Knowledge, Character, and Professionalisation in Nineteenth-Century British Science

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Historians have frequently referred to the British Association for the Advancement of Science as an institution which had the professionalization of British science as its chief aim. This article seeks to complicate this picture by asking what, if any, concept of 'professionalisation' would have been understood by nineteenth-century actors. In particular, it seeks to move away from traditional functionalist understandings of professionalisation, as the possession of specialist knowledge and expertise, and consider instead broader definitions, which incorporate the power relationships and identities constructed through discourses of professionalisation. It argues that it was just as important for professional scientists in nineteenth-century Britain to possess a particular type of character (independent, rational, self-controlled) closely identified with popular ideals of elite masculinity and developed through a thorough scientific education. It also reinterprets the growing popularity of scientific internationalism, with its emphasis on the independence of the scientist (from state control) as a crucial part of this masculinising discourse of professionalisation.

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The British Association for the Advancement of Science (BAAS) is often described as an organisation which had the professionalisation of science in Britain as its primary goal. As W.H. Brock has written, many historians have seen its foundation in 1831 along with the coining of the term 'scientist' by one of its founding members, William Whewell, in 1834, as

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'symptomatic of the professionalisation of science during the nineteenth century.'[1] Jack Morrell has even described the BAAS as 'the first national pressure group for professionalising science.'[2] Some commentators from the time including those central to the foundation of the BAAS support this view. Charles Babbage, famously writing about 'the decline of science in Britain' in 1830 lamented that '[t]he pursuit of science does not, in England, constitute a distinct profession, as it does in other countries. It is therefore, on that ground alone, deprived of many of the advantages which attach to professions.'[3]

This view of the central place of professionalisation in the mission and identity of the British Association has, however, not gone unchallenged. Among others, Roy McLeod has pointed to the continued influence of the 'gentleman-amateur' ideal within the BAAS throughout much of the nineteenth century and the significant support given to the work of amateur scientists even until the outbreak of the Second World War. As he argues, '[i]n this context, one could interpret the British Association as reacting against the corporatist, rationalist ethic embodied in the professional society (or modern 'qualifying association') and representing instead a continuing wish to cultivate a *gemeinde*, or primary group relationship, based upon families of ideas, intellectual partnerships and personal friendships.'[4] A.D. Orange has likewise argued that 'amateurism' was a central characteristic of the BAAS in the nineteenth century in comparison with 'professional' continental styles.[5]

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[1] W.H. Brock, 'Advancing Science: The British Association and the Professional Practice of Science' in Roy M. McLeod and P.D.B. Collins eds., *Parliament of Science: The British Association for the Advancement of Science 1831-1981* (Northwood: Science Reviews, 1981), 91.

[2] J.B. Morrell, 'Individualism and the Structure of British Science in 1830', *Historical Studies in the Physical Sciences* 3 (1971):, 184. Cf. Basalla, Coleman and Kargon who concluded from their analysis of the early presidential speeches of the BAAS that '[a]bove all, the British Association was a *professional* organization as compared to the *amateur* Royal Society.' See George Basalla, William R. Coleman, Robert Hugh Kargon, *Victorian Science: A Self-portrait from the Presidential Addresses of the British Association for the Advancement of Science* (New York: Doubleday and Company, 1970), 8.

[3] Charles Babbage, *Reflections on the Decline of Science in England: And on Some of Its Causes* (London: B. Fellowes, 1830), 10-11.

[4] Roy MacLeod, 'Retrospect: The British Association and its Historians' in Roy MacLeod and Peter Collins eds., *The Parliament of Science*, 7.

[5] A.D. Orange, 'Idols of the Theatre: The British Association and its Early Critics', *Annals of Science* 32, no. 3 (1975): 294.

I would argue, however, that these two ideas need not be opposed to each other. There is no doubt that a certain concept of professionalisation was central to the raison d'être of the BAAS from its beginning; but to appreciate its meaning for those involved, we need to arrive at more subtle and flexible definitions. In the 1970s, when professionalisation first became a key concept in understanding the history of science in Britain, it was chiefly defined in terms derived from functionalist sociology as the possession of certain specialist knowledge and expertise. However, as Mike Saks and other critics of this view have suggested, 'the way a profession is defined is more than just a primary function of its knowledge base.' Professionalisation must be recognised as a 'sociopolitical process involving power and interests.'[6] If we adopt this approach derived chiefly from Foucauldian discourse analysis, then we should be primarily interested in the social, cultural and political context in which the knowledge and expertise (which define a profession) are deployed in the construction of identities and power relations. Jack Morrell recognised this when he focused not so much on the knowledge and expertise of the key players in the early years of the BAAS as on what he termed their eagerness to use their social networks in order 'to promote particular ideologies and practices of science.'[7]

For the purposes of this article, this broader understanding of 'professionalisation' will be employed. The first section will concentrate on the specialist knowledge and expertise expected from would-be scientists which traditional sociological interpretations of professionalisation have emphasised. The second section, however, will move beyond functionalist definitions, to consider the broader ways in which this knowledge and expertise was constructed and deployed within the social, cultural and political context of the British Association in the nineteenth century. Above all, it will suggest that a strong case was made by leading proponents of science and science education that a study of science at school

[6] Mike Saks, 'Defining Professionalization: The Role of Knowledge and Expertise', *Professions and Professionalism* 2, no. 1 (2012): 5.
[7] J. Morrell, 'Geological Thrusting', *The British Journal for the History of Science* 25, no. 2 (June 1992): 241.

uniquely facilitated a type of character and intellectual approach which, though labelled 'scientific', closely mirrored contemporary ideals of masculinity.[8] By contrast, traditional literary subjects such as classics and literature were criticised as unmanly and effete. Thus we see that in publicly advancing the cause of science and scientists, it was not simply the specialist skills and knowledge which leading members of the BAAS emphasised, but also their (they claimed, unique) potential to foster a capable, rational and practical masculinity in boys trained in scientific study from an early age. The final section re-examines from the perspective of professionalisation an important feature of nineteenth and early twentieth-century scientific life - internationalism. It argues that what has sometimes been criticised as evidence of scientists disloyalty or cowardice is better understood as a marker of deep-seated collective identity, based on an idea of science as a distinct profession, an exclusive 'body of self-governing equals',[9] ideally free from external interference, particularly from the state.

Science as a distinct body of knowledge and expertise

From its earliest beginnings, the British Association sought to define itself as fundamentally different from other learned societies (in particular the Royal Society) by deliberately calling itself the Association *for the Advancement of Science*.[10] They also took for their model a foreign association begun eight years earlier in Germany – the *Verband deutscher Naturforscher und Ärtzte* – very clearly based on a membership of natural scientists and physicians.[11] At a couple of the early annual meetings (which moved each year to a different town within Britain), the presidents of the BAAS stressed their wish to mark their

[8] A good summary of recent work in this area is provided by Debra Schleef, 'Identity Transformation, Hegemonic Masculinity and Research on Professionalization', *Sociology Compass* 4, no. 2 (February 2010): 122-135.

[9] According to Mike Saks, this is a common understanding of 'profession' as a collective identity. See Saks, 'Defining Professionalization', 4.

[10] A.D. Orange argues convincingly that the emphasis on progress and 'advancement' derived from Francis Bacon's *The Advancement of Learning* (London, 1605). See A.D. Orange, 'Idols of the Theatre: The British Association and its Early Critics', *Annals of Science* 32, no. 3 (1975): 278.

[11] George Basalla, William R. Coleman and Robert Hugh Kargon eds., *Victorian Science: A Self-Portrait from the Presidential Addresses of the British Association for the Advancement of Science* (New York, 1970), 4.

organisation out from literary societies and pursuits. Professor William R. Hamilton, one of the two secretaries in 1835, stated very clearly in his opening address: 'Our object is not literature'.[12] The wish to distance themselves from the still dominant world of classical scholarship is clear from the presidential address in 1840. The position adopted by the then president, William Vernon Harcourt, was as follows: 'We are in no great risk of deviating into literary, or metaphysical, or theological discussions', he assured his audience. 'Sound metaphysics and literary culture will of course show themselves in the addresses of those who possess such accomplishments, but are no direct objects of our attention.'[13]

It should be remembered that those campaigning on behalf of science in this early period were at something of a disadvantage. Not only was the academic world still dominated by classical and theological scholarship; science itself was widely perceived as being in decline. The very foundation of the BAAS in 1831 was in part a response to the precarious position in which leading men of science felt themselves to be in in the early nineteenth century. Writing to Charles Babbage on 12 February 1830, one of the founding members of the BAAS, the Scottish physicist, David Brewster, expressed his satisfaction with Babbage's decision to write and publish a major piece on the 'decline of science in England', which he described as 'the most heart-breaking subject that I know.'[14] 'It seems to me', he wrote in a further letter of 16 June 1830, 'that this is the moment to do something effectual, and that an association should be organised for the reviving of science in England.'[15] The public position of science was not only vulnerable on the eve of the BAAS's foundation but continued to be so throughout the first decades of its existence.

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[12] *Report of the Fifth Meeting of the British Association for the Advancement of Science* (London: John Murray, 1836), xlii.
[13] *Report of the Eleventh Meeting of the British Association for the Advancement of Science* (London: John Murray, 1842), xxxiv.
[14] David Brewster to Charles Babbage (12 Feb 1830) BL. Add. MSS 37185, ff. 49-51.
[15] David Brewster to Charles Babbage (16 June 1830) BL. Add. MSS 37185, ff. 229-30.

In terms of developing a specialist knowledge base unique to practicing scientists, it was not simply 'literary pursuits' and classical scholarship which the founding members of the BAAS worked hard to distinguish themselves against. In the Britain of the 1830s and 1840s, science was still struggling to wrestle control over the natural world from the entrenched interests of religion and theology. While many individual scientists remained driven by a strong religious faith, increasingly, the BAAS, many of whose earliest members were clergymen, sought to counter and ultimately prevent untrained theologians from meddling in scientific matters. In November 1833, William Buckland, Regius Professor of Geology at Oxford, complained to William Vernon Harcourt about the continuing ability of conservative theologians to discourse in public at the ancient universities on geology, about which, he claimed, they knew nothing. He referred to 'enthusiastic sciolists that have inundated the world with anti-philosophical volumes which nobody has taken the trouble to contradict.' Buckland, moreover, urged Harcourt to castigate such works in the pages of the *Edinburgh Review*. 'Murchison was here 10 days ago', he wrote, 'and was outrageous at a work of similar class by Captain Fairholme entitled 'Geology of Scripture' written in utter ignorance of the very elements of the subject which he endeavours to reconcile with the letter of scripture even to its minutest details.' 'It…behoves the President of the British Association', he continued, 'to defend geology and all other sciences from the misrepresentations that pervade' such volumes. 'The time is now arrived when this school must be put down, singly they are unworthy of the notice of any scientific man.'[16]

There was also a battle to be fought within the emerging scientific community about what properly constituted scientific knowledge. Many of the earliest members of the British Association, as already mentioned, were clergymen and classical scholars. Perhaps as a natural consequence of their own education, many such members advocated the inclusion of

[16] William Buckland to William Vernon Harcourt (20 November 1833) cited in J. Morrell and A. Thackeray eds., *Gentlemen of Science: Early Correspondence of the British Association for the Advancement of Science* (London: Royal Historical Society), 182.

ancient writers on the natural world such as Aristotle, Lucretius and Ptolemy as constituting the latest authorities in emerging fields of science.[17] Many more though, of the stamp of Harcourt and Buckland dismissed the ancient natural philosophers as antiquated and irrelevant to the substance of modern science. Thomas Romney Robinson, BAAS president in 1849, provided a typical example of this view in his presidential speech when he gloried in the fact that 'the dominion of Aristotle and the schoolmen [had] disappeared before the age of Copernicus, Kepler, Galileo and Bacon.' 'From the 15th century downward', he continued, 'we find the philosophers of Europe beginning to be worthy of the name, lovers of knowledge.'[18] In this construction, science and scientific knowledge are presented as decisively modern. By the mid-1840s, 'scientists' who did not share or endorse this view could expect to be publicly criticised. Thus, for example, at the annual meeting in York in 1844, the zoologist, H.E. Strickland, commented as follows on the work of a French colleague, M. Bourjot St. Hilaire: 'What can we say of an author who...is deserting that admirably concise and effective method of nomenclature introduced 80 years ago by the great Linnaeus, and is resuming the vague and unscientific generalisations of the ancient naturalists?'[19]

From the very creation of the BAAS in 1831, the desire to establish an organisation characterised by a specialist training and knowledge had been prominent among many founding members who were keen to minimise (if not remove altogether) the influence of the interested amateur. 'One difficulty for which I do not see a remedy', wrote Charles Babbage to Harcourt on the eve of the first meeting in York in August 1831, 'will arise if… persons moderately acquainted with science possessing considerable assurance and fond of hearing

[17] See, for example, *Report of the Seventeenth Meeting of the British Association for the Advancement of Science* (London: J. Murray, 1848), xl.
[18] *Report of the Nineteenth Meeting of the British Association for the Advancement of Science* (London: J. Murray, 1850), xxxi.
[19] *Report of the Fourteenth Meeting of the British Association for the Advancement of Science* (London: J. Murray, 1845), 198.

themselves speak choose to push themselves forward.' When 'such persons…become conspicuous', he cautioned, 'and when they are unblessed with any large share of refinement or breeding they are very troublesome.'[20]

The scientific 'profession' and masculine character

It was not, though, simply the possession of a particular set of specialised knowledge and skills which was seen to define and distinguish the professional scientist in this period. He must also be seen to display a particular character; after all, to adopt the title 'professional' is not simply to claim a particular social status, but to claim a particular type of character as well, one which, historically, has shared much in common with the ideal masculine (and scientific) character – clear-headed, independent, rational. Not only was a specialist scientific knowledge a necessary component of scientific professionalism; it was also supposed to encourage (if not ensure) the development of a professional scientific character, which many advocates of science education maintained could only be imbued through a thorough training in scientific method during children's time at school.

Science education became a topic of intense interest to the BAAS within the first forty years of its existence. At the 1866 annual meeting in Nottingham, two papers were delivered as part of the Biology and Economics (and Statistics) Sections by F.W. Farrar and E. Renals respectively.[21] As a result, a Committee was established to report one year later with a plan for significantly extending scientific instruction within English public schools. Although mostly confining themselves to elite education, the Committee members did address the question of how scientific instruction might be delivered in elementary schools as well. This was likewise a topic which played an important role in the establishment of compulsory

[20] Charles Babbage to William Vernon Harcourt (31 August 1831) cited in Morrell and Thackray eds., *Gentlemen of Science*, 51.
[21] Farrar's paper ('On the Teaching of Science at the Public Schools') summarised on pp. 72-3 and Renals' ('On the Influence of Science Classes at Mechanics' Institutes') on pp. 131-3 of the Report for 1866.

elementary education through the 1870 Elementary Education Act and which ultimately led to the appointment of an additional Royal Commission in 1872 focused on scientific instruction at the elementary level *per se*. The role of the British Association and its members in setting up this Commission is clear from the addition to its title of 'the Advancement of Science.'[22]

From these early discussions, it is clear that it was not just the (specialised) type of knowledge which was at stake, but also, as Saks and other scholars have recently highlighted, the method of teaching or inculcating that knowledge in terms of the effect it was felt to have upon character. Insofar as the elementary level was concerned, increased scientific instruction was generally only looked to for boys, indicating right from the start that, for many promoters of science education, there was a clear connection between scientific knowledge and masculine character. Girls, by contrast, were to focus on subjects embraced under the heading, 'domestic economy.'[23] While this could simply be taken to reflect the traditional division of labour, as J.G. Greenwood, Principal of Owen's College, Manchester made clear in his evidence before the 1872 Commission, science education should be first and foremost about masculine character formation: 'Men of science of the highest kind', he declared, 'would certainly be the last to say...that their studies are chiefly or solely worthy to be promoted, because of their direct tendency to promote the material interests of the population.'[24] Instead, it was their perceived ability to promote an independent, rational, and decisive character which many felt to be the ideal character of the scientist and the man. This marriage of scientific and masculine ideals was no coincidence and was one of the most important rhetorical and ideological devices of the pro-science lobby across the nineteenth

[22] Of the Commissioners, B. Samuelson, Thomas H. Huxley, G.G. Stokes, Norman Lockyer (secretary), W. Sharpey and John Lubbock were all deeply involved with the BAAS. Lockyer was president in 1903; Lubbock was president in 1881; Huxley was president in 1870, just a year before the Committee's first report was published; Henry J.S. Smith was president of the mathematical section in 1873; G.G. Stokes was president in 1869, the previous year; William Sharpey was president of the Biology section in 1867.
[23] *Royal Commission on Scientific Instruction and the Advancement of Science Vol. I*, 552.
[24] Ibid., 476.

century. To realise the goal of mass manufacturing this ideal character via the school system, however, it wasn't enough to simply ensure science was being taught in British schools; it had to be taught in a *scientific* way.

Many champions of science expressed great dissatisfaction with the existing education system at all levels, elementary, secondary and university, dominated as it was, by a traditional model of literary education based on the Greek and Roman classics. So that even when science was being taught, it wasn't being taught in a scientific way. According to John Phillips, Professor of Geology at Oxford, interviewed by the 1872 Commission, children of the scientific and industrial class who went to read natural sciences at Oxford could 'hardly be regarded in the light of fellow-students' by their classically-trained peers.[25] Indeed, they were shunned as uncultivated and unmanly. Advocates of science like H.J.S. Smith, Savilian Professor of Geometry at Oxford, made similar accusations in their evidence. 'The teaching in the colleges', Smith commented with regard to Oxford and Cambridge, 'is necessarily somewhat of a schoolboy kind...it is kept close to textbooks, and close to the purposes of the University examinations, and by itself it does not always have a very awakening effect upon the intelligence of young men; it is apt to have something of a "grinding" character.'[26] J.G. Greenwood, a Professor at Owen's College, Manchester, remarked similarly that 'the tendency to call into too exclusive operation one set of mental faculties, the aesthetical side of the mind, for instance; and again the tendency to lean upon authority and tradition, rather than to bring into play the correctives supplied by inductive processes are very strong.'[27]

The dominance of the literary model of science teaching was apparently also visible in schools, above all, in the negative and 'unmanning' effect it had on male pupils. According to Rev. J.H. Rigg, Principal of the Wesleyan Training College, Westminster, there was a

[25] *Royal Commission on Scientific Instruction and the Advancement of Science Vol. I*, 202.
[26] Ibid., 220.
[27] Ibid., 475.

'waste of power and time' in current science teaching in school.[28] Thomas Anderson, president of the Chemical Section of the BA in 1867 and Professor of Chemistry at Glasgow agreed. To his mind, '[t]he difficulty [lay] in the kind of instruction offered; the usual practice having been to give lectures from which the discussion of principles and everything which exercises and develops the mind, is eliminated, and only that which it is supposed will entertain or surprise is retained, and boys are thus led to look upon science merely as a pastime.'[29] By contrast, Fleeming Jenkyn, Professor of Civil Engineering at Edinburgh, argued that science education needed to be remodelled in order to produce men 'more capable of doing work'. 'A man who merely hears about work', he continued, 'has no definite idea of what is meant by it.' Learning science should be a process of masculine hardening involving real work in the real world. 'The men who learn are the men who have been brought into contact with the work, who have already felt their ignorance – they get [a] chance of learning, they absorb knowledge with great rapidity.'[30]

Others were worried that the dominance of the literary or aristocratic model of learning science as one learned the classics meant that the whole manliness of the nation was put at risk. Particularly criticised was the tendency of England to train scientists at the same schools and universities as everybody else rather than in specialised institutes in centres of industry. Here, as might be expected, it was the example of German science which was repeatedly drawn on as a model to be emulated. As I.L. Bell, an industrialist involved in lead, iron and coal manufacturing in Northern England, commented:

> There is a class of men I find on the continent almost entirely wanting in England, namely, men of science who have devoted a great portion of their time to questions of applied science...there are scientific men abroad...who not only possess great scientific acquirements, but they devote their scientific knowledge to the careful

[28] Ibid., 552.
[29] *Report of the Thirty-Seventh Meeting of the British Association for the Advancement of Science* (London: J. Murray, 1868), 31.
[30] *Royal Commission on Scientific Instruction and the Advancement of Science Vol. I*, 94.

> observation of the operation of the blast furnace, of the manufacture of steel, or of the rolling mill.[31]

In his evidence, Dr Zeuner of Zurich, himself citing Helmholtz, repeated the view that a literary approach to science teaching unmanned students and robbed them of their independence - that chief characteristic of a scientist and a man:

> Philological culture has an ill effect on those who are to devote themselves to science, the philologist is too much dependent on authority of books, he cannot observe for himself, or rely upon his own conclusions, and having only been accustomed to consider the laws of grammar, all of which have their exceptions, he cannot understand the invariable character of physical laws.[32]

Henry Hennessy, Professor of Physics at the Catholic University of Ireland, citing his own 1859 work, *A Discourse on the Study of Science in Relation to Individuals and to Society*, before the Commission agreed: 'In his practice and profession, a superficial student' (one who had a merely literary acquaintance with scientific facts) 'would soon find the narrow boundaries within which his acquirements could be useful, and he would be constantly overwhelmed with difficulties which his limited stock of ideas and his feeble power of applying them would render him unable to surmount.' Rather than a manly, analytical, independent mind, he would have 'a mind at once so delicate and so voracious.'[33]

Men of science should be independent inquirers, able to subdue and harness the forces of nature by understanding their inner workings. Such a figure was a potent symbol of masculinity. As H. Bence Jones, physician and former student of Liebig at Giessen and President of the Chemical Section in 1866, told the BAAS in his presidential speech at the Annual Meeting that year, if medical men were to receive a properly designed scientific training instead of Greek and Latin, they would tend to be men of much greater 'influence and power':

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[31] Ibid., 623.
[32] Ibid., 507.
[33] *Royal Commission on Scientific Instruction and the Advancement of Science Vol. II* (London: George Edward Eyre and William Spottiswoode, 1874), 26.

> If every medical man...could use all the forces in nature for the cure or relief of his patient, and if he could, from his knowledge of chemistry and physics; and their application to disease and medicine, become the best authority...on every question connected with the health and welfare of his neighbours...surely the position and power and agreement of medical men would be very different from that which they now obtain by learning some Latin and less Greek.[34]

Many felt that science instruction and training should be moved entirely out of the sphere of education given that the whole environment of the school and university connoted immaturity and dependence, the very opposite of the qualities a successful man and scientist needed to exhibit. 'There are a great number of men', remarked Warren de la Rue, a member of the Royal Society and a chemist and astronomer, 'who would be fully qualified to undertake original research, who might not like to appear to be students at an educational establishment.'[35] Here the distinction between a literary and a scientific education becomes particularly sharp. As Henry Hennessy put it, it meant the difference between cultivating what he termed 'original workers of science' as opposed to 'mere book-men'.[36]

Above all, advocates for science education stressed the unparalleled mental training it gave. As W.B. Carpenter, Registrar of the University of London and biologist, stated to the Commission,

> The great evil in the present system of ordinary school education is the ignoring of that exercise of the mind which science alone gives – the observation of the phenomena of nature, and the application of the mind to reasoning upon those phenomena. There is no branch of school education, putting aside science, which in any way cultivates those faculties. Classics, Maths, and English are all concerned with abstract ideas.[37]

As Rev. J. Challis, Plumian Professor of Astronomy and Experimental Philosophy at Cambridge, told the Commission, a scientific training was the best means, in his opinion, of guiding a boy's mind to intellectual manhood, 'to learn to classify...to sharpen and to mature

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[34] *Report of the Thirty-Sixth Meeting of the British Association for the Advancement of Science* (London: J. Murray, 1867), 32.
[35] *Royal Commission on Scientific Instruction and the Advancement of Science Vol. II*, 305.
[36] Ibid., Appendix VI, 25.
[37] *Royal Commission on Scientific Instruction and the Advancement of Science Vol. I*, 539-540.

the reasoning powers.'[38] Not only did its advocates claim that science offered a more effective mental training and maturing of the intellectual faculties of boys; they also claimed that science was far more open and accessible to the masses than the elitist literary training of the public schools. In this sense, the intellectual manhood a training in science promised was truly democratic. As William Richardson, a machine manufacturer from Oldham, told the Commission in 1872: 'We ought...to get the best man from wherever he comes, even though he is out of the poorest class, if he will make the biggest man we have got, we ought to encourage him, and make him into the biggest man.'[39] Nor was it a training which prepared boys for lives of leisure, but, as we have heard, for lives of hard work in the world. To quote Thomas Coomber, Head of the Bristol Trade School: 'As far as its value as a mental training is concerned, I attach a very high one to [science] indeed, inasmuch as not only is a rigorous treatment demanded to ensure success in the studies that we take up, but the boys themselves form a liking for their work.'[40]

However, it would be wrong to say that science was intended by its supporters only as a training for the mind. The quality of 'manly independence' has already been mentioned. A trait closely connected with this which was often mentioned at BAAS Annual Meetings and before the Royal Commission as the peculiar fruit of a scientific training was a high degree of self-control and openness of mind. As M.E. Grant Duff, President of the Economics and Statistics Section at the BA in 1867, put it, 'a determination to receive every fact with equal favour, a determination to restrain not only all the ordinary disturbing prejudices, but even that love of hasty generalisation which is characteristic of fine intellects, a spirit resigned to collect, one by one, the stories of the temple which a successor may build up, - these are the

[38] Ibid., 277.
[39] Ibid., 110.
[40] Ibid., 409.

marks of a true student of…science.'[41] Humility and selflessness thus were also traits which many thought science particularly to induce in those who studied it.

This is why it was seen by many as providing an excellent training for those wishing to go into the world of politics and public life. On the one hand, such men were to be selfless, dedicating their lives to the service of their country; yet on the other, they were to be daring and manly in the work of the real world. For many within the pro-science lobby, a training in science was a way of avoiding effeminacy of mind. According to Henry Hennessy, whose work we have already cited, in studying science, boys 'enter[ed] upon a struggle wherein great difficulties are to be conquered, but for which they have never been provided with suitable weapons, nor properly exercised in the management of such arms as they may happen to possess.'[42] Military metaphors and references to 'manly exercises' and to school athletics abounded. 'The knowledge acquired by the study of experimental physics is, of itself, of the highest value', argued the Report of the BA Committee for Promoting Scientific Education in Schools (1867) 'while the acquisition of that knowledge brings into healthful and vigorous play every faculty of the learner's mind'; 'Not only are natural phenomena made the objects of intelligent observation, but they furnish material for thought to wrestle with and to overcome, the growth of intellectual strength being the sure concomitant of the enjoyment of intellectual victory.' In this context, science is pronounced to be 'an instrument of mental training of exceeding power.'[43]

It was also held to encourage a sense of personal responsibility for character development and masculine self-fashioning vital in those who were to assume important roles in public life. As the 1867 BAAS Committee Report mentioned, since some public schools such as Rugby and Harrow had introduced systematic scientific instruction, the boys had started to set up their own voluntary Science Associations. According to the report, these

[41] *Report of the Thirty-Seventh Meeting of the British Association for the Advancement of Science*, 135.
[42] *Royal Commission on Scientific Instruction and the Advancement of Science Vol. II*, Appendix VI, 26.
[43] *Report of the Thirty-Seventh Meeting of the British Association for the Advancement of Science*, xlii.

scientific societies, 'which number upwards of 30 members', the report went on, 'meet every ten days at the house and under the presidency of one or other of the masters...We cannot too highly recommend the encouragement of such associations for intellectual self-culture among the boys of our public schools.'[44] This kind of language recalls the evidence of William Ellis, economist, educational reformer, and founder of the Birkbeck School, given before the 1872 Royal Commission. Elementary scientific training, he claimed, was a 'necessary preparation for nobility of character and goodness of conduct' for the ordinary British schoolboy. 'I take it', he continued, 'that, in the wish to give scientific education to [boys] the object is really to improve society.'[45]

Professional Science and the Politics of Distance

Although we have seen that under some circumstances a training in science could be viewed as an ideal training for public life, the dominant view among members of the BAAS and the British scientific community more broadly, was that science as a practice and a profession should know no human boundaries. The independence characteristic of the ideal masculine and scientific character in this period was also expressed geographically by many scientists in terms of an unwillingness to subordinate scientific priorities to any other form of identity or interest including national and imperial loyalties. The oft-discussed 'internationalism of science' was also an important characteristic of its professionalisation in the nineteenth and early twentieth centuries and provides a new context within which to understand frequent references to the world of science as (among other things) a 'republic', a 'parliament' and a 'democracy.'[46] There has been important work undertaken recently in the 'geography of

[44] Ibid., lx.
[45] *Royal Commission on Scientific Instruction and the Advancement of Science Vol. I*, 355.
[46] On Science and republican political metaphors, see Joe Bord, *Science and Whig Manners: Science and Political Style in Britain c. 1750-1850* (Basingstoke: Palgrave Macmillan, 2009).

science'[47] which has taught us much about the processes of circulation and movement, the so-called 'spatial mobility of knowledge'[48] which underpinned the world of British science in the nineteenth and early twentieth centuries. What is sometimes left out of such analyses, however, are the meanings ascribed by the actors themselves to their participation in these networks of science and knowledge.

Indeed, this important characteristic of professional science as boundary-crossing – as transnational, in fact - was noticeable from the earliest years of the British Association. From the beginning, it understood its mission not simply (or even primarily) in national and imperial, but also in international terms. In his inaugural speech, the Association's first president, William Vernon Harcourt, explained that its first priorities were to advance scientific knowledge and, crucially, 'to promote the intercourse of the cultivators of science with one another and with foreign philosophers.'[49] When the BAAS met for the first time in York, Harcourt highlighted the significant number of well-known foreign scientists who had joined them. He declared proudly that this was not simply 'a Meeting at which all the Science of these kingdoms should be convened', but also one at which 'foreign talent and character should be tempted to mingle with our own.'[50] This celebration of foreign collaboration was transcribed into the official constitution of the Association which emphasised the object of encouraging 'intercourse' between British scientists and their counterparts abroad.[51] Special toasts were offered regularly to foreign members at annual meetings as well as to the 'great republic of literature and science throughout the world.'[52] This idea of science as constituting

[47] See, for example, Charles J.W. Withers, *Geography and Science: A Study of the British Association for the Advancement of Science* (Manchester: Manchester University Press, 2010); Peter Meusberger, David Livingstone and Heike Jöns eds., *Geographies of Science* (London: Springer, 2010).

[48] See, for example, Peter Meusberger and Heike Jöns eds., *Spatial Mobility of Knowledge* (London: Springer, forthcoming 2016).

[49] *First Report of the Proceedings, Recommendations, Transactions of the British Association for the Advancement of Science* (York: Thomas Wilson and Sons, 1832), 10..

[50] Vernon Harcourt cited in Basalla, Coleman and Kargon eds., *Victorian Science*, 31-2.

[51] Ibid., 121.

[52] Ibid., 416.

a republic of self-governing equals free from state interference was a powerful one. 'It is often called a *republic*', wrote the famous astronomer, John Herschel to William Whewell in Septemer 1831. 'Science is a common on which everybody has an equal right of occupancy and I trust that every inhabitant would rise up and demolish the first fence that should be erected across a single corner of it.'[53] In espousing internationalism, scientists were also practising what may be termed a 'politics of distance', working to ensure their independence from alternative agendas set by government or by the state, more broadly.

Foreign members even had a role to play in the running of the Association. At the BAAS's third meeting in Edinburgh in 1834, so-called 'Corresponding Members' were elected for the first time: 'foreigners eminent in science, and desirous to cooperate in the objects of the Association.'[54] Just two years later, corresponding members from Sweden, Denmark, Germany, Italy, Switzerland and the USA had been added to the books.[55] The expectation was that corresponding members would regularly be present at Association meetings and compile reports on scientific progress in their own countries. A couple of years later, one of the first members of the BAAS, Roderick Impey Murchison, argued for biennial meetings to enable those who wished to 'be present at foreign reunions in the intervening years.' 'Many persons', he remarked, 'are highly desirous of learning something from their foreign friends.' Murchison found it personally difficult to keep on travelling to European events with his commitments to the BAAS. Indeed, in 1840 he came up with plans, which he shared with Sedgwick and Whewell, for a European scientific festival on a grand scale. It would be held at Frankfurt with Alexander von Humboldt as president.[56]

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[53] John Herschel to William Whewell (20 Sep 1831) cited in J. Morrell and A. Thackeray eds., *Gentlemen of Science: Early Correspondence of the British Association for the Advancement of Science*, 68.
[54] *Report of the Fourth Meeting of the British Association for the Advancement of Science, held at Edinburgh in 1834* (London: J. Murray, 1835), xxvii.
[55] *Report of the Fifth Meeting of the British Association for the Advancement of Science, held at Bristol in 1836* (London: J. Murray, 1837), x.
[56] Ibid., 383.

Perhaps the clearest proof of the strength of this international component of science's developing professional identity in the second half of the nineteenth century is the significant extent to which, despite the rise of the so-called 'Anglo-German antagonism' from the 1860s onwards, relations between the British and German scientific communities continued to flourish. We can examine, for instance, the various articles published in 1871 covering the fortieth anniversary of the foundation of the British Association. According to Paul Kennedy, this is now ten years into the so-called Anglo-German antagonism, and yet together with emotive outbursts about Britain lagging behind Germany in industrial and scientific development, we find just as many respectful comparisons, expressing a desire to emulate the German achievement and to foster scientific internationalism. The BAAS president in 1871, William Thompson, pointed positively to Germany's role as a model for the Association in its early days as well as to the significance of Anglo-German scientific networks in the first years of its existence. One article from the time, published in the *Wesleyan-Methodist Magazine*, emphasised how much of the best work of the Association was international in character. Anglo-German collaborations were highlighted for especial praise. Discussing the ground-breaking research of Norman Lockyer and Edward Frankland in electromagnetic spectroscopy, especially the discovery of helium, the article declared that:

> The scientific value of the meetings of the British Association is well illustrated by the fact that it was through conversation with Plücker at the Newcastle meeting that Lockyer was first led to the investigation of the effects of the varied pressure on the quality of light emitted by glowing gas, which he and Frankland have prosecuted with such admirable success.[57]

The same piece went on to highlight the elaborate international collaborative work taking place in an attempt to apply spectrum analysis to the broader fields of astronomy and chemistry. Not simply 'the chemist and the astronomer have joined their forces', it declared, but 'a devoted corps of volunteers from all nations, whose motto might well be *ubique*, have

[57] Ibid., 811.

directed their artillery to every region of the universe.'[58] Science, as a special field of knowledge and the scientist as a special type of man with a particular character, were also frequently depicted as unbounded by national, political or cultural borders. In the same journal there appeared a laudatory account of the life of John Herschel who had recently passed away. Significantly, Herschel's German background (Friedrich Wilhelm Herschel – his father – had been born in Hanover, moving to Britain when he was nineteen) was in no sense seen as counting against him. Indeed, quoting Horace, the article claimed that the British public had 'learned to see in Herschel, father and son, a praesidium et dulce decus of the precious treasure of British scientific fame.' In an outpouring of scientific internationalism, moreover, the article described the Herschels as belonging not merely to Britain, but to the whole world. They have become, it declared, 'a household word…throughout the whole civilised world…one of the Hundred Wonders of the World.'[59]

A similarly marked tone of scientific internationalism also characterised the press coverage of BAAS annual meetings in the years around 1900 when the Anglo-German antagonism was allegedly at its height together with jingoistic imperialism. An article in the *British Architect* from 1895 praised the BAAS's continued success in securing 'the continued presence and concurrence of the master-spirits of science' from abroad. 'The Association', it continued, 'has justified the views of its founders in promoting intercourse between the pursuers of science, both at home and abroad, in a manner which is afforded by no other agency.'[60] *The Practical Teacher*, covering the BAAS annual meeting at Bristol in 1898, remarked particularly upon 'the many distinguished foreign guests…several coming from various universities in Germany, France, Belgium and Canada.' '[I]t is satisfactory to testify', it continued, 'to the interest displayed in the progress of science in this country by distinguished workers in the same field on the Continents of Europe and America. Very

[58] Ibid., 812.
[59] Ibid., 807.
[60] Ibid., 184.

seldom, indeed, does a meeting take place without interchange of thought between the savants of the different nationalities.'[61]

While we can find evidence of more overtly anti-German articles following the outbreak of the First World War, these accounted for only a small portion of the overall press coverage of scientific activities. Moreover, even those pieces which were published frequently contained evidence of the long-standing relationship between British and German scientists over many decades. One such article appeared in the *English Review* in October 1914. While clearly hostile to German scientists, on closer inspection, it is shown to be the exception that proves the rule. Firstly, the author is complaining about the fact that the newly elected BAAS president (elected, it should be noted, after the official outbreak of war) was a German-born scientist, Sir Arthur Schuster, who was also a naturalised British citizen. His claim that '[h]itherto the British Association has been a British institution in constitution and conduct' and that 'it is strange that it should cease to be so and fall under alien control in this year of all years, the 85th of its existence, when we are at war with Germany'[62] is thus distinctly misleading. It hugely underestimates the long-standing collaboration of Germans (and other international scientists) with British colleagues. It also neglects the fact that Schuster was by no means the first German-born scientist to be elected BAAS president. Carl Wilhelm Siemens had been made president in 1882 which was well within living memory. Nor, as the writer of the article makes clear, was his anger at Schuster's election seemingly shared by the majority of the public back in Britain. He complains that the BAAS General Committee 'thoughtlessly accepted' his nomination in Australia[63] and that 'not a few have raised no public objection to his appearance in this office'.[64] 'In justification', he continues,

[61] 'The Meeting of the British Association at Bristol (1898)', *The Practical Teacher* xix, no. 4 (October, 1898): 185.
[62] 'A Germano-British Association Meeting and Address', *English Review* (October 1915): 328.
[63] Ibid., 328.
[64] Ibid., 329.

'we have had the usual talk of science being international' and this is just days after the declaration of war.[65]

Yet the strongest proof of the continuing vitality of Anglo-German scientific ties can be found in the writer's anger itself. The article is pervaded by a bitter, personal sense of betrayal. Although laced with crude stereotypes of Germans ('Modesty is not a Teutonic attribute' and 'The German is very obstinate'),[66] a close reading demonstrates that it is precisely the fact that German scientists now proudly supporting the German war effort had so recently been, 'the petted guest[s] of English homes' which so angers the writer of the article.[67] When he says, 'Our scientific men have asked us to turn the other cheek to the enemy',[68] he is not speaking incorrectly. The vast majority of statements emanating from the BAAS during the war do strike this tone. Many members wrote sadly of long-standing co-operations being suddenly cut off;[69] and many were still prepared to praise the work of German colleagues and even to defend them to those who attacked and insulted them.[70]

That most articulations of national rivalry and antagonism from the difficult years surrounding the First World War ought not to be interpreted as proof of growing separation between British and German science is made clear in an article written by George Haines back in 1958. Instead, Haines argues, they more accurately reflect anger and shock at many years of friendship betrayed seemingly overnight. As we have heard, those scientists who pointed out the superiority of German scientific education and research, from the 1860s onwards, such as Lyon Playfair, had often themselves spent time at German universities and were intimately connected to German science. 'That German competition in trade would

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[65] Ibid., 329.
[66] Ibid., 329.
[67] Ibid., 329.
[68] Ibid., 329.
[69] See, for example, the comments on the cooperation of England and Germany in the standardisation of measurements for temperature until the outbreak of war in 'British Association Engineering Address by Professor G.S. Hele-Shaw', *British Architect* (October 1915): 191.
[70] Ibid., 192.

sooner or later become a threat to England's industrial supremacy had been long foreseen by British scientists and scholars', writes Haines, 'who had either been trained in German laboratories and seminars, came under the influence of Prince Albert, or discovered for themselves Germany's remarkable educational development.'[71] In terms of professionalisation, moreover, he argues that between 1867 and 1887 'as a result of strong German influence…English scientists ceased to be amateurs, and the leaders in the professionalisation of the sciences were usually either German-trained or conscious of following German leadership.'[72]

Realising that professionalisation itself, at least, in the case of British science, was in part the product of the transnational transfer of knowledge and ideas, teaches us to conceive of professionalisation as more than the simple possession of specialised knowledge and expertise. While British science in the nineteenth century was very keen to make the point that scientists had distinct fields of knowledge which were distinct from traditional literary and theological scholarship, to understand the professionalisation of science in this period, we must also look at the way in which this knowledge and expertise was constructed, how it travelled and how it was deployed in the interests of particular individuals and groups, and to strengthen or undermine particular sets of power relationships. After identifying the ways in which early champions of science within the BAAS sought to distinguish scientific knowledge from existing forms of scholarship, this article went on to examine the strong claims made for science as a unique training for moral and intellectual manhood, as an inculcator of a desirable, rational, and independent masculinity, all designed to bolster the place of science within education and politics, more broadly. Finally, it sought to reconsider a traditional characteristic of nineteenth century science in Britain, namely, its internationalism,

[71] George Haines, 'German Influence upon Scientific Instruction in England, 1867-1887', *Victorian Studies* 1, no. 3 (1958): 215.
[72] Ibid., 236.

as a constituent part of its emerging professional identity. It argued that an international outlook, underpinned by long-standing practices of transnational knowledge transfer and collaboration, fitted well with a view of science and of the scientist as independent and autonomous, free from state interference, or competing loyalties and commitments. In the words of John Herschel, 'Perfect spontaneous freedom of thought is the essence of scientific progress.'[73]

Notes on Contributor

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[73] John Herschel to William Whewell (20 Sep 1831), cited in J. Morrell and A. Thackeray eds., *Gentlemen of Science: Early Correspondence of the British Association for the Advancement of Science*, 67.