodoxy, whether defined in terms of subject matter, forms of expertise, practices, audiences or sites of enquiry, were still being negotiated. The major revisionist studies of early Victorian phrenology and mesmerism are particularly instructive here because they demonstrate the significant role that these alternative sciences fulfilled in determining the boundaries of scientific orthodoxy and the social, political and cultural factors that necessarily informed this boundary work.[16] Alison Winter's study of mesmerism, for example, shows that the trajectory of this controversial medical therapy was less bound up with the question of whether a quasi-magnetic fluid really passed between mesmeric doctors and their patients than with the

University of Wisconsin Press, 1993); Seymour H. Mauskopf, 'Marginal Science', in R. G. Olby, G. N. Cantor, J. R. R. Christie and M. J. S. Hodge (eds.), *Companion to the History of Modern Science* (London: Routledge, 1990), pp. 869–85; Daniel P. Thurs and Ronald L. Numbers, 'Science, Pseudo-Science and Science Falsely So-Called', in Massimo Pigliucci and Maatern Boudry (eds.), *Philosophy of Pseudoscience: Reconsidering the Demarcation Problem* (Chicago University Press, 2013), pp. 121–44. Many recent historical approaches to science and pseudo-science owe a debt to Harry Collins and Trevor Pinch's classic sociological study of parapsychology. This understood the conflict between parapsychologists and their scientific adversaries as one between rival and incommensurable forms of scientific method, rationality and expertise, rather than between science and pseudo-science: H. M. Collins and T. J. Pinch, *Frames of Meaning: The Social Construction of Extraordinary Science* (London: Routledge and Kegan Paul, 1982).

[15] This is well captured in Arne Hessenbruch (ed.), *The Readers' Guide to the History of Science* (London: Fitzroy Dearborn, 2000). A critical assessment of 'alternative science' is Shiv Visvanathan, 'Alternative Science', *Theory, Culture and Society*, vol. 23 (2006), pp. 164–9.

[16] The classic accounts are Roger Cooter, *The Cultural Meaning of Popular Science: Phrenology and the Organisation of Consent in Nineteenth-Century Britain* (Cambridge University Press, 1984) and Alison Winter, *Mesmerized: Powers of Mind in Victorian Britain* (Chicago University Press, 1998). For analysis of the 'boundary work' involved in demarcating scientific from non-scientific enterprises see Thomas F. Gieryn, *Cultural Boundaries of Science: Credibility on the Line* (Chicago University Press, 1999).

challenges that it posed to early Victorian ideas about professional authority, and about the relations of class, ethnicity and gender.

The fluid boundaries of scientific orthodoxy make it equally perilous to approach mesmerism, spiritualism and psychical research with rigid distinctions between natural and supernatural, material and spiritual, manifest and occult. These distinctions were constantly being contested in the nineteenth century, not least because of the puzzling phenomena associated with the alternative sciences.[17] The notorious materialised spirits of seances, for example, seemed to challenge all these distinctions: they were clearly manifest to the senses, and had natural and even grossly material aspects, but their causes were hidden or occult, and ostensibly in the domain of the supernatural or spiritual. These kinds of phenomena were often deemed worthy of scientific investigation precisely because of these former qualities, but also because natural scientific enquiries had long proven successful in embracing phenomena that seemed to be supernatural, spiritual and occult.

Winter's study amply demonstrates the insights that can be gained into alternative sciences when situating them in their historical contexts. It is an approach that has, in the past few decades, yielded more nuanced and altogether more satisfactory historical interpretations. Spiritualist mediumship proved an attractive career move to many nineteenth-century American and British women because it conferred on them powers of speaking, writing and behaving that subverted the oppressive femininities of the Victorian patriarchy; spiritualism secured many followers among English plebeians because it helped them challenge the control that educational, religious, medical and political institutions wielded over them, and it gave bereaved men welcome opportunities to write about emotionally charged communions with loved ones on the other side, and thus challenge the oppressive ideologies of masculinity that shunned public displays of grief.[18]

[17] On alternative sciences and ideas of natural law see Asprem, *Problem of Disenchantment*, esp. chapter 7; Bret E. Carroll, *Spiritualism in Antebellum America* (Bloomington, IN: Indiana University Press, 1997), pp. 60–84 and Richard Noakes, 'Spiritualism, Science and the Supernatural in Mid-Victorian Britain', in Nicola Bown, Carolyn Burdett and Pamela Thurschwell (eds.), *The Victorian Supernatural* (Cambridge University Press, 2004), pp. 23–43.

[18] Ann Braude, *Radical Spirits: Spiritualism and Women's Rights in Nineteenth-Century America* (Boston: Beacon Press, 1989); Alex Owen, *The Darkened Room: Women, Power and Spiritualism in Late Victorian England* (London: Virago, 1989); Marlene Tromp, *Altered States: Sex, Nation, Drugs and Self-Transformation in Victorian Spiritualism* (Albany, NY: State University of New York Press, 2006); Logie Barrow, *Independent Spirits: Spiritualism and English Plebeians, 1850–1910* (London: Routledge and Kegan Paul, 1986); Bret E. Carroll, '"A Higher Power to Feel": Spiritualism, Grief and Victorian Manhood', *Men and Masculinities*, vol. 3 (2000), pp. 3–29.

One of the most important contexts for interpreting spiritualism and other alternative sciences has been the debates on the relationship between science and religion, or, more accurately, the sciences and Christianity. As many historians have shown, spiritualists, psychical researchers and modern Theosophists expressed more widely shared preoccupations with questions of mind, spirit, morality and cosmic purpose to which neither orthodox Christianity nor the seemingly materialistic sciences provided satisfactory answers.[19] In a period when the credibility of Christian doctrines was being challenged by historical criticism and by new scientific understandings of the earth's history and the development of organic life, many aimed to safeguard their Christian faith, or to find alternatives to Christianity, by applying the methods of rational and scientific enquiry to obscure phenomena of the mind and body that had considerable spiritual, religious and moral significance.

In taking scientific and rational enquiry in these directions, proponents of alternative sciences were both extending and challenging 'scientific naturalism'.[20] Succinctly characterised by Bernard Lightman as the "English version of the cult of science" pervading nineteenth-century Europe, this was an intellectual, cultural and political enterprise closely associated with some of the most vociferous scientists of the Victorian era, notably the biologist and prominent champion of Darwinism, Thomas Henry Huxley, and a physicist well known to many of this book's protagonists, John Tyndall.[21] Scientific naturalism held that the sciences provided the most reliable understandings of the physical world (including humanity). These understandings were based on empirically established theories of material atoms, energy and biological evolution, and shunned scientifically unproven causes, including the spiritual and supernatural agencies at the core of religious institutions. Scientific naturalists' intellectual goals underpinned their other ambitions: they campaigned ardently for the sciences to be enterprises that were thoroughly professionalised, free from the control that the Anglican establishment had long

[19] Asprem, *Problem of Disenchantment*; Alan Gauld, *The Founders of Psychical Research* (London: Routledge, 1968); Oppenheim, *Other World*; Alex Owen, *The Place of Enchantment: British Occultism and the Culture of the Modern* (Chicago University Press, 2004); Frank M. Turner, *Between Science and Religion: The Reaction to Scientific Naturalism in Late Victorian England* (New Haven, CT: Yale University Press, 1974).

[20] The classic work on Victorian scientific naturalism is Turner, *Between Science and Religion*. Turner's other writings on the subject were collected in his *Contesting Cultural Authority: Essays in Victorian Intellectual Life* (Cambridge University Press, 1993), chapters 5–8. Recent perspectives are consolidated in Gowan Dawson and Bernard Lightman (eds.), *Victorian Scientific Naturalism: Community, Identity, Continuity* (Chicago University Press, 2014).

[21] Bernard Lightman, 'Victorian Sciences and Religions: Discordant Harmonies', *Osiris*, vol. 16 (2001), pp. 343–66, p. 346.