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Commentary: Dr John Brownlee MA, MD, DSc, DPH (Cantab), FRFPS, FSS, FRMetS (1868–1927), public health officer, geneticist, epidemiologist and medical statistician

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In July 1914 Dr John Brownlee was appointed head of the Statistical Department of the newly established Medical Research Committee. He had qualified in mathematics, natural philosophy and medicine at the University of Glasgow, and by 1914 had established a reputation as a public health officer, an expert in infectious diseases, and as a proponent of the Pearsonian school of the application of statistics and mathematics to medicine: an ideal background for his new position. In celebration of the centenary anniversary of the Medical Research Council and as a tribute to John Brownlee's involvement at the start, the *International Journal of Epidemiology* is reprinting in this issue one of his early papers on genetics. We comment on this paper, as well as Brownlee's background, achievements, research and his somewhat enigmatic though likeable character.

Introduction

In the first quarter of the 20th century, John Brownlee was a central figure in the development of epidemiology and of medical statistics. It is very fitting therefore for the *International Journal of Epidemiology* to highlight his work through the reprinting, in this issue of the journal, of his 1911 article with its ambiguous title 'The inheritance of complex growth forms, such as stature, on Mendel's theory'.[1]

In this commentary, we present some brief biographical details, highlight his major achievements and contributions, put the reprinted paper into the context of his career and comment on perceptions of John Brownlee and his work.

Biographical details

On 21 June 1868, in Rutherglen, Lanark, Scotland, John Brownlee was born to the Reverend John Brownlee (1826–1899) and his wife Mary Brownlee (born 1833), whose maiden name was Stevenson. When they married in 1865 she was already a widow with a son George Murray, and both her brother, William Ferrie Stevenson (1836–1908) and his son, William, were ordained. John Brownlee had a brother, William Stevenson Brownlee (1870–1930) who was also ordained. As indicated in an obituary,[2] John Brownlee was, truly, 'a son of the manse' though he did not follow this family tradition. Instead he studied mathematics and natural philosophy at Glasgow University, graduating MA with first class honours in 1889.

Staying in Glasgow, but changing direction, Brownlee went on to qualify in medicine (MB CM) in 1894, followed by MD in 1897 with a thesis on scarlatina. He then sat the examinations to receive the Diploma in Public Health from Cambridge in 1898. In 1907 he was awarded a DSc for his submission *Statistical Studies in Immunity and Incubation Period*

and the Crisis (and Other Papers), and some years after this had conferred upon him the Honorary Fellowship of the Royal Faculty of Physicians and Surgeons of Glasgow. This was an honour very seldom bestowed and this was made clear in a letter written, in response to Brownlee's obituary in the *BMJ*, by Dr A.F. Fergus who was president of the Royal Faculty when Brownlee was so honoured.[3]

After graduation he spent two years as resident physician in the Belvidere and Kennedy Street Fever Hospitals in Glasgow and then nine months as pupil assistant in the Health Department to Dr James Burn Russell (1837–1904), the famous sanitarian who became the first full-time Medical Officer of Health for Glasgow in 1872. Apparently this last experience impressed him deeply as Russell was 'for him one of those great men who alter one's whole scale of values'.[2] In 1899 Brownlee was appointed Medical Officer of Health for Guernsey in the Channel Islands, but after 18 months returned to Glasgow as physician superintendent, first at the Belvidere Fever hospital, then from 1908 at Ruchill Hospital.

In 1901, Brownlee married Margaret Fraser Cunningham and, in the subsequent year, their daughter, Margaret Fraser Brownlee, was born. In early 1909, Brownlee's wife aged 42 died of an embolism with her husband at her side.

Professionally, while in these posts, he found time to apply his mathematical skills to both medical and biological problems, and before 1914 had established a reputation as an exponent of 'the statistical method.' In July 1914 he was appointed Director of the Medical Research Committee's Statistical Department, a post he held until his sudden death from bronchopneumonia in 1927 aged 59 years. His portrait photograph appears in Figure 1.

Figure 1 The only known photograph of Dr John Brownlee, reproduced from his obituary[2] with kind permission from the *Lancet*

John Brownlee's contributions

Public health

During his MD studies, Brownlee produced a thesis titled *Scarlatina* (scarlet fever) and the 34 papers and seven reports that he published prior to 1914 focus predominantly on infectious disease. This predominance is consistent with his employment at the fever hospitals of Glasgow during this time along with his 18 months as Medical Officer of Health for Guernsey.

As outlined by Higgs,[4] during the 19th century there were never-ending cycles of infectious diseases (cholera, diphtheria, erysipelas, measles, relapsing fever, scarlet fever (scarlatina), smallpox, tuberculosis (consumption), typhoid (enteric fever) and typhus) throughout the country, though their transmission was particularly easy amid the insanitary conditions in towns. Cases were not usually admitted to general hospitals for fear of spreading the infection, and isolation of patients was required though this was simply impossible in the cramped living conditions of the poor. The first fever 'isolation' hospitals were set up spasmodically in industrial cities early in the 19th century and it required legislation around 1867 to enable building on a wider scale, though not nationally. Further legislation followed to appoint medical officers of health (1875 Public Health Act) and to require notification of cases of infectious disease (1889 Infectious Diseases Notification Act). By 1900 most provincial cities had fever facilities, though rural areas and smaller towns still lagged behind.[4]

Brownlee's interests and training were ideal to enter this comparatively new area of medicine with its practical requirements to monitor and treat infectious disease, and its more theoretical needs to understand the source, spread and ultimately decline of epidemic cycles. As a medical officer of health he was required to produce weekly summaries of notifications which were sometimes broadcast in local newspapers such as the *Guernsey Star*, and to compile detailed annual reports such as those in Glasgow between 1901 and 1909. In addition he engaged directly with the community by giving public lectures, such as one described as 'highly educative' on the spread of typhod *(sic)* fever (*Glasgow Herald*, 8 April 1898), and participating in a special course of six popular lectures entitled 'Daily Life – its healthy and unhealthy conditions' with oxy-hydrogen illustrations (*Guernsey Star*,

January 1900). Consequently many of Brownlee's early papers deal with details of particular episodes of disease arising in his work.

Biometrics, correlation, and genetics

Around 1904 a shift is evident, with the publication of a more general paper on the age distribution of zymotic (acute infectious) disease.[5] At this point, Brownlee's initial training in mathematics, or at least his ability to think quantitatively, becomes particularly noticeable. However, another influence on Brownlee also becomes evident around this time.

He is referred to as a student of Karl Pearson[6] but it is not clear whether he ever attended lectures from Pearson at University College London (UCL). Perhaps, as Hardy and Magnello[7] (p. 211) state, he is best regarded simply as a 'Pearsonian disciple'. This would be consistent with Mackenzie's characterization[8] (p. 177) of Brownlee as not a member of the Biometric School, the term used for those linked to Pearson most directly.

For whatever reason, Brownlee soon began to refer to Pearson frequently in his papers and in 1905 published his first paper[9] in Pearson's journal *Biometrika,* which was also his first paper in a statistical journal; there would be seven more, with the next also in *Biometrika* and the rest in the *Journal of the Royal Statistical Society*, a society he joined in 1908, subsequently serving on the Council of the Royal Statistical Society from 1916–1918 and from 1921–1925. This first paper was titled 'Statistical studies in immunity: smallpox and vaccination', and it made much use of tetrachoric and polychoric correlation coefficients for ordered categorical data. The use of Pearson's 'short method' for their calculation is discussed in some detail at the end of the paper.

Between 1905 and 1907, Brownlee published five papers with titles beginning 'Statistical studies in immunity',[9–13] the last being his second paper in *Biometrika*. The work reflected in these papers formed the basis of his DSc thesis submitted in 1907. The emerging theme of this work is that the number of cases of an epidemic over time closely follows a distribution close to that of Pearson's Type IV. A set of distribution curves, defined by Pearson, was widely used during this time and was also used by Brownlee in his 1904 publication[5] mentioned earlier. Type IV is a right-skew distribution but is symmetrical in its limiting form. This symmetry was linked by Brownlee to the work of Farr who argued, as described by Brownlee,[12] that the rise and fall in the number of epidemic cases could be fit by 'assuming that the second difference of the logarithms of successive ordinates of an epidemic curve is a constant'. This allowed prediction and was seen by Brownlee to tie the results to the normal distribution. Fine[14] provides an excellent discussion of this aspect of Brownlee's work. He argues that Brownlee, following Farr, felt that this pattern of an epidemic corresponded to a 'natural law'. In subsequent work, in order to explain this pattern, Brownlee argued that this could only reasonably arise from a decline in the infectivity of an epidemic organism.

As argued by Fine,[14] this reasoning was based on mathematics driving the biological conclusion. It contrasted to Ronald Ross's theory of an epidemic which incorporated the concept, new at the time, of a population of susceptibles. Ross' approach could be described as biology leading to mathematics. Fine is rightly critical of Brownlee's unwillingness to seriously consider alternative explanations for the available data throughout his life. He makes a convincing case that Brownlee just could not bring himself to give up his view that such a nice mathematical argument must correspond to a 'natural law'. Nevertheless, it is perhaps worth noting that, in his 1915 paper 'On the curve of an epidemic'[15] published in the *British Medical Journal,* Brownlee did acknowledge that Ross's work did 'demand that my arguments . . . should be reconsidered' and also that it may be 'partly, and may be wholly, true' that he had misinterpreted an equation of Ross. Thus, although thinking that 'other hypotheses . . . must play a large and even the most important part', Brownlee did not entirely dismiss Ross's work. Neither did Ross dismiss Brownlee's work for, in a further development of his original theory,[16] he points out that his new equations give almost complete symmetry when an epidemic is short and sharp 'just in such cases as Dr Brownlee refers to'. Whereas Ross doubts that infectivity can be increased and diminished by any act of the infecting organism, he is 'by no means prepared to contest Dr Brownlee's very valuable results until some attempt has been made to fit my curves to known cases'.

It is clear that Brownlee liked bringing mathematics, and statistical tools, to bear on medical problems. He did not leave his mathematical training behind when he turned to medicine even though his posts up until 1914 were primarily medical. He also did not restrict his research interests to the infectious disease medicine of his employment. For example, in 1908, one of his two published papers was on evolution, titled 'Germinal vitality: a study of the growth of nations as an instance of a hitherto undescribed factor in evolution'.[17]

This paper postulated that fluctuations in the growth rates of populations were linked to 'periods of energy' or 'germinal vitality'. Brownlee linked these to events of historical eras. Also, Brownlee postulated that this germinal vitality would eventually decline in a similar manner to the infectivity of an organism in his theory of epidemics.

Mendelian genetics

Five papers related to Mendelian genetics, one in 1910[18] and two each in 1911[1,19] and 1912[20,21] followed. It is one of the 1911 publications that is

republished in this issue of the *International Journal of Epidemiology*. As true for that publication[1] on complex growth forms, all these publications present mathematically based arguments relevant to contemporary questions. Indeed, Brownlee's paper on the inheritance of complex growth forms should be seen as one of this series of papers, all of which are based on similar arguments.

Two statistical features of note in the republished paper[1] are the prominence given to the correlation coefficient and the attention given to Pearson's curves. With respect to the former, it was only a few years earlier, in 1906, when, according to Chen,[22] the *Journal of the Royal Society* refused to publish a paper of Pearson's because they 'failed to see the biological significance of the correlation coefficient'. Interestingly, Chen also indicates that it was the rejection of an earlier paper by Pearson by the same journal that led to the founding of *Biometrika* in 1901.

In 1910, Brownlee published a paper on 'The significance of the correlation coefficient when applied to Mendelian distributions'.[18] The motivation for the paper is in the context of 'much discussion regarding the means by which properties are hereditarily transmitted from a parent organism to its offspring, and of the extent to which the Mendelian theory is capable of accounting for the facts'. The specific purpose of the paper is 'to investigate the conditions under which the theory of correlation may be applied to Mendelian groupings' and it follows the previous publication of 'two important papers on this subject', one by Pearson and one by Yule, who suggest that the departure of the correlation expected from Mendelian theory with random mating from observed correlations is not surprising if, as described by Brownlee, 'a certain amount of weight is given to the effect of hybrid and recessive elements'.

During the early years of the 20th century, there was a controversy between Pearson and George Udny Yule on the appropriate method for measuring association with categorical data (see reference 8, chapter 7). Whereas Brownlee does not appear to have entered into the statistical aspects of this controversy (the references to Yule in Brownlee's 1910 paper[18] do not appear to relate to these.), Mackenzie (reference 8, page 266) does note that Brownlee used tetrachoric correlation even 'in the case of theoretical Mendelism, where the biometricians denied its applicability'.

That paper[18] begins by considering a population of two pure races, denoting them by (a, a) and (b, b) respectively. The correlations are derived under the hypothesis that hybrids can be distinguished and, alternatively, that they are indistinguishable from a dominant homozygote. Since both are inconsistent with observed correlations, the paper explores other factors which may explain this discrepancy. These include assortive mating which emerges in the paper as having the 'more powerful' effect.

The 1911[1] paper

This 1910 paper thus provides a bit of background to the technical development of the 1911 paper on complex growth forms that is, to put it mildly, somewhat short on background explanations. 'The inheritance of complexes is of great interest' seems the epitome of a brief introduction! The problem addressed in this paper is a generalization of the earlier paper because the focus is on hereditary features that depend, in modern terms, on multiple genetic loci. The general methodology is the same however, and the issues of the departure of predicted correlations based on Mendelian theory from observed correlations, and the potential role of assortive mating, are again addressed.

Although looking back to the 1910 publication helps somewhat in understanding this 1911 publication, the examination of two loci did require different notation to represent the genetic possibilities. The notation of vertical blocks adopted appears to have been introduced by Brownlee for this purpose since, in his later 1912 paper,[20] he specifically argues for the value of the notation in contrast to the use of a sequential notation, i.e. (aa, cc), (ab, cd) etc., through which the possibilities are 'regularly written'. The assumption must be that Brownlee felt the notation to be self-explanatory in 1911 although, for whatever reason, deciding to explain the reason for it in 1912.

Why did Brownlee write these various papers on Mendelian genetics when his daily work activities were centred on infectious diseases? Perhaps he was responding to a suspicion of mathematical arguments that was present in various circles. Hardy and Magnello[7] discuss this in some detail and quote a *BMJ* editorial from 1911 that said that the modern English school of quantitative methods had 'suffered from not numbering among its members any experimental worker of world-wide reputation and perhaps also from the, largely accidental, association in the public and professional mind between mathematical methods and the heated controversies respecting Mendelism and eugenics'. In these genetic papers, Brownlee, a medical man, appears to eschew any controversy, something he did not avoid elsewhere as indicated previously, and, one suspects, just wanted to show that mathematics, and more particularly investigation in terms of the somewhat suspect correlation coefficient, could help to resolve outstanding questions regarding Mendelian genetics. Incidentally, there is a record of a letter from R.A. Fisher to Brownlee in which Fisher thanks Brownlee for his interesting papers, 'especially that on the Mendelizing race differences'.[19] Fisher then corrects some of Brownlee's calculations!

The reference to Pearson's distributional curves in Brownlee's 1911 paper[1] is more incidental. Brownlee

had used these in his work on epidemics and was attracted to the mathematics surrounding these and the normal distribution. Although not mentioned in his 1910 genetics paper,[18] they do appear in both the 1911 paper and the 1912 paper on point binomial and multinomials.[20] There is little doubt that Brownlee thought the statistical methods of Pearson had much to offer medical and biological research, reflecting, as they did, the latest in statistical methods, and was anxious to illustrate this whenever possible. And he must have done this well because, as indicated by Hardy and Magnello,[7] both Brownlee and Major Greenwood, who worked alongside Brownlee in later years and who, effectively, succeeded him as head of the Statistical Department at the MRC, had been attracted to Pearson's work. But, as indicated by Hardy and Magnello,[7] Greenwood's view was that Brownlee had taken this work further than any other contemporary epidemiologist.

The Medical Research Committee

As recorded by Thomson,[23] the first 'Scheme of Research' for the Medical Research Committee, the forerunner of the Medical Research Council (MRC), had the aim of undertaking research to extend medical knowledge with the actual field of research not being limited. To achieve this, the organization was to consist of four 'departments':

(i) investigators of the highest class in permanent employ of the scheme, devoting whole time to research
(ii) skilled investigators in permanent or temporary employ of the scheme engaged in procuring material clinically or otherwise
(iii) individual investigators, not in employ of the scheme, helped with money or otherwise for researches coordinated with research under the scheme
(iv) a statistical department: to mainly consist of persons in the permanent employ of the scheme to undertake statistical investigations useful either as a preliminary to research or confirmatory of its results.

This initially translated into a 'central institute' with separate research departments for bacteriology, biochemistry and pharmacology, applied physiology, and statistics.

Among those who appreciated the potential of statistical methods in the early part of the 20th century, Brownlee's work must have been felt to demonstrate this potential. His appointment in July 1914 to head up the newly envisaged Medical Research Committee's Statistical Department is consistent with this view. However, as evidenced in his 1911 republished paper, and described by Hardy and Magnello[7] in a comparison of Brownlee with Greenwood, Brownlee's 'papers were so reliant on mathematical-statistics that only those trained in the Biometric School could read them'.

Davey Smith, in an editorial discussing a previous historical article by another author published in *IJE*,[24] comes to a similar conclusion regarding Brownlee's perhaps most highly regarded paper (the only reference in the short biography of Brownlee in the Encyclopedia of Biostatistics[25]) that identified cohort and generational effects in tuberculosis.[26] Davey Smith writes, 'it is a paper from which it is difficult to draw straightforward conclusions', and indicates that it would not be highly regarded from the perspective of the translation of research findings. This ambivalence towards Brownlee's work is reflected in an editorial comment published with Brownlee's 1916 paper which was based on an address to the Society of Medical Officers of Health: 'Those who listened to Dr. Brownlee's address . . . *could not help feeling* (our emphasis) that in the interesting curves and graphs that were thrown upon the screen, they were witnessing the application to a complex epidemiological problem of an algebra which alone supplied the formulae necessary for its proper understanding'. This was perhaps a feeling not entirely accompanied by conviction. Lancaster[27] also points out that Brownlee was the first to apply the cohort or generation method to the analysis of tuberculosis death rates. But he also notes that Brownlee did not refer to his novel treatment of the rates in his conclusions, and this omission, coupled with the style of exposition, may have resulted in later authors, including Greenwood, missing it.

During the First World War, the Medical Research Committee offered its resources to the War Office for medical statistical purposes. This led to a sizeable expansion of the Statistical Department, with a clerical staff of over 100[28] which by 1919 was 225,[29] and these responsibilities continued until February 1921. Although Higgs[29] indicates that for all the effort and money put in, the Medical Research Committee 'had very little to show for it', this work would have had an obvious impact on Brownlee's personal research during this period. He notes, for example, at the start of his 1915 paper titled 'On the curve of an epidemic'[15]: 'As in the immediate future I shall have little time to extend the investigation [on epidemics)], I wish to state the conclusions I have come to since my last published paper'. It is not clear exactly what the Medical Research Committee would expect 'to show for it' though the fact that it continued until well after the war, and was part financed by the War Office, indicates that government considered it of importance. The records compiled about the sick and wounded were used after the war chiefly to answer questions about individual cases at the request of the Ministry of Pensions, military departments, insurance companies and various dominion, colonial, and foreign governments.[28] As Thomson states, quoting the Committee report for 1919–20, 'Nearly half of the inquiries were concerned with claims made by

soldiers for which no support could be found in their military documents; about 90 per cent of such claims were found to be supported by the medical facts recorded in the Statistical Department, and only a very small minority of cases were they actually disproved'. It is clear that such records might be regarded as contributing little to the scheme of medical research, but the individuals concerned would probably have felt differently about their value. That Brownlee oversaw this very large department and contributed to both the form of the records and their organisation must be a tribute to his abilities.

Although in 1913 he published a paper on race distribution in Scotland,[30] and in 1924 published a book[31] on the origin and distribution of racial types in Scotland, Brownlee did not continue any serious genetic work after obtaining his post with the Medical Research Committee. He did continue an early interest in death rates with periodic publications, including a paper[32] commenting on Raymond Pearl's data on the similarity of age vitality (death rates) in invertebrates and man. However, the majority of his post-1914 published work (approximately 63 articles) was related to the study of infectious diseases, and indeed he conjectured a role for infectious disease to explain some results in his paper on Pearl's data.

Another interest of Brownlee, linked to his work on infectious disease, was meteorology. In 1914, after moving to London, Brownlee was elected a Fellow of the Royal Meteorological Society.[33] This must have represented a more general interest as well since Brownlee served on the Council of this Society in 1920 and again from 1922 to 1925. As far as can be determined, he published only one paper in the journal of this society, which was a discussion of the method of taking meteorological readings used at the National Institute of Medical Research. These readings were to investigate 'the relations between health and atmospheric conditions'[34] and Brownlee's personal work in this is illustrated by his 1923 paper on the relationship between rainfall and scarlet fever.[35] He also communicated a paper[36] on this topic to the Society's journal and is reported[33] as working, shortly before his death, on a better method of eliciting relationships between periodicity in weather phenomena and cyclical changes in disease.

Figure 2 An impression of Brownlee: pencil drawing sketched on the menu for his farewell dinner at Ruchill Hospital, Glasgow, 1914. On 31 July 1914 he was appointed Head of the Medical Research Committee's Statistical Department. (From the papers of Dr Peter McKenzie held by NHS Greater Glasgow and Clyde Archives, ref. HB92/3/1)

John Brownlee's character

Published anecdotes of Brownlee, including those from six obituaries,[2,33,37-39] give the impression of a likeable, somewhat eccentric, man who could easily flit between topics during a conversation. One obituary[33] indicates 'He was invariably ready to enter freely into a discussion of any subject, not only in his field of medicine and science, but gladly accepted opportunities to make excursions into the fields of literature, art and music, where he was equally at home'. Thomson[23] records that he was a kindly man and a genius who had various foibles that endeared him all the more to his friends; in addition, he set store by his 'administrative principles, one of which appeared to be never (or hardly ever) to reply to letters'; and, 'he had an endless flow of talk displaying a wide variety of knowledge'. Yule (quoted in Higgs[29]) likened him to an 'odd sort of fly' that 'seems to be nearly still, . . . when suddenly flick! and the blessed fly is in quite a different position'. Greenwood[37] illustrates with an anecdote that 'if one were in a hurry to get from him specific information upon a matter of fact – say, the method by which he had fitted a curve – to find that, after ten minutes' conversation, one had learned a great deal about Highland place names, the organization of the Kirk in the 18th century, and the history of alchemy, but nothing at all about that curve, might be irritating'.

Despite this and although not a fluent lecturer, he was an inspiring clinical teacher to which his pupils paid tribute.[2] He was also known to the public with his enunciation of 33 weeks as the interval between epidemics of influenza and for his forecast based upon this assumption.[2]

Greenwood[2] continues, 'Nobody who knew him intimately could fail to be struck by the immense range

Figure 3 Caricature of John Brownlee explaining the play, *Hamlet*, to Dr Chalmers. One of a series by Dr Osborne Henry Mavor (alias the playwright James Bridie). © University of Dundee Archive Services. Original digital image available

of his erudition or to be charmed by the simplicity of his character. Brownlee was singularly free from personal jealousy or vulgar ambition'. Elsewhere[38] he writes, 'Nobody, not even those who knew nothing of his private acts of generosity in word and deed, could help liking and respecting the man. One thinks of him as at his best in a small circle of intimates, when there was no train to be caught, and no letters to be written, and he could have his talk out. Those who were at such gatherings know that we have lost a scholar and a gentleman'.

It is clear that Greenwood, an astute observer of character, had great respect for John Brownlee. The two worked side by side for the Medical Research Committee and its descendant the Medical Research Council, each in charge of his own statistical group. They both had engaging characters but their abilities were completely different, and the only publication they had in common was the entry on epidemiology in the *Encyclopedia Britannica* (13th, 14th and 14th edition revised). See Fine[14] for additional discussion of this entry.

John Brownlee may have been a somewhat shy and retiring man, for there is a scarcity of photographs of him, the only one we are aware of being Figure 1 which shows a serious, handsome, middle-aged man with a slightly reserved expression; its date is unknown. By contrast an unsigned pencil drawing (Figure 2) sketched on the menu for his farewell dinner at Ruchill Hospital can be accurately dated to 1914. He even attracted a caricature (Figure 3) by his physician colleague Osborne Henry Mavor (alias the playwright James Bridie) where he explains the play *Hamlet* to a Dr Chalmers, presumably Dr Archibald Kerr Chalmers (1856–1942) who was Medical Officer of Health in Glasgow from 1898 to 1925. This is one of a series dating from around 1913 but not publicized until 10 years later, apparently because some of the subjects, although not necessarily Brownlee, did not like them.

Conclusion

Little is known of John Brownlee's personal life. The early death of his wife must have influenced his life greatly. He had a young daughter and whatever

arrangements he may have had for her care to allow his professional activities, his Will demonstrates his concern for her education and welfare. She was with him when he died in London from a sudden illness in 1927.

Brownlee deserves to be remembered as a pioneer who worked assiduously to establish the 'statistical method' in medical research. He made good use of his training in both mathematics and medicine and this included a course on medical statistics given from January to March 1913, a few months before taking up his new post with the Medical Research Committee. The content (which consists of tables and figures only), available as a series of notes held at the University of Glasgow, included examples of distributions, constants of distributions, method of calculating the mean and standard deviation of a series of observations, correlation, contingency coefficient, partial correlation and probable error. This must be one of the earliest courses on medical statistics, although it was preceded by a course given by Greenwood at the London Hospital in 1908 or 1909. Brownlee was also the author of the first volume in the *Special Report Series* (or green reports as they were known from the colour of their covers) published by the Medical Research Committee and MRC starting in 1916, and which by 1972 had reached 310 volumes.[23] At the Ruchill hospital in Glasgow, the John Brownlee Research Laboratory was established in 1951, honouring his work on infectious diseases in Glasgow and more generally. The hospital was closed in 1998 after the opening of the Brownlee Centre for Infectious and Communicable Diseases at Gartnavel General Hospital.

Despite the above, it seems clear that Brownlee's lack of communication skills limited the impact of his work, particularly later in his career. But it was still of value. For example, Greenwood, based on his work with Brownlee for the MRC, was described as the 'key that unlocked Brownlee's mind' for consultative purposes.[23] And Greenwood, who had many of the communication skills that Brownlee lacked, wrote of him in the first section of one of his papers[40] that he 'hoped might be accepted as a tribute *in piam memoriam* of my friend and colleague John Brownlee': 'He approached the problem with an erudition, both biological and mathematical, to which I have no pretensions and, had his power of exposition been equal to his natural sagacity and learning, there would have been small need for any other writer.' (A list of the publications of John Brownlee is available on the MRC Biostatistics Unit website.)

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Finally we are grateful for permission to publish the portrait of Brownlee (Figure 1) from the *Lancet*, the unsigned drawing (Figure 2) from the NHS Greater Glasgow and Clyde Archives (Alistair Tough), and the caricature of Brownlee (Figure 3) from the University of Dundee Archive Services (Michael Bolik).

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