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Karl Pearson's *Biometrika*: 1901–36

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Summary

Karl Pearson edited *Biometrika* for the first 35 years of its existence. Not only did he shape the journal, he also contributed over 200 pieces and inspired, more or less directly, most of the other contributions. The journal could not be separated from the man.

Some key words: *Biometrika*; History of statistics; Karl Pearson.

1. Introduction

'There were essentially only two editors of *Biometrika* in the first 65 years and only three in the first 90 years' wrote the third of them, Cox (2001, p. 10). The first editor, Karl Pearson (1857–1936), had a conception of the journal and of his relationship to it unlike anything that followed. It was truly *his* journal: editors generally contribute to their own journals but Karl Pearson, K. P., contributed more than 200 pieces to his and most of the other material that appeared between 1901 and 1936 was inspired more or less directly by him. *Biometrika* was the house journal for Pearson's biometric establishment at University College London but it also spoke for world biometry, a responsibility that made Pearson a uniquely editorializing editor. The second editor, K. P.'s son Egon Sharpe Pearson (1895–1980), wrote much less, loosened the journal's ties with its home base and generally had a less messianic conception of the journal and the editor's responsibilities.

Biometrika was founded for the statistical study of biological problems and it was still the leading journal for biometric anthropology in 1936. Though it established a niche in this specialized branch of biology, it did not realize the hopes of its founders and the real importance of K. P.'s *Biometrika* was in its role in establishing mathematical statistics as a discipline. The centenary reviews (issue 1 of *Biometrika*, 88, 2001) considered individual papers as milestones to the twenty-first century discipline of statistics but I will stress the special character of K. P.'s journal and how different it was from its successors. The success of K. P.'s *Biometrika* was not unalloyed: 'off the pages' of *Biometrika* is where Atkinson & Bailey (2001) find some of the most important statistical work of the K. P. era and the particular tragedy of his *Biometrika* was that so much of that work was done by authors who had once been on its pages. The first half of K. P.'s term saw the loss of the important figure of G. Udny Yule and the second the loss of the critical figure of R. A. Fisher. They found other publics for their writings and so their loss was not necessarily a tragedy for the subject.

There is a substantial literature on K. P. and his place in the history of statistics (Aldrich, 2011), but it focusses on the early Pearson. Thus Porter's *Karl Pearson* (2004) covers the formation of the statistician but only glances at the last 35 years of K. P.'s life, the *Biometrika* years. For K. P.'s journal the best authority remains his son: the journal was part of E. S. Pearson's life long

before he became editor and his interest in its history flourished after he retired. Morant's (1939) annotated bibliography of K. P.'s writings is also indispensable.

2. THE FOUNDING

Biometrika was born of a crisis, the prospect that Pearson's main outlet for his writings would be closed to him. From the beginning, in 1894, the *Philosophical Transactions of the Royal Society* had taken Pearson's 'Contributions to the Mathematical Theory of Evolution'. These hefty productions from the professor of applied mathematics and mechanics at University College London appeared in *Series A* for papers of a 'mathematical or physical character'. But then in 1900 number IX was sent to a referee for *Series B*, for papers of a 'biological character', and the referee, William Bateson, rejected it; Pearson (1906a, pp. 34–6; 1930, pp. 241–9), Pearson (1936, pp. 228–32) and Cox (2001, pp. 3–4) give details of the row that ensued. The row, which belongs as much to the history of biology as to the history of statistics, proved to be a preliminary round in what historians of genetics call 'the conflict between Mendelians and Biometricians' (Provine, 1971, Chs. 2–3). K. P.'s partner in biometric research was Raphael Weldon (1860–1906), professor of zoology at University College and the first British academic biologist to use Francis Galton's statistical techniques. Stigler (1986: Part III) describes how Pearson and Weldon built on the efforts of Galton and Edgeworth to achieve the 'British breakthrough' in mathematical statistics; this is one of the great stories in the history of statistics. When Pearson's paper was rejected he and Weldon turned to their friend Galton, a grandee of British science with a large fortune. Pearson told Galton that 'if the R.S. people send my papers to Bateson, one cannot hope to get them printed. It is a practical notice to quit. This notice applies not only to *my* work but to most work on similar statistical lines' (Pearson, 1930, p. 241). Pearson also reported that he had been sounding people about a journal 'of pure and applied statistics' but had 'found a feeling pretty general that it might injure the R.S.S. Journal, although the sort of memoirs I had in view would I think not find a place in that journal.' In 1900 the only 'pure' statisticians in the Royal Statistical Society, apart from Yule who had gone as a missionary from biometry, were Edgeworth and Bowley and in line with the Society's purpose, their 'applied' statistics were social rather than biological. K. P. never joined the Statistical Society and his *Biometrika* never took any notice of its pure statistics until Fisher (1922a) criticized K. P.'s work on χ^2 in its pages; see § 7. Edgeworth published once in *Biometrika*, in 1907 on bees and wasps, but Bowley never did. Thirty-five years later at the end of the K. P. era the make-up of the Royal Statistical Society would be quite different and there was more movement of ideas and personnel; the mathematizing of British statistics (Aldrich, 2010) was largely a story of peaceful invasion by Pearson's people.

With financial guarantees from Galton, Weldon, Pearson and others the first issue of *Biometrika* appeared, dated October 1901. A new journal was not actually needed to safeguard Pearson's access to the printing press, since *Philosophical Transactions of the Royal Society A* took the disputed paper (Pearson et al., 1901), and later ones in the series too. Pearson also went on publishing in the Royal Society's *Proceedings* and in the *Philosophical Magazine*, another physical science journal. The crisis blew over but Pearson's publishing ambitions demanded more space and an extra few hundred pages each year was welcome. *Biometrika* turned out to be only the first of K. P.'s publishing ventures: in 1904 with support from the Drapers' Company he launched two series of research memoirs, a *Biometric Series* and a *Technical Series*, after the formation of the Eugenics Laboratory in 1906 came a series of *Memoirs* and *Lectures*, in 1910 Pearson launched the occasional *Questions of the Day and of the Fray* and in 1925 there was a new journal, the *Annals of Eugenics*. Without Pearson there would have been no *Biometrika* but there was much more to Pearson than *Biometrika*: from Morant's (1939) bibliography it appears

that two thirds of his publications were outside the journal. K. P.'s manifold activities are surveyed by Magnello (1999).

3. Running *Biometrika*

Pearson never ran *Biometrika* entirely on his own; indeed the original title page reads, 'edited in consultation with Francis Galton by W. F. R. Weldon, K. P. and C. B. Davenport'. Galton wrote of his own part: 'As regards joining the Editorial Committee, if it could be done in a way that both in reality and in the eyes of the public it carried no more responsibility and work than the position of "Consulting Physician" does in a Hospital, I should be pleased to do so' (Pearson, 1930, p. 241). Galton contributed only three pieces to the journal. Charles Benedict Davenport (1866–1944) was the leading foreign biometrician and, Pearson told Galton, he was 'an American editor to collect material there' (Pearson, 1930, p. 244). Davenport began as a very enthusiastic supporter of the journal (Bellhouse, 2009, 52–3), but he later became unhappy at the way Pearson ran it; see § 7.

Davenport in Chicago could not help much and contributed only one brief note (1902) while he was editor. Weldon, who had moved to Oxford, was more involved, contributing seven pieces before his early death; in the same period Pearson produced over thirty including all the editorials. After Weldon's death Pearson (1906a, pp. 35–6) described his friend's contribution:

> He was referee for all essentially biological papers; and his judgment in this matter was of the utmost value. He revised and almost rewrote special articles. He was ever ready with encouragement and aid when real difficulties arose. For the mechanical labour of editing, for proof-reading, for preparation of manuscripts and drawings for the press, or for interviews with engravers, he had little taste or time.

The modern refereeing system was not yet established and there is no sign that Pearson ever involved anyone else in evaluating the non-biological submissions; another long-term editor of the period, Keynes of the *Economic Journal*, used referees only for submissions criticizing his own work.

For the journal's 50th anniversary Elderton (1951) prepared a list of past office-holders. W. Palin Elderton (1877–1962), an actuary who published in the early days, appears in the list as Assistant Editor (1906–1909). It is evident that Elderton and others who filled the position did the assisting while K. P. did the editing. One who helped with the 'mechanical' work from the beginning was W. R. Macdonell (1852–1916), as Pearson (1917a, p. 281) recalled. Like Elderton, Macdonell was a 'lay-person' drawn to the biometric cause: after retiring from business he became a voluntary worker in Pearson's laboratory and was one of those who provided the initial guarantee fund for *Biometrika*; see also Pearson (1936, p. 199). Macdonell's chief interest was in anthropometry, see e.g., Macdonell (1902a). After Davenport and Weldon all the office-holders would be past students of K. P.: from Raymond Pearl (1879–1940), an American biologist who assisted after attending Pearson's lectures in 1905–6, to the biometric anthropologist Geoffrey Morant (1899–1964), who assisted in 1935–6 having been a University College undergraduate in 1922. Pearl returns in § 7 below.

Morant (1939, Ch. vii) prefaces his K. P. bibliography with the observation that

> he wrote or rewrote a considerable number of papers for which the material had been collected by others, and which appeared in their names alone. He was ready to do this if he found that students working under his direction were unable themselves to bring out and put down clearly the conclusions to which their investigations had led;

> he tried to ensure to the student the maximum fruits of his labours, but at the same time jealously guarded the literary standards of his laboratory publications.

Many of the projects came from K. P. On his death Major Greenwood (1936, p. 674) recalled how inspiring he had been:

> I saw him for the first time in 1902, and since then there can hardly have been a day in which some thought of K. P. has not passed through my mind, and there have been long periods when what he did, advised or suggested was a dominant motive.

4. '*BIOMETRIKA* WILL INCLUDE . . .'

Biometrika was born out of conflict and K. P.'s journal never entirely shook off its fighting posture. As to contents, Pearson's (1901, p. 2) editorial in the first issue had a list:

> (a) memoirs on variation, inheritance, and selection in Animals and Plants, based upon the examination of statistically large numbers of specimens (this will of course include statistical investigations in anthropometry); (b) those developments of statistical theory which are applicable to biological problems; (c) numerical tables and graphical solutions tending to reduce the labour of statistical arithmetic; (d) abstracts of memoirs, dealing with these subjects, which are published elsewhere; and (e) notes on current biometric work and unsolved problems. It is proposed to include memoirs written in English, German, French, or Italian.

The relative importance of the topics would change, indeed the slogan, 'a journal for the statistical study of biological problems,' did not really fit after 1918 though it remained on the masthead until 1948.

The disputed paper, Pearson et al. (1901), fell in category (a) and this would be the most heavily populated category in the period up to the Great War. Within (a) topics waxed and waned: in the first years of *Biometrika* the hottest topics would be inheritance and the controversy over Mendelism but the most durable topic proved to be craniometry: a line of skulls stretches from Fawcett & Lee (1902) to Pearson & Woo (1935). The blueprint does not mention medical statistics but this was a topic from the beginning; see Macdonell (1902b) in volume 1. In the years before the War the journal derived a bucolic charm from accounts of cooperative studies of snails, Shirley poppies, wasps and other garden offerings. A typical line-up for these studies in quantitative natural history was that for Wright et al. (1907): Wright did the measuring and some of the calculations, Lee did the rest of the computing and K. P. drafted the report. In these pre-war projects Pearson had more than 20 coauthors. After the War no new cooperative ventures were started and *Biometrika* looked less a journal for nature enthusiasts and more one for statistical technicians.

Ultimately the reputation of *Biometrika* would rest on 'developments of statistical theory'. K. P. expected that these would come mainly from him and in the first half of his term the journal was largely about applying methods he had developed in 1894–1900: the method of moments, the Pearson family of curves, normal correlation/regression and the χ^2 goodness-of-fit test. K. P. went on producing new theory, in particular extending correlation to skew distributions, to qualitative observations and to time series, but he did not usually publish it in *Biometrika*. The journal assumed some mathematical training of the reader but it was not written for mathematicians: Pearson placed his big mathematical pieces in the *Biometric Series*, such as Pearson (1904, 1905b) or in *Philosophical Transactions*, e.g., Pearson (1916) though exceptionally his 1902 treatment of curve fitting appeared in *Biometrika*. After 1916 the *Drapers'* series came to

an end because there was no more money but it is not clear why Pearson stopped publishing in *Philosophical Transactions.* In this new dispensation more of his theoretical work appeared in *Biometrika*.

The change in Pearson's publishing pattern coincided with a new view of what the biometric school was for. Pearson (1920a) disengaged the school from the original biometric project:

> The object of this school was to make statistics a branch of applied mathematics with a technique and nomenclature of its own, to train statisticians as men of science, to extend, discard or justify the meagre processes of the older school of political and social statisticians, and in general to convert statistics in this country from being the playing field of *dilettanti* and controversialists into a serious branch of science, which no man could attempt to use effectively without adequate training, any more than he could attempt to use the differential calculus, being ignorant of mathematics.

(E. S. Pearson, 1938, p. 164).

Under the third main category (c) came the dozen articles that would form the core of K. P.'s *Tables for Statisticians and Biometricians* of 1914. Tables were needed to make Pearson's procedures operational: thus Elderton's (1902) χ^2 tables complemented Pearson's (1900) goodness-of-fit test and Rhind's (1909) tables and diagrams complemented Pearson (1895) on fitting Pearson curves. A second volume followed in 1931: this contained a list of nearly 30 'collaborators and computers'. Fisher (1956, p. 2) later remarked that Pearson 'was prolific in magnificent, or grandiose, schemes capable of realization, perhaps by an army of industrious robots responsive to a magic wand.' Pearson's table-making is a good example although the table-makers were not all robots: thus Sheppard's (1903) tables of the normal probability integral and 'Student's' (1908a) tables of z, the forerunner of t, were created to serve their authors' purposes and not K. P.'s.

Accepting 'memoirs written in English, German, French, or Italian' set *Biometrika* apart from other British journals. The authors were 'outsiders', i.e., people who had not studied with Pearson. Their papers usually dealt with purely statistical topics and they seldom used the technical language developed by Pearson; the clash between the Russian and biometric styles is noted in Aldrich (2003, pp. 116–8). Both in their statistical focus and in coming from beyond University College, these contributions looked forward to the modern journal. Naturally the submissions had to interest the editor but K. P. had very broad interests: in 1904–6 he published work on estimating mixtures of normal distributions by the Italian Fernando De Helguero (Borroni, 2009 p. 83) and in 1924 on life tables by the German Emil Gumbel (Oakes, 2001, p. 100). Pearson had introduced the method of moments in 1894 to estimate mixtures of normals and life tables were also an early interest; Gumbel's work stimulated him to write a piece of his own (Pearson, 1924a). The foreign language articles were mostly in German and mostly by Russian authors: an article by Oskar Anderson (1914) started a small tradition of Russian contributions and after the war Chuprov and Romanovsky also contributed; their work on moments was related to the local work of 'Student', Isserlis and Church. Seneta (2009) considers the Russian connection. British outsiders who published in the K. P. era included the medical statistician John Brownlee, two papers in 1905–7; the psychologist Godfrey Thomson, three in 1919–23; and R. A. Fisher, one in 1915. For Brownlee see Greenwood (1927), for Thomson see Bartholomew et al. (2009) while there is more on Fisher in § 7. The Irish statistician Roy Geary (Spencer, 1976) published three papers in 1931–5 and among the American outsiders were Henry Rietz, three papers (Bellhouse, 2009, p. 28); Cecil Craig and Paul Rider. Rietz, Craig and Rider would be founder members of the Institute of Mathematical Statistics (Hogg, 1986, p. 288).

5. CONTRIBUTING TO *BIOMETRIKA*

In K. P.'s time *Biometrika* was essentially an extension of the research and teaching in biometry at University College, part of his plan to form a post-graduate school of biometry, see Pearson (1938, pp. 163–4). Most of the contributions came from people who were there or had been there, as employees, voluntary workers, visitors and students. For the permanents, publication in *Biometrika* was part of the way of life; for the transients, visitors and students, it was at least a passing out ceremony. The permanents consisted of the teaching and research staffs of the Biometric Laboratory and the Eugenics Laboratory; the two-laboratory scheme came out of the creation of the Galton chair in eugenics in 1911. There were never many employees though post-War expansion brought teaching positions for the medical statisticians Percy Stocks and Major Greenwood while Oscar Irwin and Egon Pearson started their careers in statistics in 1921. However, until 1926 K. P. gave all the statistics lectures.

G. Udny Yule (1871–1951) had worked for Pearson from 1893 to 1899 and contributed to early issues of *Biometrika*, although by 1901 the *Journal of the Royal Statistical Society* was a more important journal for him. Alice Lee, Yule's fellow-student in K. P.'s first class in statistical theory, a lecturer at Bedford College who remained around University College in various capacities, was author or coauthor of eight *Biometrika* papers. David Heron, who for 'ten years was to be Pearson's leading statistical colleague', according to Pearson (1938, p. 165), published nine pieces in the journal. After the Great War the leading contributor, after K. P., was Geoffrey Morant, a lecturer in K. P.'s department who contributed 29 papers, all but one on anthropometry. Ethel Elderton, who had been around since before the war before becoming an Assistant Professor, published 14 articles on a wide range of subjects between 1909 and 1935; Love (1979) describes her career and that of Alice Lee. J. Oscar Irwin left in 1928 and J. Wishart left in 1929 each having contributed a few papers during his stay. Edgar Fieller joined and published four articles in 1931–4. F. N. David was K. P.'s assistant from 1933 until his death and she wrote one paper under her own name and another with K. P.

For some of those who went away, publishing in *Biometrika* became part of their life: after studying with K. P. the American botanist J. Arthur Harris published 11 papers between 1909 and 1916 (Bellhouse, 2009, p. 54). The longest serving contributor to *Biometrika* in the K. P. era was the Dublin brewer, W. S. Gosset (1876–1937) alias 'Student', who had studied with K. P. in 1906/7. Gosset always used *Biometrika* as *his* journal, publishing 13 papers between 1907 and 1931 (Pearson, 1990). 'Student' submitted papers and *Biometrika* published them but most did not fit the mold. 'Student's' (1908a) paper on the probable error of the mean has long been the best remembered paper of the entire K. P. era, but Pearson was not interested in extending the outmoded theory of normal errors, and it received serious attention in *Biometrika* only when Neyman & Pearson (1928) set out to codify Fisher's use of it. Pearson was more interested in 'Student' (1908b) on the correlation coefficient and he encouraged H. E. Soper to write his (1913) paper on it; Soper was the only member of K. P.'s circle whose mathematical powers approached his own. Within the journal 'Student's' most influential paper was his 1914 piece on the variate difference correlation method of time series analysis; this was linked to K. P.'s own work and there were several follow-up papers. 'Student' was already involved with agricultural experiments before the War and he published a major paper in *Biometrika* in 1923. Despite these initial advantages *Biometrika* stood aside from the Rothamsted explosion of the 20s and the first paper to treat experiments as they were understood there, Welch (1937), came after the K. P. era; see Atkinson & Bailey (2001, p. 59).

After 1919, with Fisher established at Rothamsted, the British biometric community became bipolar. In the course of the 1920s the Department of Applied Statistics itself became bipolar as Egon Pearson grew in independence. He was the second most senior statistician and, though

not as prolific as his father, was the next biggest contributor on statistical theory in his 15 years of apprenticeship. Soon after being appointed he was publishing in *Biometrika*, in 1922 a joint paper with his father and one under his own name, and assisting in the editing. Egon Pearson (1990, 70ff) has given his own account of those years and, referring to his research up to 1927, recalls how nearly all of the subjects were suggested by K. P. The year 1926 was an important one in the Biometric Laboratory, for K. P. had a cataract operation and gave some of the lecturing to Egon. By the late 20s Egon was choosing his own research topics and was coming to have an influence on the research done by students, see, for instance, Clopper & Pearson's (1934) confidence interval paper. Egon also joined the Statistical Society and was one of those behind the formation of the Industrial and Agricultural Research Section; see Aldrich (2010). Statistical visitors still came to K. P.'s department but they were more likely to do joint work with Egon, hence such papers as Neyman & Pearson (1928) and Pearson & Wilks (1933).

In the K. P. years there were always student visitors from America and what they did and where else they went indicate how the scene was changing. Before the war biologists like Pearl and Harris came, but afterwards statisticians came. When Burton Camp came in 1924 it was to study with K. P. (Bellhouse, 2009, pp. 59–60), but when Samuel Wilks came in 1932 it was to work with Egon and with Wishart who had taken Fisher's ideas to Cambridge; Wilks (1932) brought the analysis of variance to Biometrika.

6. Editorializing

K. P.'s *Biometrika* had editorials and for him editorializing was a duty and one he relished. The heading 'Editorial' covered the most varied material reflecting the journal's multiple roles. Beyond its part in the University College apprenticeship system the journal provided a form of lifelong learning, a means of continual professional development, an apron string or umbilical cord. K. P. also used *Biometrika* as his personal journal to record his reactions to events in the biometric world: it was important to broadcast these reactions because K. P. was custodian for the subject.

Pearson wrote no textbook and he used *Biometrika* to provide a correspondence course in biometric methods. The three articles 'On the Probable Errors of Frequency Constants' (1903; 1913; 1920c) are good examples. His frequent comments on articles published in the journal aimed to show how the work fitted into a larger scheme. The unsolicited 'appendices' he wrote to papers by 'Student' and Fisher, Pearson (1915) and Soper et al. (1917), also had an educational function. Besides being unnecessary, the second appendix involved a serious misunderstanding of Fisher's intentions which soured their relations; see Aldrich (1997, p. 68ff).

The biometric congregation also needed protection and so Pearson issued warnings, as in the alarmingly titled 'On Certain Errors with Regard to Multiple Correlation Occasionally Made by Those Who Have not Adequately Studied this Subject' (1914). Pearson was particularly jealous of the reputation of biometry: a paper by his former student Raymond Pearl moved him (Pearson, 1917b, p. 432) to issue this rebuke:

> It is most regrettable that such extensions of biometric theory should be lightly published, without any due sense of responsibility, not solely in biological but in psychological journals. It can only bring biometry into contempt as a science if, professing a mathematical foundation, it yet shows in its manifestations most inadequate mathematical reasoning.

The subject's friends could be its greatest enemies: Pearson & Heron (1913, p. 159) warned that 'if Mr Yule's views are accepted, irreparable damage will be done to the growth of modern statistical theory.'

Pearson had a philosophy of controversy which he (1905a, p. 169) once articulated, 'There is not much profit as a rule in complaining of the treatment one receives at the hands of critics, but. . . .' Then followed a 30-page reply to critics of his work on skew curves. This was part of a controversy with the Dutch astronomer, Kapteyn (Pearson, 1906b), described by Stamhuis & Seneta (2009). Occasionally Pearson published criticism of his own work, e.g., Burnside's (1924) critique of Pearson's (1920b) interpretation of Bayes' theorem, though naturally the last word went to Pearson (1924b); the exchange is discussed in Aldrich (2009).

Pearson did not claim to be infallible: 'Peccavimus!' of 1919 corrected 'some slips made recently at the Biometric School and which it is desirable to correct at once before the formula which need correction pass into general use.'

7. COMING OFF THE PAGES

All journals have a changing body of contributors and it is in the nature of a school that its pupils grow up or of a missionary society that its members go away. Often they return sentimentally as old boys or to retire but K. P.'s *Biometrika* alienated some of its most strongest supporters, among them Davenport, Pearl, Yule, Fisher and perhaps Greenwood.

Witkowski (2008, pp. 40–1) describes how Davenport departed in 1903 when he objected that *Biometrika* was being run 'in the interest of one idea'. Davenport returned on one occasion to answer criticism of his work published in the journal. On that occasion Davenport (1910, p. 400) made a pointed remark to which Pearson responded:

> [. . .] it is a pleasure to see the increasing catholicity of the active editorship of *Biometrika* in accepting such a paper for publication.†
>
> †[This statement of Dr Davenport's needs an editorial comment. No paper dealing with heredity from the Mendelian standpoint has ever been refused by this journal, although such papers would be declined if they were considered inadequate experimentally or theoretically. Biometric papers British, American, and foreign have been rejected on these grounds. K. P.]

Davenport returned but did not stay. As this exchange illustrates, K. P. and his critics never saw things the same way.

The first major statistical figure to depart was Yule. Yule had such a long and close association with K. P., see § 4, that this may have been the most painful of the separations. Yule contributed to the first three volumes of *Biometrika* but then parted from Pearson in 1906, after criticizing the master's treatment of association; for an account see MacKenzie (1981, p. 161ff). Yule (1936, p. 101) later reflected on the separation, 'Those who left him and began to think for themselves were apt, as happened painfully in more instances than one, to find that after a divergence of opinion the maintenance of friendly relations became difficult, after express criticism impossible.' After K. P.'s death Yule returned to *Biometrika*. Greenwood also went missing after a dispute over the originality of some results in Neyman (1925). Perhaps Pearson (1927, p. 210) defended his publication of Neyman's work rather too vigorously: 'One page of creative work I personally hold is worth fifty of such journalistic criticism.'

When Davenport's name came off the title page in volume 7, 1909, Raymond Pearl's did so too. Pearl was more of an insider than Davenport, having studied with Pearson, and more of a contributor too, providing 10 articles between 1901 and 1910. Matthews (1995, p. 117) quotes Pearl writing to Pearson 'I can see no reasons why a firm conviction of the value of statistical methods in biological work should necessitate that one should subscribe to your views as to

the method and nature of inheritance.' Bellhouse (2009, pp. 53–4) describes Pearl's fluctuating relations with Pearson. When Pearson died Pearl (1936, p. 664) wrote

> For while K. P. and I fell apart many years ago about some scientific matters, which never thereafter were discussed between us, our friendship grew ever closer and deeper as the years went on, and I am sure mutually so.

Their personal relations may have been repaired but Pearl did not contribute to *Biometrika* after 1910.

In his remarks on these separations Pearson (1938, p. 184) indicates 'independence' and 'loyalty' as qualities his father prized; perhaps not loyalty to him personally but to the cause. K. P. liked people to have their own ideas and some of the most impressive publications of his era came from writers going their own way: a good example is Smith's (1918) 'amazing paper' on optimal design (Atkinson & Bailey, 2001, p. 55). Gosset had the secret of being independent and loyal. As well as going his own way, he disagreed with Pearson: in a 1922 letter to Fisher he wrote that 'in some cases I have agreed to differ from [K. P.] long ago' (McMullen, 1970). Gosset's personality helped sustain his relationship with Pearson but there were other factors: Gosset confined his criticism of Pearson to their correspondence and his work applying statistical ideas to the problems of brewing was too marginal to the cause to ever threaten it.

The palpable absence of K. P.'s last decade was R. A. Fisher. Fisher was not as closely associated with Pearson or with his journal as the other departed but, like them, he had begun by taking *Biometrika* at Pearson's estimation: Fisher made this clear in 1916 when Pearson told him that the journal might have to go abroad for lack of funds, 'It would be a most terrible loss as well as an appalling indignity, if this country cannot support such an important and valuable school of research' (Pearson, 1968, p. 451). For nearly ten years *Biometrika* was the journal Fisher wanted to publish in but he succeeded only once in 1915. The break came in 1920 when K. P. rejected another of his papers; the details are in Pearson (1968, p. 453) and there is more on Fisher's relations with K. P. in Box (1978). Leonard Darwin (Bennett, 1983, p. 73) told his young friend:

> As someone said, one must not treat Pearson like anybody else. I think he means to be civil. But it is an astounding attitude to take up. To allow nothing to be published which does not back him up, or which he personally does not have time to read and pitch into – it is going too far.

K. P. never accorded Fisher the dignity of launching a massive barrage against him: unlike Yule, Fisher was a cadet statistician to be patronized or ignored. Pearson (1922, p. 191) dismissed Fisher's (1922a) criticism of K. P.'s treatment of the number of degrees of freedom in the χ^2 test with an amused flourish:

> I trust my critic will pardon me for comparing him with Don Quixote tilting at the windmill; he must either destroy himself, or the whole theory of probable errors, for they are invariably based on using sample values for those of the sampled population unknown to us.

Fisher's *Statistical Methods for Research Workers* (1925) with its expressed and implied criticism of K. P. was not reviewed in *Biometrika*. Pearson mentioned Fisher on one subsequent occasion, in the posthumously published criticism (1936) of Fisher's criticism of the method of moments and advocacy of maximum likelihood. Neither of Pearson's attacks shows any understanding of what Fisher was doing.

Although Fisher was off the pages of *Biometrika*, his ideas were not. Egon Pearson (1926) reviewed his book elsewhere and his influence can be seen in publications like

Neyman & Pearson (1928); incidentally this would be almost the only contribution to general methodology of the K. P. era that would make a mark; see Davison (2001, p. 14). Fisher was not only where the action was but he was also an employer and he recruited John Wishart and Oscar Irwin from University College. Wishart continued to contribute to *Biometrika* after the move. His article introducing the Wishart distribution belonged in *Biometrika* because it was a development of Fisher (1915) on the exact distribution of the correlation coefficient. Wishart (1928, p. 43) acknowledged Fisher's help: 'My thanks are due to Dr R. A. Fisher, in whose laboratory this paper was written, and without whose critical help it would have been difficult to generalize the geometrical methods employed by him.' In 1927 K. P. was 70 years old: he was still contributing but he had lost control of the statistical agenda of *Biometrika*, though he remained lord of the skulls.

8. CONCLUSIONS

The June 1936 issue of *Biometrika* opened with this announcement:

> KARL PEARSON died on the 27th April 1936 in his 80th year, having passed for the press all but a few pages of the present issue of *Biometrika*.

K. P. had retired from his University College chair in 1933 but he had continued to edit the journal.

K. P.'s final issue has two pieces by him. One, (1936a), a comment on a preceding article on racial anthropometry by Morant & Samson (1936) illustrated one of K. P.'s abiding interests and his engagement with everything published in the journal; the year before he had published 45 pages of 'Thoughts suggested by the papers of Messrs Welch [(1935)] and Kołodziejcyk [(1935)]', papers based on the Neyman–Pearson testing paradigm. The other, (1936b), a reply to Fisher (1922b) criticism of the method of moments was his only publication to treat Fisher's ideas about estimation and underlined his partial disengagement from what had been *his* subject.

Two big stories are associated with the rise of mathematical statistics in Britain and K. P.'s *Biometrika* was not central to either. It came after the Galton–Edgeworth–Pearson–Weldon 'breakthrough' at the end of the nineteenth century and it missed Fisher, who Hald (1998) described as a 'genius who almost single-handedly created the foundations for modern statistical science'. As noted in § 5, the design and analysis of experiments, Fisher's subject, was virtually off the pages of K. P.'s *Biometrika*. K. P.'s journal did not provide many milestones to the modern discipline and it does not emerge with much glory from the *Biometrika* centenary reviews: there were impressive individual papers and important sequences including the correlation sequence, 'Student' (1908b), Soper (1913) and Fisher (1915), and the testing sequence initiated by Neyman & Pearson (1928) but these were few. And yet K. P.'s *Biometrika* was a great journal.

In 1901 *Biometrika* was unique as a journal of pure and applied statistics and its uniqueness reflected K. P.'s genius and the circumstances of his time. It was part of his project to establish biometry, and later mathematical statistics, as major studies. In 1936 Britain had several centres for statistics. At University College Egon Pearson had inherited the Department of Applied Statistics while the Eugenics Laboratory was in Fisher's hands. Rothamsted continued to thrive under Yates, and Wishart had moved on to establish the research and teaching of Fisherian statistics at Cambridge University. *Biometrika* was joined by two other journals heavily involved with pure statistics, the *Supplement* to the *Journal of the Royal Statistical Society* and the *Annals of Eugenics*. The *Supplement* began publication in 1934 and continued after the Second World War as *Series B*; its history is discussed in Aldrich (2010, 16ff). The *Annals*, which continues as the

Annals of Human Genetics, had only a brief spell as a statistical theory journal coinciding with Fisher's editorship and his term as Galton professor. All this growth came from people who had learnt how to do statistics from *Biometrika*. Seen from outside Britain, *Biometrika* was both the international forum for mathematical statistics and an example of what a journal of pure statistics could be: in 1939 when the editorial team of the *Annals of Mathematical Statistics*, the journal of the Institute of Mathematical Statistics, was refashioned, the new leaders were Wilks, Hotelling and Neyman: all contributors to K. P.'s *Biometrika*. Of course, for them, as for their British contemporaries, the original project of the statistical study of biological problems had no continuing significance.

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