The institutionalisation of biology in the British Association for the Advancement of Science, 1866-1894

A institucionalização da biologia na British Association for the Advancement of Science, 1866-1894

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Abstract

Biology, like most scientific disciplines, emerged in the nineteenth century. However, disciplinary institutionalisation processes are not linear; a concept can be proposed, but not develop. Biology originated in the presence of established traditions such as anatomy, physiology, botany, and zoology, which represent the thematic and practical diversity under which it was understood. Based on the records of the annual meetings of the British Association for the Advancement of Science, the process by which biology emerged will be described. We will also recount how the discipline underwent changes throughout the century, where contrasting methodologies and theories were emphasized at different times.

Keywords: biology; natural philosophy; institutionalisation; professionalisation; scientific institutions.

Resumo

A biologia, assim como a maioria das disciplinas, surgiu no século XIX. No entanto, os processos de institucionalização das disciplinas não são lineares; um conceito pode ser proposto, mas não ser desenvolvido. A biologia originou-se em meio a tradições estabelecidas, como a anatomia, fisiologia, botânica e zoologia, que representam a diversidade temática e prática sob a qual era compreendida. O processo do qual a biologia emergiu será descrito com base nos registros dos encontros anuais da British Association for the Advancement of Science. Relatamos também como a disciplina passou por modificações ao longo do século, em que metodologias e teorias contrastantes ganharam evidência em diferentes momentos.

Palavras-chave: biologia; filosofia natural; institucionalização; profissionalização; instituições científicas.

In 1877, one of the great promoters of Victorian science, Thomas Henry Huxley (1825-1895), defined the discipline that unified the life sciences as follows: "The term 'Biology' is [not] simply a new-fangled denomination, a neologism in short, for what used to be known under the title of 'Natural History' …, on the contrary, … the word is the expression of the growth of science during the last 200 years, and came into existence half a century ago" (Huxley, 1877, p.219). Huxley's rhetoric is well known among historians, but his interest in consolidating Victorian society's scientific agenda is also well known. Quotes like the one above show that it is important to remember his interest in unifying the different scientific traditions among British naturalists.

From a youthful age, it was clear to Huxley that if he wanted to influence the British scientific community, there was one forum he had to not only belong to, but be an active participant in: the British Association for the Advancement of Science (BAAS). On 12 July, 1851, Huxley commented to Scottish politician and naturalist William J. Macleay:

> The last time I attended one was at Southampton five years ago, when I went merely as a spectator, and looked at the people who read papers as if they were somebodies. This time I have been behind the scenes myself and have played out my little part on the boards. I know all about the scenery and decorations, and no longer think the manager a wizard.
> Any one who conceives that I went down from any especial interest in the progress of science makes a great mistake. My journey was altogether a matter of policy, partly for the purpose of doing a little necessary trumpeting, and partly to get the assistance of the Association in influencing the Government (Huxley, 1901, p.95).

It is striking to see that, although it is well known that the term "biology" emerged in Germany and France in 1802, the history around the institutionalisation of disciplines is vast, as Joseph Caron (1988, p.223) points out: "The number and variety of turning points identified as ostensibly crucial to the constitution of the science of 'biology' is quite surprising." Considering the range of approaches involved in the study of the living throughout history, there is a lengthy list of candidates who could be ostensibly identified as the "authentic" founders of the discipline, and in each case, an associated tradition or methodology is believed to have influenced the understanding of living phenomena (p.223-224). Caron traces the growth of British biology during the nineteenth century, providing details of the fundamental role played by Huxley in that process. Still, while he does not focus on the role played by meetings of the British Association for the Advancement of Science, he does briefly mention the turbulent start of Section D when it was renamed "Biology" in 1866 (Caron, 1988, p.250-251), an event that will be discussed in more detail later in this paper.

When discussing the history of biology, we must refer to the general accounts that various authors provided, especially at the beginning of the twentieth century. One point worth noting is that some of these early histories were written by non-English-speaking authors and later translated into English. Examples are authors such as the Czech biologist, historian, and philosopher Emanuel Rádl (1873-1942), and his *Geschichte Der Biologischen Theorien Seit Dem Ende Des Siebzehnten Jahrhunderts* (1905), and *Geschichte Der Biologischen*

Theorien. Geschichte Der Entwicklungstheorien In Der Biologie Des XIX. Jahrhunderts (1909), published in English in 1930.

Another notable example is the history written in Swedish by the Finnish-born, Swedish geologist and Arctic explorer Erik Nordenskiöld (1872-1933). Published in three volumes between 1920 and 1924 under the title *Biologins Historia*, it was published in English in 1928 with a second edition in 1935. A common view – also shared by other authors, such as Singer (1989) and Serafini (1993) – is to consider Darwin and his work as the turning point of modern biology, as part of a long history dating back to antiquity.

The developments, or "speculations," which took place throughout the eighteenth century and led to the appearance of biology in the following century are outlined in Philip Ritterbush's work. In this sense, Ritterbush (1964, p.186) ventures to claim out that the first modern biologist was John Hunter (1728-1795), who understood the life sciences through: "Pursuit of a theory of life, sophistication in experimental method, and the study of comparative anatomy." One point that both Ritterbush himself and Phillip Rehbock will emphasise is the role of German idealism, through *Naturphilosophie*, in the development of biology during the first half of the nineteenth century. Rehbock (1983) provides a broad overview of the specific case of British biology, particularly with respect to Robert Knox (1791-1862), Richard Owen (1804-1892), and Edward Forbes (1815-1854) as exponents of "philosophical naturalism." As will be seen below, the influence of German biology will be of vital importance to British biology.

One of the historical accounts that has best described the discipline throughout the nineteenth century is William Coleman's work (1977). In particular, he refers to three subjects that shaped the main discussions that took place in Europe around biology: form (understood from cell theory and the development of individuals), function (from the idea of the "animal machine"), and transformation (with particular emphasis on the role of Darwin's ideas). More recently, in historiographical terms, the history of biology has focused on reconstructing localised episodes, both geographically (Alberti, 2001, 2005; Kraft, Alberti, 2003) and theoretically (Morgan, 1980; Kraft, 2004; Erlingsson, 2009, 2013; Button, 2018). This paper intends to follow a historiographical line that, beyond seeking to understand biology in a broad sense, will attempt to reconstruct a scientific practice that emerged as part of the interaction between scientific and political interests in a specific geographical context, namely Great Britain in the second half of the nineteenth century.

This paper then aims to describe the discussions related to biology within the scope of the BAAS annual meetings, from when they began to be held in 1866 until they were halted in 1894. The first part serves to briefly present a discussion on understanding the process of institutionalisation, emphasising how such processes occurred within the BAAS. Next, both the Association's importance to British science and its organisation is explained in order to understand the decisions that determined which scientific endeavours were defined as legitimate. Finally, biology is examined as a case study, starting with Thomas Huxley's initial impulse and the renaming of Section D as Biology in 1866, until its "disappearance" in 1894.

Institutionalisation and disciplinary identity

In his account of the history of biology in the life sciences, Caron (1988, p.274) puts forward three criteria on which to base a conclusion of whether or not a field of knowledge can be considered a discipline as such: "It is necessary to document (a) existence of a distinct scientific content; (b) evidence of scientific debate about the existence of the science and/or the postulates of the science; and (c) traces of the social processes informing and shaping the institutionalisation of biology." From the 1850s to the 1890s, there was a strong movement that led to the creation and consolidation of a new synthetic discipline, biology, which in general terms meets the three criteria established by Caron. However, unlike the biologies that emerged elsewhere, such as in France or Germany, the British proposal was different: "A further particularity marks this science: it has solely an introductory and elementary content. No research tradition is produced under the rubric 'biology', at this time" (Caron, 1988, p.244).

An idea that complements what Caron has said is the notion of "disciplinarity" put forward by Jan Golinski (1998, p.69): "By this is meant not simply the reconfiguration of the scientific disciplines … but also the embeddedness of this process in larger formations of power." In turn, this proposal is closely related to that of Michel Foucault (1995), who understands disciplinarity as a form of control, not necessarily the sum of absolute truths. Thus, disciplines are "apparatuses of power that function to produce knowledge about the human world they bring under control" (Golinski, 1998, p.71).

Institutionalisation goes hand in hand with an agreement within a community, which regulates individuals' behaviour. As Golinski (1998) points out, to speak of a "discipline" reminds us of its ambiguity, since in addition to seeking to control behaviour, it is also a form of instruction. As will be seen below, the dynamics under which BAAS functioned in the nineteenth century lead us to understand that the consolidation of a field of knowledge (a discipline) resulted from political arrangements, not necessarily the consolidation of a scientific agenda.

The institutionalisation of a discipline is a process of difficulties. There cannot be a "uniform" process by which a field of knowledge is consolidated. On the contrary, it is increasingly a process that we must understand from local conditions, both geographical and temporal, and from continuous discussions. Speaking of "British biology" should not sound strange, beyond the fact that we intend to understand a scientific practice more concretely with such adjectives. However, geographic adjectives referring to countries are not enough. Even within each country, it is possible to refer to specific geographical regions or specific research traditions. Further, we can focus on regions or cities and the concrete spaces where scientific practices occur (universities, laboratories, and associations).

David Cahan (2003, p.292) reminds us of the scarcity of existing studies on nineteenth-century scientific institutions, despite the acknowledged importance of many of them, because of "the difficulty of characterising institutions and communities in a way that provides the historian with a useful means for pursuing systematic analysis. Placing their study within some sort of conceptual framework is no easy matter" (p.293). Cahan also mentions that scientific communities and institutions are those in which individuals

share similar cognitive interests and values, which help to consolidate a social identity. As Charles W.J. Withers has pointed out, BAAS was a space within Victorian science in which diversity, both thematic and geographical, was the rule.

In the case of BAAS as an association, changes were moderated by factors typical of "national" scientific practice – often embodied in the work being done in London – combined with the interests of the cities where the annual meeting of the Association was held. An example of the importance of the local aspect of BAAS meetings was the election of both political and scientific representatives from each city, and their greater local media impact. Among the politicians, there were such renowned cases as the Prince consort, Prince Albert of Saxe-Coburg and Gotha (1819-1861), at the meeting in Aberdeen (1859), or Walter Montagu Douglas Scott, the fifth Duke of Buccleuch and seventh Duke of Queensberry (1806-1884), a local aristocrat from Dundee (1867) with a markedly conservative outlook (Rodríguez-Caso, 2018, p.182-183). In other words, "scientific" decisions depended on the political interests of the moment. As for local scientists, it was common for members of the Philosophical or Antiquarian Societies, for example, to participate both in the organisation and with presentations. One of the characteristics of the role of BAAS in the Victorian era was to facilitate the confluence in the same space not only of scientists from different fields of knowledge but also of "amateurs" and the emerging "professionals." From its beginnings, in York in 1831, mobility through the provinces was privileged, since "The BAAS was concerned always that science should have civic benefit" (Withers, 2011, p.116), and this is something that was reflected in local participation, especially of scientists who were often not so well known at the national level.

What was the importance of a discipline being recognised as a section? In the words of Morrell and Thackray (1981, p.451): "The sections not only served as forums for clashes between particular cliques and scientific views; they also provided a context in which the devotees of different disciplines could fashion a sense of common identity." However, getting new spaces recognised was not a simple task. As will be seen below, numerous filters had to be passed through, and beyond scientific interests, political manoeuvring was vital.

Victorian science and the role of BAAS

The very idea of "Victorian science" and its influence on the general development of science is continuously discussed in numerous academic works. What is often overlooked is that: "There existed a great popular interest in science, and it was deliberately fostered by scientists and science journalists, who worked to bring the excitement and results of scientific discovery and endeavor to laymen" (Basalla, Coleman, Kargon, 1970, p.3) One way of assessing the relevance of the BAAS meetings and discussions is through their significant presence in the press, both positive and negative. Newspapers such as *The Times* and the *Athenaeum* devoted entire pages to reproducing the presidential speeches and a selection of the presentations that took place during the meeting. Others, such as *Punch*, presented harsh criticism of their members through satirical caricatures. If we want to evaluate the importance of BAAS within British culture and politics, we can exemplify it with sir John Lubbock's presidential speech in 1881. At that time, Lubbock (1834-1913) was a member of

a distinguished family of bankers and served as Liberal MP for Maidstone, the county town of Kent. In his own words, he described the increasing importance of the association over the years, even over other bodies such as the Royal Society: "The history of the Association, however, is really the history of science, and I long shrank from the attempt to give even a panoramic survey of a subject so vast and so difficult" (Lubbock, 1860, p.2).

One of the most common ways of describing the association was as the "parliament of science," which provides a basis for explaining its functioning in political and social terms. As mentioned earlier, from the beginning of the Association, the union of science with political and economic interests was evident. The founders of BAAS were aristocrats, and the members in decision-making positions had clear links to political power. As Morrell and Thackray (1981, p.19) remind us, after its founding, "[i]t quickly assumed a central role in early Victorian culture. Its members included earls, marquises, and viscounts, while politicians of the calibre of Sir Robert Peel and Lord Palmerston were pleased to accept office within it; the Prince Consort himself was President in 1859." In the same space, individuals of the most diverse professions were brought together: clergy, physicians, members of the military, engineers, naturalists, and gentlemen of leisure. Over the years, it became the main forum for promoting the professionalisation of scientific practice in Great Britain, a situation that paralleled the emergence and consolidation of new disciplines. It is essential to recognise the conjunction of interests that led to decisions on the opening and closing of sections:

> The British Association was run by an oligarchy, presiding over a severely limited democracy. As the parliament of science prospered, the power of its inner cabinet was bolstered by the various changes which were made in the organisation of the Association. At the same time the ruling elite of Gentlemen of Science secured the enthusiasm and co-opted the services of many leaders in the wider scientific clerisy. The result was the creation of an institution with impressive power to make knowledge, by the giving or withholding of its blessing, its authority, and its resources (Morrell, Thackray, 1981, p.449).

As mentioned earlier, the organisation proposed by the association laid the foundation for the operation of other scientific organisations. The initial proposal to found BAAS to revitalise British science was valuable because of its objective of bringing not only science, but scientists themselves, closer to the public. One of the Association's primary functions, given its peripatetic nature, was to serve as a space for discussion and, at various times, consolidation of different fields of knowledge. The role of BAAS within Victorian science was as a kind of "experimental field" concerning what was happening within the scientific community in general. For a week, bringing together the great scientists of the time with others of lesser renown led to discussions that otherwise were unlikely to take place. The provincial character of BAAS differed from other societies, bringing discussions about science closer to a diverse public, including women.

A crucial part of BAAS was its organisation: the way science was presented and organised. Although there was some flexibility between 1831 and 1835, from that time onwards, the sections were consolidated, which "not only served as forums for clashes between particular cliques and scientific views; they also provided a context in which the devotees of different

disciplines could fashion a sense of common identity" (Morrell, Thackray, 1981, p.451). The sections, identified by letters, represented the fields of knowledge recognised by the gentlemen of science, and at the same time, they reflected the strength of London societies. For example, in the 1860s, there were: A for mathematics and physics, B for chemistry, C for geology, D for botany and zoology, E for geography and ethnology, F for economics and statistics, and G for mechanical sciences (BAAS, 1867). This organisation was not static, but changed according to the interests and discussions generated in British science, as will be seen later regarding sections D and E. In any case, the change of name went hand in hand with an epistemic change, as when in 1865 section E dropped ethnology or in 1866 section D became biology.

A strength of the Association was to show science in a unified way, a point emphasised by Pickstone (2005) regarding British science during the nineteenth century, a situation that did not prevent the existence of new sections or sub-sections (departments from 1865 onwards) over the years. This continuing "fragmentation" was part of the growing importance of science in Victorian society. Given this importance, another fundamental element is to understand who the decision-makers in the Association were. From the beginning, the gentlemen of science aimed to control everything that happened within the Association: the meetings, the reports, the money. Committees were set up to deal with each of the activities, and there were both permanent and non-permanent members. Among the former was the "scientist of the empire" Sir Roderick I. Murchison (1792-1871), aristocrats such as the Duke of Devonshire and the Duke of Argyll, and renowned men of science such as John Herschel (1792-1871) and Richard Owen (1804-1892). The committees in charge of decisions within each section rotated and changed every year, at which time a president, vice-president and secretaries were elected. In the case of the departments, a president and a secretary were also chosen. These decisions were made by the Association president, a position of importance in political and scientific terms, and the General Committee, composed of those who had published at least one scientific paper (Barton, 2018, p.249-251). Through his annual speech – published in full in the Association's reports as well as in much of the press in both London and the province – and the election of committee members, the president laid an essential foundation for what BAAS wanted to show to Victorian society each year (Basalla, Coleman, Kargon, 1970). As Ruth Barton (2018, p.251) notes: "There were two loci of power in the association, the trustees and semi-permanent officers who had long-term power, and the president and section presidents who had great influence over their particular meeting."

This organisation allowed specific fields of knowledge to be promoted to the detriment of others based on individual and group interests. Despite its popularity in Victorian Britain, phrenology never was recognised as a science. The same situation occurred with medicine, which until well into the twentieth century was recognised, although under the banner of physiology. The main reason for rejecting any field of knowledge as "legitimate" was that, given the hierarchy that had been initially established, with the physical sciences as the most important, the life sciences were not held in high esteem. Also, another factor to consider was "popularity" among the public, that is, fields such as phrenology or medicine were related to radical politics, which in the eyes of the ruling aristocracy in

the Association were not useful when seeking to attract public attention and, especially, funding from the government.

The role of BAAS in Victorian science can be summarised as follows: to promote not only the organisation of science but to consolidate the professionalisation of science within British society; to become one of the main spaces for informal education, through conferences and exhibitions; and above all, to allow all those interested in science to come together in one space, to become true "arbitrators of knowledge;" "The concerns of the British Association for the Advancement of Science affected the whole spectrum of Victorian scientific activity. The Association represented the aspirations and revealed the problems of scientists who laboured to integrate science into Victorian thought and society" (Basalla, Coleman, Kargon, 1970, p.20-21).

Victorian biology

Biology had a disparate history since the beginning of BAAS. It must be clear that what happened in BAAS, as was said before, reflected what was happening in London. The force that guided the beginning of that history was Thomas Henry Huxley. His influence on disciplines and education and the intention to place science at the forefront of Victorian society has not always been recognised. However, as Joel Schwartz points out, his place was well earned:

> Huxley became a one-man industry, with his days filled with scientific research and teaching, and the rest of his hours devoted to lectures, meetings, and writing in order to advance the interests of professional scientists and earn extra income to support his family. His support for evolution was so effective and enthusiastic that, although he offered few original ideas in this area – examination of the minute structure of organisms appealed to him more – his public image has been most associated with Charles Darwin and evolution. Huxley's career as a populariser of science and defender of evolution was a by-product of his interest in defending the emerging professional status of scientists. The decisions he made and the rhetoric he employed were shaped by this ambition (Schwartz, 1999, p.344).

Huxley's efforts to promote science were combined with those of scientists such as Herbert Spencer (1820-1903), Lubbock, Joseph Hooker (1817-1911), and John Tyndall (1820-1983), among others, as part of what was known as the "X-Club," which existed from 1864 to 1892 (Barton, 1998, 2003). An essential point for promoting science and its place in society was taking part in scientific societies and making the public aware of scientific practices and their benefits. Publications were essential, and given the rapid pace at which knowledge was generated, journals became the primary source of information. *Nature*, published from 4 November 1869, would become that source, the medium that would allow science, at least the vision defended by the X-Club, to be placed at the centre of the discussion (Kjærgaard, 2002, p.248-249). It is therefore not surprising that Huxley wrote the first article published in *Nature*, an introduction inspired by the work of the German poet Johann Wolfgang von Goethe (1749-1832), to emphasise again that it was through science that the mysteries of Nature could be unravelled (Huxley, 1869, p.9-11).

This interest in nature, reflected in his advocacy of the new discipline, "biology," was part of Huxley's efforts to bring it into the laboratories – and, therefore, to distance it from the field – in order to give it a more significant scientific character and to have it transmitted in schools (Desmond, 1997, p.419). Scientific naturalism was the framework in which professionalisation was promoted. It was the way to establish an alternative to the dominant view: the natural theology defended in academic spaces such as Cambridge and Oxford. The life sciences would be the spearhead of this movement towards change, and as we will see, BAAS became a real battleground in the struggle to legitimise "authentic" science. From the 1850s to the 1890s, there was a strong movement that led to the creation and consolidation of a new synthetic discipline, biology, an idea that had Darwin's proposal at its core, as Lubbock (28 Nov. 1860) pointed out to Darwin himself: "Such remarks as yours just make the difference whether a memoir does or does not advance Biology." However, unlike the biologies that emerged elsewhere, such as France or Germany, as already noted, the British proposal was different.

Several naturalists in London defended alternative views on the study of nature. The most remarkable intellectual dispute regarding the nascent discipline of biology in Britain was between Huxley and the anatomist Richard Owen (1804-1892). Both authors clashed in the "Hippocampus Controversy" at the BAAS meetings between 1860 and 1862. The dispute was about the anatomical relationships between apes and humans, specifically the development of brain structure. Despite the recognition Owen obtained in the 1850s, Huxley was a clear winner, not only because of the extensive evidence he presented from the work of both British and European anatomists, but also because of the vigorous campaign he organised against Owen together with other naturalists (White, 2003, p.51-58; Rupke, 2009, p.182-208).

Huxley would have the honour of promoting the new discipline, biology, as a union of anatomy and physiology, a situation reflected in his Hunterian lectures between 1856 and 1858. However, as the years went by, he integrated a new subject into the range of biology, which would be evolution, based on Charles Darwin's proposal and his well-known work published in 1859, *On the origin of species*. Note, however, that Huxley was sceptical of the validity of the mechanism of natural selection, and his interest focused on evolution as the naturalistic mechanism par excellence to explain nature. Although Huxley's synthetic proposal is the one that would achieve institutional consolidation, within the X-Club, other members proposed different views on the new discipline. The most notable case was that of the polymath Spencer (1864), with his *Principles of biology*, which is best known for being where the expression "survival of the fittest" was coined. However, his proposal was unsuccessful, even among the X-Club members themselves, apparently because he was not radical enough in his approach to the new science. In Hooker's opinion, Spencer's reasoning was to describe biology with the language of physics (Barton, 2018, p.219), which led to a vague vision.

As Adrian Desmond points out, there was no full consensus within the X-Club. As an illustration, he draws on the example of physiologist William B. Carpenter (1813-1885) to discuss the diverse interests in biology: "Carpenter illustrates how the value of authority in biology depends on the contingent nature of negotiation and is bound up in the

construction of temporary images of orthodoxy and heterodoxy. This of course is what the Xs were negotiating: the legitimacy of initially suspect secularist biologies" (Desmond, 2001, p.6). In the end, the perspective raised by Huxley and some other members of the X-Club, such as the chemist Edward Frankland (1825-1899) and the physicist Frederick Guthrie (1833-1886), was based on the efforts expended in South Kensington, the place where British biology formally began. It is worth remembering that numerous cultural and scientific spaces were consolidated in that area of London, such as the Royal College of Chemistry (later Imperial College), the Victoria and Albert Museum, and the Natural History Museum, among others.

According to the X-Club, "biology was a product of the socially and culturally radical forces that historians have described in connection with fields such as phrenology during the early 1800s and then the debate about science and religion later in the century" (Renwick, 2014, p.114). Therefore, the inclusion of discussions about biology within BAAS was not accidental, since "[b]iology must be seen as a publicist science *par excellence*" (Caron, 1988, p.253), and the forum provided by the Association was unbeatable in terms of publicity.

Biology and BAAS

Now, the history of the sciences of life was not simple, despite their existence since the beginning of BAAS. The importance of the physical sciences in developing the idea of science itself in England made the life sciences, or natural sciences, a case for discussion for BAAS. In the words of Morrell and Thackray (1981, p.491):

> The sciences of geology, botany, and zoology were innocent of mathematical connotations. Nor did they afford the sort of discipleship apparent among the chemists. The comparatively strong showing of reports on subjects that belonged in Sections C and D reflects instead the interest of the Association's managers in internationalism, imperialism, and natural theology. If topics which fell under these rubrics were deliberately cultivated, others were tolerated as being congruent with the managers' concerns. … All were compatible with the developing 'Humboldtian' interest in *physique du globe*.

Life sciences were present in BAAS from the beginning. From 1832 to 1834, a committee was established to incorporate zoology, botany, physiology, and anatomy. However, at the 1833 meeting in Cambridge, a separate committee was established for physiology and anatomy, whose interests were irregularly focused on in Section E from 1835 to 1865. Zoology and botany remained together from 1835 to 1847, and beginning in 1848 physiology was included again. From 1866 onwards, there was a formal proposal to rename Section D "Biology," with the intention of incorporating all areas of knowledge about life into one single space (BAAS, 1895). To achieve this, Huxley undertook a convincing effort that occurred in parallel with his efforts in London. The first step was taken when he was appointed president of Section D, Zoology and Botany, at the Cambridge meeting in 1862. His inaugural address, delivered on 2 October, was entitled "The Condition and Prospects of Biological Science." Huxley defined biology as the science of investigating nature and its

relation to organisms and divided it into four sub-areas: (1) morphology, which included development, anatomy, and histology, as well as taxonomy; (2) physiology, or the study of life functions; (3) distribution, both in time (palaeontology) and space (geographical distribution); and (4) ætiology, or the laws of origin and variation. On this last point, Huxley stressed the importance of Darwin's proposal, even though he did not agree with all of his results. The address concluded with a call for biology to be recognised as a legitimate discipline of study, especially in universities (Collingwood, 1863, p.243-244).

This first effort by Huxley continued over the next few years with the support of the X-Club. That support can be seen in the active participation of other members in the organisation in promotion of biology. At the Birmingham meeting in 1865, an agreement was finally reached to rename Section D from "Zoology and Botany" to "Biology" (BAAS, 1866, p.43). The president of this first Biology section would be Thomas Huxley himself, and he decided to open two departments, Physiology under the leadership of physiologist and anatomist George Murray Humphry (1820-1896), and Anthropology under the presidency of Alfred R. Wallace (1823-1913). The latter was also the first time that a space dedicated to discussions on the "sciences of man" was formally opened in the Association (Rodríguez Caso, 2018), since in previous years human-related studies had been grouped in Section E, alongside geography (Withers, 2010, p.165-177). Other X-Club members saw the presence of both Huxley and Wallace as a breakthrough in their agenda (Hooker, 4 Sep. 1866).

In the early years, the role of the X-Club, or people related to it, was well known in the endeavour to consolidate this space, such as the presidencies of George Busk (1807-1886), George Rolleston (1829-1881), who was Huxley's friend and protégé, Edwin Ray Lankester (1847-1929), who was Huxley's student, and John Lubbock. Although it is true that, given the Association's dynamics, the search for balance was continual, we can see in Table 1 that diversity was always the rule.

Table 1: Summary of presidential addresses (and topics covered) in Section D, Biology, the presidents, and venues for meetings from 1866 to 1894

Year	Section D, President	City	Speech	Main themes in speech
1866	Thomas H. Huxley	Nottingham	Yes (not published in the Report)	Biology as a synthesis, science education
1867	William Sharpey	Dundee	Yes	Anatomy, physiology
1868	Rev. Miles Joseph Berkeley	Norwich	Yes	Lower organisms, physiology, botany, inheritance, maternalism
1869	George Busk	Exeter	Yes (Address by Spence Bate)	Geology, plant distribution, marine zoology
1870	George Rolleston	Liverpool	Yes	Professionalisation and experimental laboratories, science education, museums, spontaneous generation, natural history of humanity
1871	Allen Thomson	Edinburgh	Yes	Recent history of the section, histology and embryology, science education, criticism of "extra-scientific" explanations
1872	John Lubbock	Brighton	Yes	Public education, importance of Darwin's ideas in the understanding of organisms

Table 1: Summary of presidential addresses (and topics covered) in Section D, Biology, the presidents, and venues for meetings from 1866 to 1894 (cont.)

Year	Section D, President	City	Speech	Main themes in speech
1873	George James Allman	Bradford	Yes	Biology and scientific method, anatomy, development, taxonomy, distribution and evolution.
1874	Peter Redfern	Belfast	Yes	Cell theory, anatomy, physiology
1875	Philip L. Sclater	Bristol	Yes	Distribution and zoology
1876	Alfred R. Wallace	Glasgow	Yes	Geology, evolution, colouring, antiquity and origin of humanity
1877	John Gwyn Jeffreys	Plymouth	Yes	Deep-sea Mollusca
1878	William Henry Flower	Dublin	Yes	Classification and Linnæus, zoology, botany
1879	St. George Mivart	Sheffield	Yes	Natural history and Buffon, transformism, vitalism, physiology, psychology
1880	Albrecht Carl Ludwig Gotthilf Günther	Swansea	Yes	Museums (provincial, national, natural history), zoology, botany, mineralogy
1881	Richard Owen	York	Yes	History of the Natural History Museum, London
1882	Arthur Gamgee	Southampton	Yes	Physiology, embryology
1883	E. Ray Lankester	Southport	Yes	Professionalisation of biology in Europe, cellular theory and experimentation, public funding for scientific practice
1884	Henry Nottidge Moseley	Montreal	Yes	Marine biology, physiology, zoology
1885	William C. McIntosh	Aberdeen	Yes	Phosphorescence of marine animals
1886	William Carruthers	Birmingham	Yes	History of botanical species, geology
1887	Alfred Newton	Manchester	Yes	Palaeontological discoveries, evolution (Darwin and Wallace), species, natural selection, survival of the fittest, geographic distribution
1888	William Turner Thiselton Dyer	Bath	Yes	Botany, taxonomy, heredity and Darwin, Lamarckism, physiology
1889	John Scott Burdon-Sanderson	Newcastle-upon-Tyne	Yes	Physiology, chemical processes, the living, vitalism
1890	Arthur Milnes Marshall	Leeds	Yes	Embryology, recapitulation theory, natural selection
1891	Francis Darwin	Cardiff	Yes	Botany ("movements"), morphology, physiology
1892	William Rutherford	Edinburgh	Yes	Physiology, colour sense
1893	Rev. Henry Baker Tristram	Nottingham	Yes (Read by W.H. Flower)	Natural history, field naturalists, migrations, mimicry
1894	Isaac Bayley Balfour	Oxford	Yes	Brief history of the section, forestry

Source: The information was obtained from individual BAAS reports published in 1866-1894.

The changes in the new Biology section can be assessed in two ways: from section addresses and the topics covered in the presentations. In the case of the addresses, it should be clear that it was not a simple recounting of scientific events, but rather the public's opportunity to learn essential information about the topics covered by each section. In a sense, the president in charge could even set an agenda to address the topics.

Regarding the addresses, there are some points to note. Traditionally, they were conceived as an introduction to the most significant achievements in biological issues over the preceding year. However, some issues were given higher priority, depending on the president's background. For example, in the early years and as part of the agenda to

increase professionalisation – and visibility – promoted by Huxley and the X-Club, one of the most frequently addressed issues was education, not only of in general science, but more specifically of biology.

One of the most striking points in these speeches is the role of Darwin's ideas. Contrary to what is claimed by historiographical currents that defend the "Darwinian revolution", Darwin and his ideas had a minor impact. Only those presidents who already had some connection with Darwin beforehand sought to emphasise the importance of Darwin's interpretation in the new biology. In the 1866 inaugural address – which was not published in full in the annual Report – Huxley sought to reinterpret physiology based on Darwin's ideas, as he believed there had to be a reorientation towards two fundamental questions, an inquiry into forms and an inquiry into forces and causes (The British…, 25 Aug. 1866).

Sometimes, the response to the address was not necessarily positive, as can be seen in Hooker's account to Darwin of the Liverpool meeting in 1870. The public's reception of Huxley's presidential address was not the best since "the general public could not follow the subject, and were profoundly ignorant of what he was driving at" (Hooker, 24 Sep. 1870). An analogous situation arose with Rolleston, whose speech was heavily criticised in the local press (Hooker, 24 Sep. 1870).

The generality of the discourses shows the diversity within biology at that time, both theoretically and methodologically. Rather than promoting the unification of criteria regarding the appropriate methodology for practising biology, the presidents focused on discussing what they thought would be relevant to the public. This perspective depended on the professional training of each and on the venue. For example, if a port city hosted the meeting, the focus was on fisheries or marine biology issues. If there was a naturalist tradition in the city, such as botany, the local history of plant scholars was discussed.

The change of name, or rather, the return to the original names, which finally occurred in 1895, can be explained by what was said by the presidents of the "new" sections. The president of the Botany Section, William Turner Thiselton Dyer (1843-1928), then director of the Royal Gardens, Kew, raised the issue of the relationship between the biological disciplines:

> And though there has been from time to time some difference in the grouping of the several biological sciences, the two great branches of biology have only now for the first time formally severed the partnership into which they entered on that occasion. That this severance, if inevitable from force of circumstances, is in some respects a matter of regret, I do not deny. Specialisation is inseparable from scientific progress; but it will defeat its own end in biology if the specialist does not constantly keep in touch with those fundamental principles which are common to all organic nature (BAAS, 1895, p.836).

On the other hand, the president of the Zoology Section, William Abbott Herdman (1858-1924), began his speech this way:

> This year, for the first time in the history of the British Association, Section D meets without including in the range of its subject-matter the Science of Botany. Zoology now remains as the sole occupant of Section D – that 'Fourth Committee of Sciences,' as it was at first called, more than sixty years ago, when our subject was one of that group

> of biological sciences, the others being Botany, Physiology, and Anatomy. These allied sciences have successively left us. … Our subject-matter has been greatly restricted in scope, but it is still very wide … It is to be hoped that this section will always retain that general and comparative physiology which is inseparable from the study of animal form and structure (BAAS, 1895, p.698).

As can be seen from what was said by both presidents, biology "disappeared" nominally from the Association's organisation. However, in practice, recognition of its unifying character was maintained, while recognising a common phenomenon within scientific practices: increasing specialisation.

Table 2 caption: Number of presentations by general topics

Year	Botany	Zoology	Anatomy, Physiology	Anthropology	Other
1866	8	16	19	30	9
1867	16	15	25	0	2
1868	20	11	25	1	4
1869	9	10	12	28	4
1870	11	2	15	26	14
1871	14	16	22	32	6
1872	9	17	13	37	0
1873	12	8	20	15	0
1874	14	11	13	23	0
1875	13	7	11	30	0
1876	9	5	29	27	7
1877	12	4	12	22	1
1878	9	18	11	24	0
1879	5	14	9	29	1
1880	9	18	11	24	0
1881	7	16	13	34	5
1882	0	5	15	14	10
1883	6	18	5	19	10
1884	3	13	33	0	8
1885	14	44	20	0	5
1886	13	12	22	3	12
1887	21	25	21	0	21
1888	9	16	6	0	15
1889	21	17	11	1	13
1890	18	11	8	0	10
1891	11	12	5	0	13
1892	20	35	10	0	13
1893	5	14	9	0	10
1894	22	18	5	0	14

Note: In 1867 and 1868, anthropological issues were discussed at meetings parallel to the Association's. From 1884 onwards, Anthropology was given its own space, Section H. The Other category includes works related to science education, museums, critiques of Darwin's ideas, "ecological" approaches, economics, and "psychology."

Source: The information was obtained from individual BAAS reports published in 1866-1894.

However, if we refer to Table 2, we can see how the section was organised over the years in terms of presentations and topics. The "traditional" fields of knowledge – botany, zoology, anatomy, and physiology – maintained their hegemony, with the largest number of presentations. The case of anthropology is remarkable, and reflects the enormous interest in the "sciences of man" in the Association. The D and E sections dedicated to these issues tended to have the largest audiences, especially women, according to Withers (2011, p.114). Except for 1867 and 1868, when anthropological topics were dealt with in parallel meetings, discussions on man were the majority until 1884. From that year onwards, the Association consolidated a truly exclusive space for anthropology – that is to say, not linked to other fields of knowledge – namely Section H (Sillitoe, 2005).

The point here is not just the number of presentations in a particular area, but also the approaches taken. Botany and zoology referred to discussions on the geographical distribution of organisms, the results of collection both within Britain and abroad. Descriptive approaches, typical of natural history, remained predominant in both areas. As for anatomy and physiology, areas dominated by physicians and surgeons, the methodologies were like those developed years earlier. Furthermore, despite the discussions, promoted by figures such as Huxley, on incorporating new theoretical views – namely, Darwin's ideas and the possibility of understanding the origin of organisms and the phenomena of inheritance from novel points of view – there were exceptions. For example, in 1866, the main discussion on Darwin came when James Hunt (1833-1869), the president of the Anthropological Society of London, presented "On the principle of natural selection applied to anthropology, in reply to views propounded by some of Mr. Darwin's disciples," which received harsh criticism from both Huxley and Wallace. Another notable example was the presentation by D'arcy W. Thompson (1860-1948), entitled "On some difficulties of Darwinism," in which he questioned the efficacy of the "struggle for existence," as forms and other modifications in organisms were the result of the "laws of growth" (Biology…, 1894, p.435).

Areas such as palaeontology were traditionally included in Section C, Geology, with exceptions over the years, included in botany or zoology, to explain the origins of organisms. In 1894, there were discussions such as that of Henry Fairfield Osborn (1857-1935) on the fossil records or the morphology of the remains of Archæopteryx.

As for what is referred to here as "Other," this category includes work that did not fit entirely into any of the other categories, mainly because it presented methodologies or approaches that differed from natural history or anatomy and physiology in the traditional sense. It is striking that the largest number of "different" submissions before the mid-1880s was when Huxley himself was president of BAAS in 1870. Moreover, although there may be thought to have been a "balance" in the number of presentations at each meeting from 1886 onwards, the topics concentrated on the new theoretical trends that emerged towards the end of the century: the role of museums in popularising science, heredity, micro-organism studies, embryology, cell theory, marine biology, mathematical approaches to biology, pharmacology, physico-chemistry, fisheries and economics, mycology, and critiques of Darwinism.

One of the most notable figures in disseminating Darwin's ideas – which were also his own – was Wallace. His presentations, such as "On reversed sexual characters in a butterfly"

(1866), "On bird's nests and their plumage; or the Relation between sexual differences of colour and the mode of nidification in birds" (1867), and "On malformation from pre-natal influence on the mother" (1893), and his continued participation in discussions, are evidence of the localised impact that evolutionary issues had.

This search for a disciplinary identity for biology, which could be claimed from what was said by the Section presidents or by the agreements that resulted in the presentation of specific topics, was not successful. The traditions of zoology, botany, anatomy, and physiology, strong in other learned societies and universities, meant that Huxley and the X-Club's efforts, though successful in London, did not produce the same result in the Association.

Final considerations

Biology within BAAS was short-lived, at least in name. However, this is not something that should come as a surprise. The development of biology at the Association's meetings confirms the dynamic already described by Caron at the time, namely that this British biology had a propagandist aim rather than the consolidation of an identity or a practice. The above highlights the importance of BAAS within British nineteenth-century scientific discussions, as a local laboratory in which national discussions were conducted.

Despite the X-Club members' initial efforts, the dynamics under which BAAS operated prevented any group from imposing its agenda. The quest to "impose" or "suggest" a new identity, biology, for those practising the life sciences, met with strong opposition from established traditions. On the other hand, the peripatetic nature of the Association may have proved more of a complication than an advantage when seeking to consolidate a discipline. It should be remembered that each meeting brought in new members from local philosophical and naturalistic societies, who belonged to different traditions from those promoted in London.

The lack of methodological unity, for example, was notorious over the years. As can be seen from the different presentations given over the years, the traditional life science disciplines remained botany, zoology, anatomy, and physiology. The only discipline that emerged and was maintained on its merit was anthropology, a situation that must also be assessed based on the consolidation of institutions outside the Association, such as the Royal Anthropological Institute (1871). This lack of unity forces historians to reconsider how biology was practised throughout the nineteenth century in Britain. One of the persistent myths often assumed about British biology is the "revolutionary" nature of Darwin's ideas in its consolidation. However, within the BAAS meetings, Darwin's ideas were championed only by X-Club members or people associated with them. Individuals such as Lankester sought to consolidate a "modern" British biology in the twentieth century (Lester, 1995). Indeed, it is recognised that natural history was the dominant tradition during the nineteenth century and that "scientific biology" would develop to its full potential only well into the twentieth century (Berry, 1983, p.330).

The discussions in learned societies such as BAAS need to be analysed in more detail by historians. Beyond the traditional recognition of Darwin's contributions, through analysis

of the "everyday" discussions among scientists, we can glimpse the agreements that result in the formation of a field of knowledge such as biology. It is essential to recognise the diversity of traditions surrounding nineteenth century biology. The example of disciplines in the Association highlights their complexity: the search for identity does not imply the establishment of a theoretical or methodological tradition. It should be remembered that the "national" character of the Association was related to the presence and participation of local scientists. Traditional historical accounts usually recognise the importance of scientific work conducted in London, Oxford, or Cambridge, and from there, its "imposition" in other contexts. However, the disputes within BAAS show that traditions such as natural history persisted despite metropolitan efforts to consolidate a "new" understanding of nature.

While valuing the importance of long-range disciplinary histories, it is through histories that focus on the interactions between scientists in local contexts that we can recognise the intricate vicissitudes that disciplines undergo.

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REFERENCES

ALBERTI, Samuel J.M.M. Civic cultures and civic colleges in Victorian England. In: Daunton, Martin (ed.). *The organisation of knowledge in Victorian Britain*. Oxford: The British Academy and Oxford University Press, 2005. p.337-356.

ALBERTI, Samuel J.M.M. Amateurs and professionals in one county: biology and natural history in late Victorian Yorkshire. *Journal of the History of Biology*, v.34, n.1, p.115-147, 2001.

BAAS, British Association for the Advancement of Science. *Report of the meeting of the British Association for the Advancement of Science*. London: John Murray, 1895.

BAAS, British Association for the Advancement of Science. *Report of the meeting of the British Association for the Advancement of Science*. London: John Murray, 1867.

BAAS, British Association for the Advancement of Science. *Report of the Meeting of the British Association for the Advancement of Science*. London: John Murray, 1866.

BARTON, Ruth. *The X Club: power and authority in Victorian science*. Chicago: University of Chicago Press, 2018.

BARTON, Ruth. Men of science: language, identity and professionalization in the mid-Victorian scientific community. *History of Science*, v.41, p.73-119, 2003.

BARTON, Ruth. Huxley, Lubbock, and half a dozen others: professionals and gentlemen in the formation of the X Club, 1851-1864. *Isis*, v.89, n.3, p.410-444, 1998.

BASALLA, George; COLEMAN, William; KARGON, Robert H. (ed.). *Victorian science: a self-portrait from the presidential addresses of the British Association for the Advancement of Science*. New York: Anchor Books, 1970.

BERRY, Robert James. The evolution of British biology: presidential address to the linnean society delivered at the anniversary meeting, 24 May 1983. *Biological Journal of the Linnean Society*, v.20, n.4, p.327-352, 1983.

BIOLOGY at the British Association. *Nature*, v.50, n.1296, p.433-436, 1894.

BUTTON, Clare. James Cossar Ewart and the origins of the animal breeding research department in Edinburgh, 1895-1920. *Journal of the History of Biology*, v.51, n.3, p.445-477, 2018.

CAHAN, David. Institutions and communities. In: Cahan, David (ed.). *From natural philosophy to the sciences: writing the history of nineteenth-century science*. Chicago and London: University of Chicago Press, 2003. p.291-323.

CARON, Joseph. A. Biology in the life sciences: a historiographical contribution. *History of Science*, v.26, n.3, p.223-268, 1988.

COLEMAN, William. *Biology in the nineteenth century: problems of form, function and transformation*. Cambridge: Cambridge University Press, 1977.

COLLINGWOOD, Cuthbert. Zoology, botany, and physiology. *Popular Science Review*, v.2, n.6, p.243-249, 1863.

DESMOND, Adrian. Redefining the X Axis: professionals, amateurs and the making of mid-Victorian biology: a progress report. *Journal of the History of Biology*, v.34, n.1, p.3-50, 2001.

DESMOND, Adrian. *Huxley: from devil's disciple to evolution's high priest*. London: Penguin Books, 1997.

ERLINGSSON, Steindór J. Institutions and innovation: experimental zoology and the creation of the British Journal of Experimental Biology and the Society for Experimental Biology. *The British Journal for the History of Science*, v.46, n.1, p.73-95, 2013.

ERLINGSSON, Steindór J. The Plymouth laboratory and the institutionalization of experimental zoology in Britain in the 1920s. *Journal of the History of Biology*, v.42, n.1, p.151-183, 2009.

FOUCAULT, Michel. *Discipline and punish: the birth of the prison*. New York: Vintage Books, 1995.

GOLINSKI, Jan. *Making natural knowledge: constructivism and the history of science*. Cambridge: Cambridge University Press, 1998.

HOOKER, Joseph D. Darwin Correspondence Project: Letter n. 7323, 24 Sep. 1870. Available at: https://www.darwinproject.ac.uk/letter/DCP-LETT-7323.xml. Access on: 30 Jan. 2021.

HOOKER, Joseph D. Darwin Correspondence Project: Letter n. 5206, 4 Sep. 1866. Available at: https://www.darwinproject.ac.uk/letter/DCP-LETT-5206.xml. Access on: 30 Jan. 2021.

HUXLEY, Leonard. *Life and letters of Thomas Henry Huxley*. 2v. New York: D. Appleton and Company, 1901.

HUXLEY, Thomas Henry. On the study of biology. *Nature*, v.15, n.376, p.219-224, 1877.

HUXLEY, Thomas Henry. Nature: aphorisms by Goethe. *Nature*, v.1, n.1, p.9-11, 1869.

KJÆRGAARD, Peter C. Competing allies: professionalisation and the hierarchy of science in Victorian Britain. *Centaurus*, v.44, n.3-4, p.248-288, 2002.

KRAFT, Alison. Pragmatism, patronage and politics in English biology: the rise and fall of economic biology 1904-1920. *Journal of the History of Biology*, v.37, n.2, p.213-258, 2004.

KRAFT, Alison; ALBERTI, Samuel J.M.M. Equal though different: laboratories, museums and the institutional development of biology in late-Victorian Northern England. *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences*, v.34, n.2, p.203-236, 2003.

LESTER, Joseph. *E. Ray Lankester and the making of modern British biology*. Oxford: British Society for the History of Science, 1995.

LUBBOCK, John. Darwin Correspondence Project: Letter n. 3001, 28 Nov. 1860. Available at: https://www.darwinproject.ac.uk/letter/DCP-LETT-3001.xml. Access on: 28 Jan. 2021.

MORGAN, Neil. The development of biochemistry in England through botany and the brewing industry (1870-1890). *History and Philosophy of the Life Sciences*, v.2, n.1, p.141-166, 1980.

MORRELL, Jack; THACKRAY, Arnold. *Gentlemen of science: early years of the British Association for the Advancement of Science*. Oxford: Clarendon Press, 1981.

NORDENSKIÖLD, Erik. *The history of biology: a survey*. New York: Tudor Publishing Co., 1935.

PICKSTONE, John. Science in 19th-Century England: Plural Configurations and Singular Politics. In: Daunton, Martin (ed.). *The organisation of knowledge in Victorian Britain*. Oxford; New York: The British Academy and Oxford University Press, 2005. p.29-60.

RÁDL, Emanuel. *The history of biological theories* (E.J. Hatfield, Trans.). London: Oxford University Press, 1930.

RÁDL, Emanuel. *Geschichte Der Biologischen Theorien. Geschichte Der Entwicklungstheorien In Der Biologie Des Xix. Jahrhunderts*. Leipzig: Verlag Von Wilhelm Engelmann, 1909.

RÁDL, Emanuel. *Geschichte Der Biologischen Theorien Seit Dem Ende Des Siebzehnten Jahrhunderts*. Leipzig: Verlag Von Wilhelm Engelmann, 1905.

REHBOCK, Philip F. *The philosophical naturalists: themes in early nineteenth-century British biology*. Madison: University of Wisconsin Press, 1983.

RENWICK, Chris. Herbert Spencer, biology, and the social sciences in Britain. In: Francis, Mark; Taylor, Michael W. (ed.). *Herbert Spencer: legacies*. Abingdon; New York: Routledge, 2014. p.111-132.

RITTERBUSH, Philip C. *Overtures to biology: the speculations of eighteenth-century naturalists*. New Haven: Yale University Press, 1964.

RODRÍGUEZ-CASO, Juan M. Institucionalización de la antropología en las reuniones de la British Association for the Advancement of Science (BAAS), 1863-1870. *Cuicuilco Revista de Ciencias Antropológicas*, v.25, n.73, p.167-188, 2018.

RUPKE, Nicolaas A. *Richard Owen: biology without Darwin*. Chicago: University of Chicago Press, 2009.

SCHWARTZ, Joel S. Robert Chambers and Thomas Henry Huxley: science correspondents: the popularisation and dissemination of nineteenth century natural science. *Journal of the History of Biology*, v.32, n.2, p.343-383, 1999.

SERAFINI, Anthony. *The epic history of biology*. New York: Springer, 1993.

SILLITOE, Paul. The role of section H at the British Association for the Advancement of Science in the history of anthropology. *Durham Anthropology Journal*, v.13, n.2, p.1-17, 2005.

SINGER, Charles. *A history of biology to about the year 1900: a general introduction to the study of living things*. Ames: Iowa State University Press, 1989.

SPENCER, Herbert. *The principles of biology*. London: William and Norgate, 1864.

THE BRITISH Association. *Daily News*, n.6336, p.1-8, 25 Aug. 1866.

WHITE, Paul. *Thomas Huxley: making the man of science*. Cambridge: Cambridge University Press, 2003.

WITHERS, Charles W.J. Scale and the geographies of civic science: practice and experience in the meetings of the British Association for the Advancement of Science in Britain and Ireland, c. 1845-1900. In: Livingstone, David N.; Withers, Charles W.J. (ed.). *Geographies of nineteenth-century science*. Chicago: University of Chicago Press, 2011. p.99-122.

WITHERS, Charles W.J. *Geography and science in Britain, 1831-1939: a study of the British Association for the Advancement of Science*. Manchester: Manchester University Press, 2010.