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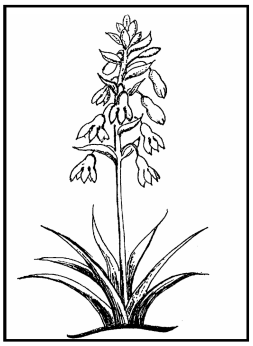

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The Galton Institute

NEWSLETTER

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Contents

EDITORIAL

In this issue we have an important paper by Professor A.W.F. Edwards on Galton's influence on R.A. Fisher which he presented at a meeting of the Royal Statistical Society this summer. This is timely as the 2012 conference of the Institute is being held in conjunction with the Fisher Memorial Committee; it is the fiftieth anniversary of R.A. Fisher's death in 2012. We also have reviews of our 2011 Conference, which was a great success and over-subscribed, and of the British Society for Population Studies 2011 Conference, to which the Institute gave a grant.

To end there is a progress report on a project the Institute is part-funding on teenage pregnancy and childbearing. My aim is to provide a wide variety in each Newsletter, some contributions may provoke a discussion.

Galton Institute Conference 2011: Human and Primate Evolution

Report by Dr Tom Dickins

The 2011 Galton Institute Conference was held on 9 November at the British Academy in Carlton House Terrace, London. The topic of the meeting was human and primate evolution.

There were eight talks, which covered five themes - the emergence and spread of humans; the diversity of the human phenotype; the evolution of the brain; the evolution of behaviour; and, the adaptive flexibility of behaviour.

The Galton lecturer, Professor Chris Stringer, spoke predominantly to the first theme. He presented a beautifully crafted cautionary tale about the uses of archaeological evidence, debunking previous hypotheses, whilst at the same time discussing the latest ideas of the spread of humans from Africa that are founded upon this record but also modern genetic studies. He discussed the arrival of Neanderthals in northern Europe, before anatomically modern humans, as well as the possible interactions and interbreeding between the two species. In so doing he was openly softening his previously stringent position on the out of Africa hypothesis, which saw anatomically modern humans as simply emerging from Africa and taking over the globe, pushing other species to one side. However, the constant theme throughout his talk was a cultural one – what kind of technologies and practices did our forebears have in order to survive the climatic conditions in our part of the world and in order to hunt the fauna available?

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Dr Andrea Manica presented genetic models of the temporal spread of anatomically modern humans from Africa around the world that took account of climatic patterns across time and hypothesized key bottlenecks, which he characterizes as founder effects. These models were then compared with the current archaeological record and the coordination was impressive. His use of founder effects was also employed to account for a reduction in genetic and phenotypic variation and he has published a fascinating account of how this variation diminishes as the populations move further from the African point of origin.

Professor Robert Foley was concerned to emphasise human diversity and he was particularly keen to invoke cultural change as a source of selection pressure, which is much in keeping with the claims made by Professor Stringer in his new book on the origins of humans. Core to this kind of model is the idea that a relatively genetically bottle-necked species such as our own can colonize many environments as a consequence of a flexible behavioural repertoire and the spread of good ideas through social learning, or cultural transmission. In this way some of own activities will also change the selection pressures we are under, and lead to changes in gene frequencies. This idea has been referred to as cultural niche construction and is readily captured by standard evolutionary ecological models.

Dr Nicholas Mundy broadened the focus beyond humans and discussed primate evolutionary genetics. He showed how recent work in his lab had isolated four genes associated with brain size that have undergone positive selection across all the major clades of anthropoid primates. This indicates a high degree of conservation in primate brain size evolution. He moved on to discuss particular polymorphisms for dichromatic and trichromatic vision in lemurs, and suggested possible selection stories for this based on the ecological niches inhabited by each species in Madagascar. Finally, he showed conservation on a number of other genes across a limited set of primates including humans, indicating positive selection for, among other things, changes in auditory sensitivity. Dr Mundy stressed that these latter findings were very new and he was uncertain how to interpret them at this point.

The brain size story was continued by Dr Susanne Shultz who introduced the audience to the social brain hypothesis and the idea that brain size selection was driven by changes in social organization, and therefore a cognitive need to track key elements of relationships within groups. This idea challenges previous notions that increases in relative brain size were driven by allometric changes in overall body composition as a consequence of ecological factors. Dr Shultz also mentioned her most recent paper demonstrating that primate social structures are very conserved across species and across time indicating that they have been resilient in the face of various ecological differences and changes. This work showed that the move from solitary foraging to large aggregations of multiple female and multiple male groups happened about 52 million years ago followed by a second transition to pair-living and then, in some cases, single male harem structures around 16 million years ago. This shift to sociality is likely associated with a transition from nocturnal to diurnal living, which in turn increased predation risks. Living in a group will statistically and behaviourally reduce such risks. There is clearly some synergy between the genetic conservation found in Dr Mundy's lab and this latest finding within Dr Shultz's and it was exciting to see these brain size stories converging.

Brains produce behaviour, and that behaviour can be regarded as a part of an evolved phenotype. Dr Rebecca Sear explained the three main approaches to evolutionary human behavioural science in her talk. These are evolutionary psychology, human behavioural ecology (her own discipline) and cultural evolution understood both as social transmission and also a source of phenotypic variation at the behavioural level. Dr Sear's

Convivial atmosphere of the 2011 Conference held at the British Academy

own approach takes what is sometimes referred to as the phenotypic gambit. This means that behaviour is analysed in terms of its affect on average lifetime inclusive fitness but the proximate causes of this behaviour at the psychological and neurological level are assumed but not explored. She demonstrated the power and utility of this approach by discussing some of her own work on human fertility in Gambia. Dr Sear has focused upon the effect of mothers on child survival and also shown significant cooperative breeding effects in terms of matrilineal grand-parental support.

A key concept in Dr Sear's paper, and within human behavioural ecology as a whole, is that behaviour is facultatively responsive to ecological demands. This idea was given substantial support from Dr Stephen Suomi who presented his work on rhesus macaques. He has explored mother-infant attachment and its significant effects upon future development, again in keeping with Dr Sear, but his principal focus is upon the proximate machinery of possible adaptations. Individuals with poor attachment, and who live in stressed environments, will be more likely to develop challenging social behaviour including increased aggressive response. Moreover, maternal attachment, if good, can buffer the effect of particular genes, such as the monoamine oxidase alpha (MAOA) gene, which is associated with particular kinds of violent behavioural profile. If a macaque has a good mother and the MAOA gene it will not be aggressive, but if its mother is poor it will be. Dr Suomi discussed how such effects were mediated by the passive stress response of the hypothalamic pituitary adrenal (HPA) axis. There is a growing body of literature that suggests stress response can have epigenetic effects upon gene expression in rodent models, and Dr Suomi's work on macaques is consilient with this. Moreover, as Dr Suomi made clear macaques live in a vast array of ecologies and are successful generalists, not unlike rats and humans. The ability to differentially control relative aggressiveness may well be a facultative adaptation that enabled relevant levels of competition in stressed environments where and when they were encountered. As such behaviours carry costs an ability to switch them off in rich environments would be advantageous. It is worth noting that these are maternally induced fitness benefits with transgenerational effects. A poor maternal signal changes offspring behaviour, which is a fitness investment for the mother.

Professor Tecumseh Fitch began his paper with reference to Niko Tinbergen's four questions – the mechanistic, the ontogentic, the functional and the phylogenetic – and his work on language has encompassed all of these layers of explanation. Professor Fitch showed how a focus upon the dynamics of the proximate machinery of the larynx across a number of species enabled him to demonstrate that a descending larynx was not a peculiarly human trait, thereby calling into question a key argument on language origins that suggested human vocal anatomy was idiosyncratic. Professor Fitch was keen to point out that language should be broken down into its constituent faculties and that from that perspective there was no one point of origin for language, but different components came on line over evolutionary time. Dynamic vocal range appears to have been selected for at a number of points in evolutionary history across a number of species. The obvious question then becomes "what else is needed?" and Professor Fitch sketched a partial answer to this by taking the audience through an experiment on rhythmic sound patterns. The patterns were organized as tree-like hierarchies that demanded a certain amount of computational capacity to discern and remember. Professor Fitch argued that the extent of this capacity is peculiarly human and is related to prosody in language and the general disposition to process higher order syntax like structures.

As I hope is apparent the conference was a diverse meeting, which is unsurprising given the focal species. The buzz of conversation lasted well beyond the formal questions and I am certain everyone left the British Academy stimulated and even more curious than when they arrived. This is in no small part due to the excellent and professional presentations that the speakers gave but the Galton Institute and the delegates must also thank the General Secretary, Betty Nixon, who worked tirelessly behind the scenes to organize this meeting, as she does every year.

Key publications

For those wishing to follow the detail of the arguments outlined above, I have drawn up a key publications list presented in the order discussed in this report. I hope it is of use.

Professor Chris Stringer

Stringer, C. (2011.) *Origin of Our Species.* London: Allen Lane

Dr Andrea Manica:

Betti, L., Balloux, F., Amos, W., Hanihara, T., & Manica, A. (2009.)

Distance from Africa, not climate, explains within-population phenotypic diversity in humans. *Proceedings of the Royal Society London B,* 276: 809-814

Manica A., Amos W., Balloux F., & Hanihara T. (2007.) The effect of ancient population bottlenecks on human phenotypic variation. *Nature* 448: 346-348

Professor Robert Foley:

Lewin, R., & Foley, R.A. (2003.) *Principles of Human Evolution*: Oxford: Blackwell

Dr Nicholas Mundy:

Montgomery S.H., Capellini, I., Venditti. C., Barton R.A., & Mundy, N.I. (2011.) Adaptive evolution of four microcephaly genes and the evolution of brain size in anthropoid primates. *Molecular Biology and Evolution, 28* (1): 625-38

Dr Susanne Shultz:

Shultz, S. & Dunbar, R. (2010.) Encephalization is not a universal macroevolutionary phenomenon in mammals but is associated with sociality. *PNAS, 107* (50): 21582-21586.

Shultz, S., Opie, C. & Atkinson, Q.D. (2011.) Stepwise evolution of stable sociality in primates. *Nature,* 479: 219–222; doi:10.1038/nature10601

Dr Rebecca Sear:

Sear, R. & Coall, D.A. (2011.) How much does family matter? Cooperative breeding and the demographic transition. *Population and Development Review 37*: 81-112

Dr Stephen Suomi:

Cirulli,F., Francia, N., Berry, A., Aloe, L., Alleva, E., & Suomi, S.J. (2009.) Early life stress as a risk factor for mental health: Role of neurotrophins from rodents to non-human primates. *Neuroscience and Biobehavioral Reviews*, *33* (4): 573-585

Professor Tecumseh Fitch:

Fitch, W. T. (2011.) Unity and diversity in human language. *Philosophical Transactions of The Royal Society B: Biological Sciences,* 366: 376-388.

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Professor Chris Stringer, FRS with the Galton Plate which is presented to the Galton Lecturer each year.

The silver dish was designed by Leslie Durbin, who designed the Queen's Head for the Royal Jubilee medal and the reverse of £1 coins in the 1980's. He also designed the decoration on the Stalingrad Sword, given by Churchill to Stalin to honour the citizens of Stalingrad in the 1940's, the actual engraving was done by George Taylor Friend. Leslie Durbin was honoured in many ways including a retrospective exhibition at Goldsmiths' Hall entitled *Fifty Years of Silversmithing*.

The Galton lecture has been given almost every year since 1914.

Galton's influence on R.A.Fisher

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Introduction

Twenty years ago the Galton Institute held a symposium *Sir Francis Galton, FRS, The Legacy of His Ideas* to mark the eightieth aniversary of his death and to celebrate its change of name from the Eugenics Society two years previously. Founded in 1907 and originally called the Eugenics Education Society, it secured the aged Galton as its Honorary President in 1909, though he had initially declined. The symposium was organised by Milo Keynes, himself a direct descendent of Charles Darwin and therefore related to Galton through their common ancestor Erasmus Darwin. In due course the book of the symposium was published under his editorship.

Milo asked me to give one of the talks and handed me the title 'Galton, Karl Pearson and Modern Statistical Theory' to make what I would of it. Though I had written a little history of science over the years, this was the first time I had been commissioned to do anything more than a modest encyclopedia entry. In my innocence I thought I should start by reading Pearson's *Life, Letters and Labours of Francis Galton*, and I have a vivid memory of carrying the four tomes through the tourists on Cambridge's King's Parade from the Whipple Library to my room in Caius College, arms aching. On examination it turned out to be just as revealing about Pearson as Galton, which should have suited my topic. At the symposium Bynum was to remark that it was 'clearly a labour of love, although sometimes as revealing of its author as its subject', and he discussed some of its reviews.

However, there was Forrest's 1974 biography to fall back on. In expressing his 'great debt' to Pearson's volumes Forrest wrote in his Preface 'Without Pearson's compilation it would have required many more years to complete this book'. Yet 'The deterrent effect of Pearson's mammoth 2000 page biography is considerable. It was written as a monument to the man whom Pearson admired above all others, but its sheer bulk resulted in the burial of the man beneath the monument'. Bynum remarked 'A new biography of Galton is a desideratum, and any future biographer will have more reason to praise than to rail at Pearson'. Since then we have benefitted from a *Life* by Gillham (2001) and Bulmer's (2003) *Francis Galton* which, though not a biography as such, is invaluable for its scientific perspective, as its subtitle *Pioneer of Heredity and Biometry* indicates. Stigler too has been indefatigable in explaining Galton and Pearson to us, from his Fisher Memorial Lecture in 1986 to his recent talk at the Pearson sesquicentenary earlier this year.

Yet as I worked at my symposium talk, reading widely as the list of forty-five references shows, my Fisherian background began to intrude, for in the preceding twenty-odd years I had ransacked Fisher's statistical books and papers in an attempt to understand the arguments about statistical inference and in particular the role of likelihood. So I rounded off my talk with a section entitled 'GALTON'S INTELLECTUAL HEIR?' which started:

> In conclusion, I venture to exceed my brief by advancing a thesis which presents itself so naturally at this stage that I am surprised that it has never occurred to me before. It is simply that in statistics the young R.A.Fisher was the real inheritor of Galton's intellectual mantle. Perhaps this explains something of the antagonism Pearson felt towards him. This thesis stands principally on three of Fisher's early contributions. First, his 1918 paper 'The correlation between relatives on the supposition of Mendelian inheritance' which brilliantly synthesised the biometrical and Mendelian standpoints (1918*a*); secondly, his contemporaneous invention of the analysis of variance (the phrase first occurs in his *Eugenics Review* paper 'The causes of human variability' [1918*b*]) which was not only Galtonian in its context but manifestly starts where Galton's dissection of Normal variation had left off; and thirdly, his path-breaking determination of the exact sampling distribution of the Galtonian correlation coefficient, which heralded the dawn of modern mathematical statistics (Fisher, 1915).

It will be well to remember the dates of birth of the three men, Galton 1822, Pearson 1857 and Fisher 1890, with the substantial gaps of 35 and 33 years. Galton died on 17 January 1911, just as the undergraduate Fisher was busy founding the Cambridge University Eugenics Society, which held its first meeting on 22 May. The principal link between them was not Pearson but his near-contemporary Leonard Darwin, Charles's fourth son and Fisher's fatherly mentor. Leonard succeeded Galton as President of the Eugenics Education Society in 1909 and

served for 18 years, lending advice and encouragement to the young Fisher throughout. To him Fisher's great evolutionary work *The Genetical Theory of Natural Selection* is dedicated, and it is he whom Fisher thanks for suggesting the topic of the 1918 paper: 'Finally, it is a pleasure to acknowledge my indebtedness to Major Leonard Darwin, at whose suggestion this inquiry was first undertaken, and to whose kindness and advice it owes its completion'. It is pleasant to believe that Fisher, who had just passed the Mathematical Tripos as a Wrangler, was amongst the undergraduates in the Senate-House when on 6 June 1912 Leonard was admitted to the titular Cambridge degree of Doctor of Science *honoris causa.* In introducing him, the Orator spoke first of his Presidency of the Eugenics Education Society.

As Professor J.H.Bennett relates in his introduction to the Darwin–Fisher correspondence,

> Darwin's earliest letters in 1915 set out various problems arising from Galton's work which he hoped Fisher would solve; these are concerned mainly with biological variation and inheritance, Galton's law of ancestral heredity, parental correlation and regression, as well as natural selection and mutation. Darwin said he was 'building up ideal conditions and seeing how far they work like nature does work'. He was especially anxious to know if Galton's work on ancestral heredity could be given a Mendelian interpretation. ... This problem must have come forcefully to Leonard Darwin's attention in 1914 when his brother Francis gave the first Galton Lecture before the Eugenics Education Society. Francis said that Mendelism requires that we 'look at variation in a very different way to that of Galton' and that whilst 'a progressive study of heredity must necessarily be on Mendelian lines', it 'does not follow that the laborious and skilful work of Galton and his school is wasted'.

In the passage from my 1991 symposium paper quoted earlier I explicitly associated the name of Galton with two of the three papers of Fisher's that I mentioned, but not with the 1918 paper. However, from the Darwin–Fisher correspondence and Bennett's account of the background to it we see how directly that paper grew from the Galtonian interests of these two Darwin brothers. Fisher set to work and finished it in 1916, only for it to be unfavourably reviewed for the Royal Society by both Pearson and Punnett. It not only reconciled the Mendelian and biometric approaches, but out of it came Fisher's development of the analysis of variance.

This is not to suggest that Pearson had no influence on the paper. Leonard Darwin had already encountered difficulty with him, in 1913 questioning the use of the phrase 'the relative influence of heredity and environment' to which Pearson had replied by means of a paper in *Biometrika* with the astonishing title 'On certain errors with regard to multiple correlation occasionally made by those who have not adequately studied the subject'. When he came to examine the controversy two years later, Fisher thought Darwin had been right, but nothing came of the suggestion for a response. From then on Fisher's own analysis developed rapidly, culminating in the 1918 paper. For a discussion of the connections between it and earlier work, including Pearson's, see my 'How much did Pearson's work influence Fisher's genetics'.

Bennett remarks that 'For Fisher the friendship with Darwin, with his close links with Charles Darwin and Francis Galton, had special significance'. After Darwin's death in 1943 Fisher wrote to Milo Keynes's mother, Leonard's niece, that his 'very dear friend' was 'surely the kindest and wisest man I ever knew'. Nor must we overlook the contact with two other Darwin brothers, George and Horace, through the Cambridge University Eugenics Society, and later with George's son Charles Galton Darwin, Fisher's contemporary, who reviewed *The Genetical Theory* for the *Eugenics Review* in 1930, corresponded with Fisher about sexual selection in 1932, gave the Galton Lecture in 1939, and became President of the Eugenics Society in 1953. I recall us research students from Fisher's Department of Genetics going to the Senate-House to hear Darwin's 1958 Rede Lecture 'The Problems of World Population' on 29 April. I am afraid I also remember that we were not very impressed, finding fault with his biological reasoning. But probably we just resented a physicist trespassing on our territory. I think Fisher may have been absent, probably travelling abroad, having retired the previous September.

Direct influence

I now turn from these general comments about a Galtonian influence on Fisher via Pearson and Leonard Darwin to a case in which he was influenced by Galton's writings directly, and then conclude with a survey of Fisher's own comments on Galton's work.

In 1968 Joan Box, Fisher's biographer daughter, found a typescript of her father's at the back of a cupboard in the family home in Harpenden,

and deposited it in the Fisher archive in Adelaide. Some seventy pages long, it is the start of a book on the evolutionary reasons for the decline of civilisations. Bennett dates it from 1919. It forms the basis of much of Chapters VIII to XII of *The Genetical Theory*, some of the wording being reproduced exactly.

In Chapter I of his draft Fisher starts by pointing out that for the human race to be undergoing evolutionary change (1) groups must differ in their rates of increase and (2) they must also differ in their 'heritable qualities'. Moreover, the association between the rate of increase and the heritable quality must continue from generation to generation. The rest of the chapter is devoted to a survey of the evidence that (1) is true both within and between societies. Chapter II starts with Galton's 1869 *Hereditary Genius* and an acceptance of Galton's thesis that the 'natural gifts' of men (and he only considered men) are in part heritable. Fisher goes on to argue that 'differences of temperament affect reproduction' with the result that, these being heritable, fertility itself has a heritable component. Then, in Chapter III, Fisher refers to Galton's most influential discovery from his statistical enquiries, that the reason peerages die out is that although the financial advantage of marrying an heiress is obvious, there is a less obvious biological penalty, because heiresses come from relatively infertile families, and fertility is in part inherited. What is more, in Galton's own words,

> I look upon the peerage as a disastrous institution, owing to its destructive effects on our valuable races. The most highly-gifted men are ennobled; their elder sons are tempted to marry heiresses, and their younger ones not to marry at all, for these have not enough fortune to support both a family and an aristocratical position. So the side-shoots of the genealogical tree are hacked off, and the leading shoot is blighted, and the breed is lost for ever.

Fisher quotes extensively from this part of *Hereditary Genius*, and then turns to the natural generalisation of Galton's argument, advanced in 1913 by J.A.Cobb in the *Eugenics Review* who

> has given reasons for believing that the case of heiresses, observed by Galton, is but a particular instance of a far more general tendency. Restricting himself to the unconscious causes of relative infertility, Mr Cobb points out that just as the fortune of an heiress enables her to make a socially advantageous marriage, so among the children of parents of any one class, members of the smaller families will in the average commence life at a social advantage compared to members of larger families. Alongside the many excellent qualities which enable a family to improve its social position, relative infertility also plays its part. In this way the less fertile stocks having the social advantage, will gradually permeate the upper classes of society, and there cause the peculiar situation in which the more fortunate and successful of mankind have the smallest birthrate.

Fisher added a footnote with a long extract from Cobb's paper.

Here then, is the argument, stemming from Galton, that informed Fisher's eugenical thinking. His concern is the decline of civilisations, about which he was, through extensive reading, historically well-informed. Chapters VIII to XII of *The Genetical Theory* are all about the problem and its evolutionary causes. Much is taken from the 1919 draft, including the above report of Cobb's paper. The concern reappears in his 1932 Herbert Spencer lecture 'The social selection of human fertility' and informed his campaign before the war for family allowances to be paid not as a flat rate but proportional to the income of the parents.

Changing the subject completely, there is a well-known story that the format of the statistical tables in Fisher's *Statistical Methods for Research Workers* might have been influenced by the fact that earlier tables of χ^2 were copyright, so Fisher prepared a new table giving values of χ^2 for selected values of the tail probability P instead of the other way round, thus immortalizing the concept of the level of significance. But the story needs supplementing by Fisher's comment in Chapter I of *Statistical Methods* that 'the form which we have adopted ... has been used for the normal distribution by F.Galton and W.F.Sheppard (1907), *Biometrika*, V. p.405; T.L.Kelley, *Statistical Method*, pp. 373–385'. In fact Galton was the sole author of the paper 'Grades and deviates', acknowledging Sheppard as the calculater of the table for him. Galton notes that he first gave such a table in *Natural Inheritance* in 1889; of course it derives from his 'ogive', or diagram of the cumulative normal distribution, and ultimately from the table 'Classification of men according to their natural gifts' in *Hereditary Genius*.

So perhaps he should share with Fisher some of the blame for the rise of significance tests.

Fisher on Galton

In 1947 the world-wide Biometric Society was founded with Fisher as

its first President, and on 29 April 1948 the inaugural meeting of the British Region was held. (To conform to modern sensibilities it is now the International Biometric Society and ours is the British and Irish Region.) Fisher addressed the meeting on 'Biometry' and claimed for the subject the 'the honour of compassing the second great stage of intellectual liberation [following on from deductive logic], by making known the principles of that second and scarcely explored mode of logic, which we know as induction'. ... 'it has been reserved for Biometry, the active pursuit of biological knowledge by quantitative methods, to take this great step; and the man who in the nineteenth century did more than any other to prepare the way was, I think, undoubtedly Francis Galton'.

> The peculiarity of Galton's temperamental make-up which led him to play this part was, in my opinion, the insistent need that he felt to think constructively about variable phenomena. Unquestionably he was led to concentrate his attention upon variation, through the central place which variation held in the theory of evolution, which his half-cousin Charles Darwin had put forward, and which influenced Galton profoundly, as appears clearly in his book *Hereditary Genius*, published after the *Origin* by only ten years. To Galton, however, variation of all kinds had an appeal, or a fascination, as much in meteorology for example as in heredity, and this appeal we can appreciate if we can consider what an obstacle to coherent thought mere quantitative variation had formerly been.

Already in 1925, in the first edition of *Statistical Methods for Research Workers*, Fisher had stressed this Galtonian perspective:

> The conception of statistics as the study of variation is the natural outcome of viewing the subject as the study of populations. ... To speak of statistics as the study of variation also serves to emphasise the contrast between the aims of modern statisticians and those of their predecessors. For, until comparatively recent times, the vast majority of workers in this field appear to have had no other aim than to ascertain aggregate, or average, values. The variation itself was not an object of study, but was recognised rather as a troublesome circumstance which detracted from the value of the average. ... Yet, from the modern point of view, the study of the causes of variation of any variable phenomenon, from the yield of wheat to the intellect of man, should be begun by the examination and measurement of the variation which presents itself.

Just how Galtonian is this 'modern point of view' can be seen from Galton's own remark in his autobiography of 1908 *Memories of My Life*: 'The primary objects of the Gaussian Law of Error were exactly opposed, in one sense, to those to which I applied [it]. They were to get rid of, or to provide a just allowance for errors. But these errors or deviations were the very things I wanted to preserve and to know about'. I do not know if Fisher ever read the autobiography, though he had certainly read *Hereditary Genius* by 1911 as his talk to the Cambridge University Eugenics Society shows.

Three years after his Biometric Society address Fisher contributed an essay 'Statistics' to a book *Scientific Thought in the Twentieth Century* with a second section 'Galton and Statistical Biology' which starts:

> A man who, towards the end of the nineteenth century, played a peculiar part in precipitating modern developments was Francis Galton. A man of means and, had he chosen, of leisure, Galton made his name early in life as an African explorer. In 1869, evidently reacting eagerly to his cousin Charles Darwin's evolutionary theory, he had written *Hereditary Genius*, one of the most remarkable books of the century, and in it had demonstrated how apparently intangible concepts, at first vaguely apprehended, can be made quantitative and relatively precise by the collection and adequate presentation of statistical data. Throughout his life this possibility evidently exercised a fascination on his mind. In a crude way he attempted to collaborate in discussing the numerical results of his cousin's experiments with plants. He tried his hand at the statistical expression of meteorological phenomena, and, towards the end of his long life, armed with much experience, but without adequate mathematical technique, he became convinced that quantitative, and particularly statistical, methods were needed to consolidate Darwin's ideas, and to give confidence to their practical application. In Karl Pearson he found a man of boundless confidence and ambitious energy, and, with the sympathy of W.F.R.Weldon and his wide biological knowledge, Galton believed that a solid foundation could be built for a timely advance in the method

and theory of biological research.

The 'crude way' to which Fisher here refers was Galton's attempt at analysing some of Darwin's data, to which Fisher devoted a chapter in *The Design of Experiments*: III – 'A historical experiment on growth rate'. His criticism of Galton's procedure is, however, there made more in order to illustrate the fact that 'the logic of statistical induction was in its infancy' than to belittle Galton's efforts.

Much of the paragraph quoted above is drawn from a draft entry for Karl Pearson that Fisher made in 1946 for the *Dictionary of National Biography*, but which he later withdrew after declining to accept the changes that the editor wished to make.

Also in 1951 Fisher wrote of *Hereditary Genius* that it

> stands to-day as one of the great books of the nineteenth century. This is not due to its influence on popular thought, but to its inherent qualities. It was first published in 1869, ten years after the *Origin of Species*, and only separated by two years from the appearance of the first volume of *Das Kapital* by Karl Marx. The latter book is its natural antithesis. Its central aim is the political control of wealth, whereas Galton had his eyes fixed on biological well-being; it dogmatically asserts human equality, while Galton is concerned to measure the important inequalities; it appeals to hatred and vindictive destruction, while Galton, not irrationally for his period, looks forward with confidence to the progressive improvement of existing institutions; above all *Das Kapital* appealed to passion, but *Hereditary Genius* to an almost stoically detached reason. Ideological war had broken out, right in Bloomsbury. It is small wonder that the leftist tradition has never ceased to assail Galton's work, with an animus that Galton could never begin to understand. Sooner or later, however, the world will have to choose between them.

In 1956 Fisher awarded Galton, 'that versatile and somewhat eccentric man of genius', the ultimate encomium of the opening paragraphs of his last book *Statistical Methods and Scientific Inference*. Too long to quote in full, it refers to 'the fruitfulness and success of the train of studies initiated by Galton'. 'Galton's great gift lay in his awareness … of the vagueness of many of the phrases in which men tried to express themselves in describing natural phenomena. He was before his time in his recognition that such vagueness could be removed … through the assembly of objective data and its systematic examination'.

I think we may fairly conclude that Fisher's debt to Galton was substantial and fully acknowledged by him. In return, I think Fisher's tenure of the Galton Professorship of Eugenics at University College London from 1933 to 1943 forwarded the science closest to Galton's heart in just the way he had intended on making the endowment.

Galton has had to wait a long time for a reassessment. No-one, except perhaps Fisher's friend C.D.Darlington, noticed Fisher's views. The Introduction that Darlington wrote to a 1962 edition of *Hereditary Genius* is the first sign of change known to me. More in keeping with the times was Gould's remark in *The Mismeasure of Man* 'Lest this [work of Galton] be taken for the harmless musings of some dotty Victorian eccentric, I point out that Sir Francis was taken quite seriously as a leading intellect of his time'. And now once again, we may add.

Dr Eileen Magnello will be editing a collection of the papers on Galton that were given by 13 speakers at the two-day meeting on Francis Galton at the Royal Statistical Society on 6-7 September 2011

British Society for Population Studies
Annual Conference 2011

The 2011 British Society for Population Studies Conference at the University of York was exceptionally well-attended, with over 200 participants over the course of the two days. This was, perhaps, not surprising given the international representation this year, with speakers from the USA, Italy, Austria, Spain, Germany, Greece, Argentina, Israel, Russia, Australia, Singapore, England, Wales, Scotland and Northern Ireland. Not to forget the 2011 LEDC initiative representative, Dr. Gobopamang Letamo from the University of Botswana, who gave a paper on *The prevalence and correlates of low body mass index in a country undergoing nutrition transition: the case of Botswana*. An innovative feature of the Conference was a training session as an option for an afternoon session, developed and led by Piers Elias and Eileen Howes. Aimed at local authority demographers, the session covered LA-level population estimates, LA-level projections, small area estimates & projections, and data handling. Training session spreadsheet material can now be accessed at the BSPS

website, where it is hoped to update the material periodically:

http://www2.lse.ac.uk/socialPolicy/BSPS/annualConference/2011/Training%20session%20material.aspx

One hundred and thirty-eight submitted papers were presented in parallel sessions. All the abstracts for these presentations, plus some of the presentations themselves where made available, can be accessed at the BSPS website at:

http://www2.lse.ac.uk/socialPolicy/BSPS/annualConference/2011/2011%20Conference%20-%20York.aspx

The first evening saw a lively poster session, with over twenty posters presented. The winner of the poster competition was Emily Freeman (LSE), for her poster *Sex that gives and takes away: sexuality in older age in rural Malawi*. The competition was judged by the distinguished plenary speakers, Professors John Hobcraft and Ken Hill.

The result of the 2011 BSPS Prize, for the best Masters dissertation on a demographic topic from the previous academic year, was also announced at the reception, held simultaneously with the poster session. The winner was Michelle Weinberger from LSE for her dissertation *Making Sense of Tanzania's Fertility: The Role of Contraceptive Use*.

The Conference also marked the last official duties as President for Professor Emily Grundy, who completed her two-year term of office during the event. BSPS thanks Emily for her efforts during her term, and sends all good wishes for her new appointment as Head of the Cambridge Group for Population and Social Structure from May 2012. The New President, Professor Ludi Simpson was welcomed at the AGM, as was the new Vice-President, Professor Tony Champion.

Reports of the plenary sessions follow. BSPS thanks Ben Wilson and Alice Goisis, postgraduate students at LSE, who provided these reports.

Recordings of the plenary sessions can also be accessed at the BSPS website, as can several of the submitted presentations. Please see the menu at:

http://www2.lse.ac.uk/socialPolicy/BSPS/annualConference/2011/2011%20Conference%20-%20York.aspx

Plenary 1
Professor John Hobcraft
University of York

A Multidisciplinary Demographic Life-Course: Genesis of a 2020 Vision

Those who attended the first plenary of this year's conference were treated to a warm, enthusiastic and inspiring talk. Professor Hobcraft began by introducing his central theme, demography and the life-course, and then reflected on his own life-course and broad-ranging career. After crediting his influences (including Coale, Ryder and Brass), he focused on the career of David Glass, the British demographer and professor of sociology who was fundamental in the establishment of BSPS.

Professor Hobcraft then discussed the application, availability, and benefits of longitudinal studies for demographic research. Although the methodological advantages were emphasised, a more holistic view was presented, placing emphasis on the legacy of longitudinal studies and how life-course studies have profited from the introduction and continuation of cohort studies since the Second World War. Professor Hobcraft reinforced his summary with a variety of examples, including a list of previous research projects that have successfully informed recent policy debates. Research using the 1958 and 1970 birth cohort studies has shown that childhood cognitive test outcomes are persistently associated with adult outcomes, with the influence of many factors similar across cohorts and genders. Research using the Millennium Cohort Study was also highlighted, contributing to the body of life-course research on 'legacies of the past', which have been shown to be 'persistent and pervasive'. Examples include research on early years, poverty and extended unemployment.

Having established the lineage and strengths of longitudinal life-course research, the second half of the plenary began to look to the future. Professor Hobcraft's aim was to highlight developments in data collection, and to emphasize one of the key areas of research that will benefit from these developments, namely biosocial interplays and research on epigenetics. Admitting that this is a difficult area of research to summarise, Professor Hobcraft introduced the ABC of Alleles, Brains, and Contexts, and the three P's of Pathways, Processes, and Progressions. He then focussed on gene-environment interplays, arguing that understanding these processes might answer the question: 'what causes the persistence of intergenerational effects?' This linked strongly with the first half of the plenary, moving from remote to proximate causes. Encouraging a movement away from rudimentary social science theories of genes versus environment, Professor Hobcraft then discussed developments in theory and research, including work

by Caspi et al. (2003) on 5-HTT (a gene for susceptibility for depression), and the dandelion-orchid hypothesis (which suggests two different types of biological sensitivity to context – i.e. some children are like orchids, requiring specific conditions to develop fruitfully, and some are more like dandelions).

In the final section of his paper, Professor Hobcraft demonstrated how biosocial data is being currently used, and discussed how it might be used in the future. For example, the US Fragile Families study (a longitudinal cohort study of close to 5,000 children) has already collected DNA from mothers and children when the children were aged 9. After emphasising that the amount of information stored in a genome is a treasure-trove of data and, importantly, even in very small samples (or subsamples), Professor Hobcraft closed with an outline of developments to Economic Social Research Council funded data, both for existing sources like Understanding Society and for upcoming sources like the new cohort study. With plenty of food for thought, we can look forward to these exciting opportunities.

Plenary 2
Professor Kenneth Hill
Harvard Center for Population and Development Studies

Development Goals and Mortality Measurement in the Age of Immediate Gratification

Professor Kenneth Hill began his plenary with an introduction to the 2015 Millennium Development Goals (MDG) and, in particular, with a discussion of Goal 4 of the MDG, which concerns the improvement of child health. The target linked to this goal is to reduce the under-five mortality rate (U5MR), that is, the period probability of dying by the age of 5 years, by two-thirds between 1990 and 2015. In order to reach these quantitative targets, data availability and quality is crucial. Accurate knowledge of mortality levels and trends in the low-income countries is hampered by a widespread lack of complete vital registration systems. These countries must therefore rely on alternative data collection methods. Professor Hill compared three different available data sources to collect mortality data in low-income countries and discussed their strengths and weaknesses.

The first source of data discussed was sample vital registration. This system is in place in some developing countries (e.g. India) and it is based on a double recording system whereby vital events registration is continuous together with periodic household surveys to record recent events. However, doubts have been expressed about the quality of this recording system and it has been documented that mortality monitoring has been poor. The second was nationally representative data such as censuses and large sample surveys. Although this recording system is appealing, as it can collect mortality data through a variety of mechanisms and the cost per unit is low, it is also characterized by long periodicity (around 10 years) and uncertainty about data quality. The third method was smaller household surveys, such as the Demographic and Health Survey Mortality data is collected through full birth histories (i.e. collecting dates of birth and ages of death for each child a woman has given birth to), siblings birth history and summary birth history (i.e. number of children ever born and children dead). The clear advantage of this collection method is that U5MR can be computed with standard life table methods and there is greater frequency relative to larger surveys. However, this collection method is also characterized by data quality issues, the costs per unit are huge and frequency of information is still quite low (e.g. every 5 years). The conclusion on existing data sources was therefore that it is not (yet) possible to produce annual estimates of U5MR and that nothing can be done at a reasonable cost.

This led Professor Hill to pose the question whether demographers and policy makers could make better use of existing data. Summary birth histories (SBH) is, for example, a prominent method of data collection on child mortality; it is a substitute of full birth histories (FBH) and is cheaper and/or allows a larger sample to be collected. Recent research that Professor Hill has carried out with Livia Montana has addressed the question of whether it is possible to correctly impute FBH from SBH. The preliminary results show that the method works reasonably well and they set the ground for the possibility in the future to extract more informative estimates for U5MR from SBH rather than expensive and inaccurate FBH. Another promising method has been highlighted by Fengmin Zhao who has revealed a tight relationship between U5MR and the ratio of deaths over births. Professor Hill concluded his presentation by highlighting the fact that there isn't, at present, any method for real time mortality monitoring at a reasonable cost. The long-term solution lies in civil registration systems.

Ben Wilson and Alice Goisis, London School of Economics and the BSPS Secretariat.

BSPS would like to take this opportunity to thank **The Galton Institute**, who again gave BSPS a generous grant towards Conference expenses.

Early pregnancy and childbearing: A psychosocial approach

Stephanie Clutterbuck and Daniel Nettle

Teenage Pregnancy is widely regarded as a problem in need of prevention and intervention. The argument put forward from public and political platforms alike is that early childbearing invariably leads to a future defined by poverty, low educational attainment and overall poorer quality of life. From the time this phenomenon appeared on the government agenda as a crisis in need of addressing in the early 1990s, academics began exploring and debating the issues associated with becoming a young mother. Consistently, a pattern emerged in the research suggesting that the factors widely accepted as inevitable outcomes were instead predictors of this life course. Studies found that females growing up in these stressful environments characterised by father absent families, deprived neighbourhoods and high rates of morbidity and mortality were the ones more likely to become young mothers.

Interestingly, these effects of the early stressful environment manifest not only in the reproductive timing of adolescents but also in the essential precursors to reproduction, namely sexual maturity and initiation. For example, females experiencing more early life stress tend to be younger when entering puberty and younger at first sexual experience. It would seem that female reproductive strategies are being altered in the presence of certain environmental cues. More specifically, when the external environment is dangerous and resources are limited it may be in one's best interest to reproduce early and often to ensure survival of offspring.

Though the correlational research is vast there has been comparatively little study into the process by which the adverse environmental stimuli manipulates reproductive behaviour. In other words, not *what* leads to early childbearing but *how* can we see it happening?

One process might be an increased interest in infants. It is generally accepted that we pay more attention to people or things that interest us. Thus we can assume that a young woman planning, consciously or not, to produce offspring may increase her attention to infants in preparation for the role of motherhood. To explore this process we are studying interest in infants in girls aged 9 to 14 years from schools across the metropolitan borough of North Tyneside, in the Northeast of England. Through self-report questionnaires we will obtain measures of level of deprivation, family structure, family stress, neighbourhood quality, perceived future chances, self-esteem and pubertal stage. To determine the level of interest in infants we will use one of the two tools currently being validated for their efficacy at measuring this construct. The tools consist of a forced choice adult-infant preference task and a computer based adult-infant recognition task.

Ultimately, this study will explore the variation in interest in infants amongst girls experiencing different levels of early life stress. In line with the literature we predict that girls growing up in harsher environments will be more advanced in pubertal stage relative to their same age peers and will display a higher level of interest in infant stimuli. The kinds of psychological measures which I am developing may be of use in future in providing subtle indicators of who is at risk for early pregnancy and childbearing.

The Galton Institute are part-funding with Newcastle University this research into ***The Psychosocial context of early childbearing in North Tyneside***.

THE GALTON INSTITUTE/FISHER MEMORIAL COMMITTEE

CONFERENCE 2012

To be held at The Royal Society on Wednesday, 14 November, 2012

HUMAN GENETIC DIVERSITY

Speakers include: Professor Mark Stoneking, Dr Himla Soodyall, Professor Carlos Bustamante, Professor Sir Walter Bodmer, FRS, Professor Hugh Montgomery, Dr Simon Myers, Professor Peter Donnelly, FRS and Professor Luigi Luca Cavalli-Sforza

Admission is free but strictly by ticket, available from The Galton Institute General Secretary betty.nixon@talk21.com