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CENTENARY SYMPOSIUM

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WHAT MAKES US

HUMAN?

The centennial meeting of the Galton Institute was held on the precise site of the house (long demolished) of Francis Galton's more famous cousin: the Darwin Lecture Theatre at University College London, a location doubly appropriate because of the long tie between the Galton Laboratory at UCL and the Institute itself.

The event attracted a diverse audience of over a hundred, sometimes rising to twice that number, who came to hear a series of eclectic but inter-connected talks, given by some of the most distinguished geneticists and human biologists of the present day (together with a lecture by the President of the Institute). Francis Galton would have been familiar with many of the questions discussed at the meeting, but would have been amazed by the answers now emerging.

The first session dealt with the vexed question of what makes us into human beings, rather than just an unusually bald primate. The answer, clearly, lies in the mind; but what does that mean? Steve Jones reminded the audience quite how close we lie to our relatives in genetic terms. The famous 98.8% DNA sharing between humans and chimps is an overestimate, for technology reveals many insertions and deletions of short segments of DNA during the evolution of the two species missed using the primitive methods of two or three years ago, but the proportion of the double helix held in common by ourselves and our relatives remains remarkably high.

We often respond by Darwinian means to the challenges we have faced over our history. We understand the forces of natural selection behind the global patterns of skin colour, the ability to drink milk when adult (a minority talent) and the power to digest starch. Differences in the ability to survive infection by the human immunodeficiency virus turn on the genotype at a cell surface receptor used by the virus to gain access to human cells. Populations – such as those in Africa – long exposed to the virus have multiplied up copies of the gene itself. Some are now more or less resistant to its malign effects. Chimpanzees (the source of human infection) have faced the virus for millennia and have even more copies of the relevant protective variant. As a result, the virus has almost no ill effects.

Crucially and uniquely *Homo sapiens* has the ability to plan ahead, and to look back, to design a defence against the disease. From changes in behaviour to the development of the latest anti-HIV effects he has done so – rendering the Darwinian process more or less irrelevant to the future of the disease. The notion that humans are alone in their ability to understand cause and effect was taken further by Professor Lewis Wolpert (University College London) who made a persuasive case that causal belief is what makes us what we are. A man who sees fruit fall from a tree shaken by the wind is tempted to shake it himself on a calm day to repeat the experience: while a chimp could never make that intellectual leap. Chimps or crows use tools in a very simple way – a stone to break a nut – but no crow or chimp has ever made a tool from two separate items, for to do that demands an ability to understand how it works. Causal belief may make us human – although, as a less desirable side-effect, it leads some of us to ascribe the workings of the natural world to the actions of a third party, perhaps a divine one.

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Professor Robert Plomin (Kings College London) took a more analytical look at the human mind, with a particular emphasis on intelligence – a topic of interest to Galton, who himself said that “there is no escape from the conclusion that nature prevails enormously over nurture”. Such statements are fatally easy to make and to believe, but harder to prove. A variety of mental illnesses cause a drastic decrease in intellectual ability, and many are strongly heritable. In some cases – such as early-onset Alzheimer’s disease, or the Fragile-X syndrome – the genes have been tracked down. Finding the genes behind variation in IQ within the “normal” range has been much more tricky. Intelligence itself may have several components, but they overlap to a considerable degree, and the idea of “general cognitive ability” is now widely accepted. Dozens of family and adoption studies show a high heritability of that attribute – which increases with the age of those studied – and the controversy that raged for many years over the truth of that statement has now largely disappeared. IQ tests measure something real, which is passed down from generation to generation.

But what? One unpleasant surprise to emerge from the new human genetics is how hard it has been to find genes of small, or even medium, effect that might affect characters such as height, obesity or blood pressure; and the same seems to be the case for variation in mental attributes. The genetics of mild mental disability involves unlucky combinations of genes that when inherited in less damaging mixtures correspond to variation in the normal range, rather than genes specifically associated with educational problems. The needles are in the haystack – and, worst of all, some of them may be blades of grass.

Chips that can variation in thousands of different DNA sites at once are being applied to IQ variation. Huge studies, involving samples taken from those at the high and the low end of the spectrum, have revealed a few sites that play a part, albeit a small one, in overall variation in IQ score. None is responsible for as much as one percent of the total variation, but together they may cooperate to push a child several points up, or down, in the scale. The latest technology may reveal more – but, as so often true we are learning more about the DNA involved than we understand about how the genes do their job.

The afternoon session turned from the

difficulties of understanding our nature today, to the more challenging task of predicting what it might become over the next several thousand years or more. Professor Lee Silver (Princeton University) talked about the new science of “reprogenetics”, which began with the birth of the first test-tube baby in 1978. Thirty years later, the field has been revolutionised – and, given that rate of progress, where might it be in three hundred years? Eugenics in its early days, said Professor Silver, had set out to limit human freedom – but reprogenetics would do the opposite. Parents have always wanted to do the best for their children, and now they can do so through nature, as much as through nurture. Embryo selection in the negative sense – rejection of fertilised eggs that would develop into a genetically damaged child – is already routine, and, he said, there can be no reason to deny the same process carried out with the intent of selecting the healthiest and most able child. Although we do not yet know what genes might lead to long life, liberty and the pursuit of happiness, we should look for them, and if they are found use that information.

And in three millennia? Perhaps genetic enhancement will become commonplace for those who can afford it – and, if it is, society needs to consider the implications. The issues were familiar to Galton and the eugenicists, and although the technical and ethical landscape has been transformed since their days, the disasters to which the simplistic interpretation of genetics led warn us that the new genetics must be more carefully scrutinised than its predecessor was in the pre-history of the subject, a few decades ago.

The Centenary Galton Lecture was given by Professor Sir David Weatherall (University of Oxford) who spoke on genetics and world health: future opportunities and new ethical issues. His talk reminded the audience quite how far the higher speculation so much indulged in by geneticists and ethicists is detached from the day to day experience of those who live with genetic disease – which, in many parts of the world, is now a major killer of children. In a great swathe of the Middle East and Indonesia, the thalassaemias – inherited deletions of sections of the haemoglobin chains – are taking up more and more of the health budget. They evolved in response to selection by malaria, but as that disease is being defeated are

emerging as a public health – and social crisis of their own.

Around eight million children a year are born with birth defects and those associated with errors in the red blood pigment haemoglobin are responsible for around three hundred thousand of them – which is more than the numbers of children born with Down’s syndrome. They are concentrated in tropical countries; with two thirds in nations classified as “low income”. In Thailand, with its population of between sixty and seventy million, more than half a million people have thalassaemia. Indonesia, too, faces the problem – and would need well over a million units of blood a year to carry out the transfusions needed. The enormous expense involved, and the individual distress caused, means that there are many calls for pre-natal diagnosis and for pregnancy termination when fetuses are found to suffer from the disease.

The meeting’s second day covered eclectic grounds from sex to language to the nature of being human. Demography and population growth has long been an interest of the Galton Institute and one of its best-known early members, Marie Stopes, was a pioneer in early contraceptive services. Professor John Hobcraft of the University of York talked about the decoupling of human sexual and reproductive behaviours which comes from our new ability to control the birth rate. Since the first world war and before there have been repeated alarms about both increasing and collapsing populations, most of which turn on differential acceptance of birth control, and of social contrasts in the availability of medical care by different groups at different times. In spite of a brief interlude, the baby boom of the 1950s and 1960s, the general picture is that fertility has declined throughout the developed world; a trend which – with the exception of sub-Saharan Africa – has spread. Geographical differences in fertility are hence much smaller than they have been in historical times. Differences in survival are taking longer to catch up, but throughout Europe and elsewhere there has been a demographic shift to low birth rate and low death rate. It marks the end of an unprecedented period of human population growth and, perhaps, the beginning of a slow decline that may begin within the present century.

Two talks by Professor Fareeh Vargha-Khadem (Institute of Child

Health, UCL) and Dr Simon E Fisher (University of Oxford) gave an account of the molecular windows into speech and language which have emerged during the past decade. As so often in genetics, the abnormal gives an insight into the normal. Around one child in twenty has some problems with the normal development of language. The discovery of a large family living in southern England with a very specific disorder of that kind has concentrated attention on a remarkable gene locus, FOXP-2, which appears to play an important part in the ability to speak – and is also more active in birds such as parrots that can mimic speech than in others that cannot. It produces a protein that regulates the activity of a variety of circuits in the brain, and is not the “gene for language” so often referred to in the press: but it does play a crucial part in the processing of linguistic information. It is also active in the lung, the intestine, and the heart; why, we do not know. The latest work involves studying the activity of normal and mutant versions of FOXP-2 in neurons cultured in the laboratory. Once again, the development of gene chips may revolutionise our ability to dissect the talent of language, and to understand the great variety of disorders in speech – from stuttering to autism – found in human populations.

The meeting ended with three talks on the legal and ethical aspects of the new human genetics. Professor John Harris of the University of Manchester, Editor of the *Journal of Medical Ethics* asked: Should we stay human? He took a robust view of the social and political issues that emerge from science and argued that although caution is called for, it would be a mistake to hold back from what progress in improving the human condition because of vaguely formulated concerns about some Frankenstein-like end result. Professor David Galton of Queen Mary College London spoke on Eugenics, then and now: and argued that the issues now being faced by society are not very different in their nature from those that concerned the Victorians and that the horror so often evoked by the mere word “eugenics” is misplaced. Much of the problem comes from the desire of states to control the fertility, if not the quality, of their citizens: and, almost always, their policies have been based on ignorance and prejudice rather than on science. People, he said, should have more freedom to make their own

choices, and over-regulation would be a mistake. We must also face the potential development of a “genetic underclass” who may find difficulties in finding health insurance, or indeed health care. These issues will not go away simply by being ignored: however unpalatable they may be to some, they must be discussed. Finally, Professor Reinhard Merkel of the University of Hamburg talked on the legal rights of the embryo as seen in European perspective. There are remarkable differences among the nations of the EU in their attitudes to human genetics, many of which reflect their distinct histories. The subject is particularly contentious in Germany, for obvious reasons. There, pre-implantation genetic diagnosis, widely accepted in the rest of Europe, remains a matter of debate; and the embryo itself is given wider legal protection than in many other continental countries. The “slippery slope” argument is much used. Some attempt should be made to generate a more consistent European attitude to human genetics, but the time for so doing may not yet be ripe.

The questions considered at the Centenary Symposium of the Galton Institute have scarcely changed from those discussed during the organisation’s early days; but the answers – or at least those few that we have – would astonish our predecessors. No doubt the report of the Bicentenary Symposium will end with a sentence that says more or less the same.

Steve Jones
President, The Galton Institute

CENTENARY DINNER

On the evening of 7th November there was with a well-attended dinner for the speakers and organisers at Bertorelli’s, Charlotte Street. Galton speaks in his memoirs of his schoolboy days and a “party assembled in cosy comfort at dessert, after a good dinner, with a brightly burning fire, shining mahogany table, wine, fruits, and all the rest”. Then, he was called out on his father’s orders to test his real desire to study medicine - to a post mortem. We lacked the fire, but the post-mortem of the meeting, all agreed, showed the Institute to be in excellent health upon its hundredth birthday.

Speakers:

Professor Steve Jones,
University College London:
Is Man just another animal?: the view from the genes

Professor Lewis Wolpert,
University College London:
What Makes us human, and different from all other animals, namely causal beliefs

Professor Robert Plomin,
Institute of Psychiatry, Kings College London:
Genetics and the Mind

Professor Lee M Silver,
Woodrow Wilson School of Public and International Affairs, Princeton University:
Darwinian selection, rerogenetics, and the future of the human species

The Centenary Galton Lecture, 2007:
Professor Sir David Weatherall,
Weatherall Institute of Molecular Medicine, Oxford:
Genetics and World Health: Future Opportunities and New Ethical Issues

Professor John Hobcraft,
Department of Social Policy and Social Work, University of York:
From Eugenics to Epigenetics: Exploring the Decoupling of Human Sexual and Reproductive Behaviours

Professor Fareneh Vargha-Khadem,
Institute of Child Health, University College London:
Genetics and Language

Dr Simon E Fisher,
Wellcome Trust Centre for Human Genetics, Oxford:
Molecular Windows into Speech and Language

Professor John Harris,
School of Law, Manchester University:
Should we stay human?

Professor David Galton,
Wolfson Institute of Preventive Medicine at St. Bartholomew’s Hospital:
Eugenics – then and now

Professor Reinhard Merkel,
Faculty of Law, University of Hamburg:
Legal rights of the embryo – a European Perspective

Celebrating 100 years of Medical Genetics

Meeting of Medical Genetics Section of The Royal Society of Medicine in association with The Galton Institute

Thursday/Friday 22/23 May 2008
at The Royal Society of Medicine

The Galton Lecture will be given by Professor Sir Walter Bodmer

Other speakers: Dr Richard Wyse, Professor Sir Patrick Bateson, Professor Sir David Weatherall, Professor Marc Feldman, Professor Adrian Hill, Dr John Holloway, Dr Ken McElreavey, Professor Francesco Muntoni, Professor Peter McGuffin, Professor Mandy Fisher, Professor Eamonn Maher, Professor Tom Kirkwood, Professor Sian Harding, Professor Peter Donnelly, Professor Rory Collins, Dr Joanna Mountain and Dr Peter Corry

**Members of The Galton Institute are invited to apply to attend this meeting
There are a limited number of tickets which will be issued on a first come basis**

Tickets from: The General Secretary

**A deposit of £20 is required which is refundable by cheque upon attendance.
There is also a Dinner at Chandos House for which there is a charge of £90 (non-refundable)**

Robert Peel, **Past-President** **of the Galton Institute**

At the meeting of the Council on 21 November 2007 it was agreed that a warm tribute should be made in the next *Newsletter* to Robert Peel on his ceasing to be a Council member. This note, written without his approval and published against his wishes, now acknowledges with gratitude the enormous amount of work he carried out quietly and efficiently on behalf of the Institute over very many years. We must hope that, despite this and if he reads this encomium, it will still give him some pleasure in a similar way to that provided in its writing.

Robert Peel read biological sciences at Cambridge, concentrating on genetics in his third year. While still an undergraduate he became a member of the Eugenics Society, and first attended its annual symposium in 1975, reporting on the subsequent meetings either in *Biology and Society* or in the *Newsletter*, and later becoming very involved as editor with seven of the publications of the proceedings and in getting the centenary volume into print. After Cambridge he trained for three years to join the Civil Service, from which in 2005 he took early retirement. On leaving his post as a senior civil servant who advised Ministers on tax policy, he has worked for a range of charities and taken a particular interest in

the field of charity governance and the role of charity Treasurers.

He was first elected to Council in 1982 and since then, with two breaks because of the nine-year limit, he has held every Honorary Office, including being President from 1996 to 1999. In 1991 he initiated and edited the quarterly *Newsletter*, and more recently worked most successfully in setting up and expanding interest in the Institute's web site. In 1981 he gave the Caradog Jones Lecture on "Natural Selection, Social Evolution and Economic Strategy". The news of his retirement was received with sadness and regret by the Council.

Milo Keynes

REPRODUCING REGULATION

New Laws for Fertility Treatment and Embryo Research - Will We Get It Right?

A conference organised by the Progress Educational Trust (PET), 1 November 2007, held at Institute of Child Health, London.

This conference was extremely timely, given that a new Bill revising regulation of assisted reproduction and embryo research will be introduced during the next session of Parliament. This Bill is intended to revise and supersede the earlier Human Fertilisation and Embryology 1990 Act in light of developments in science and society. In view of this, it was most appropriate that the first speaker was Liberal Democrat MP, Phil Willis, who chairs the House of Commons Science and Technology Committee. He chaired a joint scrutiny committee of both houses that recommended significant changes to the Government's draft Human Tissue and Embryos Bill in the summer. He told the conference of his pleasant surprise that the Government had accepted the recommendation to *not* merge the Human Fertilisation and Embryology Authority (HFEA) with the Human Tissue Authority to create a new Regulatory Authority for Tissue and Embryos (RATE). The scrutiny committee had argued that RATE would lack the expertise to regulate fertility and embryo research activities, particularly if more regulatory powers were to be devolved to the regulatory authority, as they had hoped would be the case. It also seems that the Government has accepted the use of animal-human hybrids embryos in research within the 14 day limit under licence from the regulatory authority. A recommendation that 'donor' be added to the birth certificate after conception by sperm or egg donation (to encourage disclosure to the child) was not accepted by Government. This tricky issue was explored in detail by Professor Blyth at the end of the day (see below). Phil Willis concluded by saying that the ethical issues were always the most taxing and he favoured the establishment of a standing Parliamentary Bioethics Committee to help their deliberations. Someone in the audience did not agree fearing it might become a 'puppet' of Government.

Next James Lawford-Davies, a senior associate at law firm Clifford Chance and lecturer at Newcastle University reminded the audience that differences in the laws and regulations between countries meant that many people who could not get what they want in terms of assisted conception in one country would travel to another to buy it. He presented evidence of such 'reproductive tourism' (a phrase he felt trivialised the needs of such couples) from a survey conducted jointly by the Institute of Prospective Technological Studies (one of eight research institutes of the European Commission), the European Society for Human Reproduction and Embryology and the European Society of Human Genetics. Following on in international mode, Maureen McTeer, adjunct professor of medical law at the University of Ottawa, mentioned reproductive tourism between the USA and Canada, but concentrated on the slow but steady development of fertility treatment and embryo research regulation in Canada. This, she said, owed a lot to the pioneering work in the UK.

After lunch, Dr Tom Shakespeare, research fellow at the Institute for Policy and Practice at Newcastle University, tackled issues relating to embryo selection following pre-implantation genetic diagnosis (PGD), talking to the title 'Means, Ends, Commodities or Gifts: the Ethics of Choosing Children'. Liberal in his approach, he drew back from advocating that parents alone should decide on the use of PGD. In the discussion that followed there was broad support for devolving regulation of PGD to the regulatory authority in a way that took account of the views of the parents and the clinicians caring for them.

In the same way that research into PGD provided a backdrop during the passage of the 1990 Human Fertilisation and Embryology Bill through Parliament, so human embryonic stem cell research provides the backdrop now. Dr Stephen Minger, Director of King's Stem Cell Biology Laboratory at Kings College London introduced the science behind therapeutic and research applications of human stem cells, embryonic and otherwise. He explained that it was the expected very low success rate of being able to grow human embryonic stem cells after therapeutic cloning - placing a nucleus from a somatic cell from a specific person (such as the patient) into an enucleated egg - that was behind his recent application to the

HFEA to use bovine rather than human eggs for his research. He expects to use thousands of bovine (enucleated) eggs during research to learn how better to create human embryonic stems in a way that would be useful for the treatment of conditions like Parkinson's disease in the future.

After tea, John Parsons, consultant obstetrician, gynaecologist and director of the Assisted Conception Unit at Kings College Hospital, tackled a problem area with current legislation that has been rather overlooked in the debates so far, namely widespread and often irrational confidentiality restrictions. Based on his own clinic survey, he concluded that only with gamete donation is it perhaps appropriate for the patient to be asked to agree to her GP being informed of the procedure. In other areas of assisted reproduction, he argued that confidentiality should be as for all other medical procedures - it would make for better clinical practice.

Finally, Eric Blyth, professor of social work at the University of Huddersfield discussed the politics of donor conception and birth registration, starting with a review on how attitudes to gamete donation and legislation have changed since the late 1940's when the Archbishop of Canterbury called for artificial insemination to be made a criminal offence. Whilst there seems to be increasing acceptance that children should be told about the nature of their conception, it was not clear what the best way was of achieving this. It is not just a debate of what goes on the birth certificate, but how all the various birth and related registers are handled for the benefit of the children born of donor conception.

The day's proceedings were admirably chaired by Baroness Ruth Deech, former chair of the Human Fertilisation and Embryology Authority and Professor Alison Murdoch, head of reproductive medicine at Newcastle University. In the Progress Educational Trust tradition, there was ample time for audience participation in the discussion.

The Progress Educational Trust was grateful for a **Galton Institute** conference grant and some sponsorship from Clifford Chance to help with the costs of putting on the conference.

Report by Professor Marcus Pembrey, Chair, Progress Educational Trust

Letter to the Editor

The Human Tissue and Embryos Bill

I read with great interest Professor Pembrey's article on the above topic in Newsletter number 64. I do not share his optimism that any new legislation for assisted conception will be very effective; indeed I believe it will probably lead to even more confusion. Numerous factors will make it difficult to develop practical and effective legislation for the regulation of the new techniques of assisted conception. These include:

- *the rapid pace of genetic discoveries and the new technologies evolving from them
- *diversity of opinions for the applications of the new technologies in a multi-cultural society
- *the paramount importance of preserving basic freedoms of scientific research and communication if too many restrictions are to be imposed by statutory bodies
- *the evolving social norms of society regarding the use of these techniques.

To take two examples of legislation for abortion and sterilization. Before the Abortion Act of 1967 it was a criminal offence to procure an abortion in the UK unless the life of the mother was at risk. After the Act the justification for abortion was widened to anything that might im-

pair the physical, mental or social well-being of the mother. However the Act does not extend to Northern Ireland where it remains a criminal offence unless it be to save the life of the mother. So it remains a glaring inconsistency that within the same jurisdiction of the UK it is both a criminal offence and not a criminal offence to procure an abortion if the mother's life is not at risk. There is thus a drift of pregnant Irish women to England to obtain a termination. The Law at a basic level should be consistent across a country if it is to retain the respect of the people.

Even worse was the ruling of the Supreme Court of Justice in the USA on the case of *Roe v Wade* in 1973 legitimizing abortion on demand. It has led to innumerable problems. It has split the nation into pro-choice and pro-life factions leading to violent clashes. Since 1993 seven doctors who performed abortion have been murdered by pro-life groups; and during the last two decades more than 2,300 incidents of violence against abortion clinics have been reported including arson and bombings. It would have clearly been better if the case of the pregnancy of Ms. Roe had been kept out of legislation and the Courts.

Other major legislation involved sterilization Laws first passed in Indiana in 1907; and by 1917 such Laws had been

enacted in fifteen more States. They were applied to mental defects, to the feeble-minded and other socially inadequate persons. It came to a head in 1924 when the case of *Buck v Bell* came before the United States Supreme Court. This concerned the cases of Emma Buck, her daughter Carrie and granddaughter Vivian who were all pronounced to be mental defects. Justice Holmes pronounced his famous verdict that 'three generations of imbeciles are enough'; and Carrie and sister Doris were duly sterilized. This decision legitimised the USA sterilization laws and by 1935, for example, more than 10,000 women had been sterilized in California. It also set an example for the Nazis to justify their sterilization (and euthanasia) programmes.

Although in the past legal codes have been devised to act prospectively under the present circumstances of a fast moving field a more flexible, responsive and retro-active regulatory model may be more appropriate. As Professor Pembrey himself says the decisions involved are intensely personal and need to be handled on a case-by-case basis. They may be better regulated by ethical codes of practice of professional bodies rather than the statute book.

David Galton

Wolfson Institute of Preventive Medicine
at St Bartholomew's Hospital

Enthusiasm in Galton's Inquiries into the Human Faculty by David Berman

Compared to literary classics, scientific classics are few on the ground and, of those, even fewer are still readable and relevant. Evidence that Galton's *Inquiries into the Human Faculty* (1883) is a scientific classic can be found in the most respected historians of psychology, such as Edwin Boring, who, in his *History of Experimental Psychology* (2nd ed. 1957), pp. 482-7, ranks Galton's work with that of the acknowledged founders of modern empirical psychology, Wilhelm Wundt and Gustav Fechner. William James also testified to the *Inquiries's* importance when, in his own classic work, *The Principles of Psychology* (1890), he quotes Galton's book at length describing his results as 'making an era in descriptive psychology' (vol. 2, p. 51). Evidence that the *Inquiries* belongs to the even rarer class of classics still readable and relevant is indicated by its publishing history:

First published in 1883 by Macmillan, the book was then reprinted in New York in 1885, then went into a second, revised edition in 1907, which was re-issued in 1908, 1911, 1919, 1928, 1943, by the Eugenics Society in 1951, again in 1973 and most recently in 2004 in Honolulu.¹ And while the *Inquiries* is not elegantly written, I would say it is written well enough, so that once gotten into, it grows increasingly more compelling. Like most classics, it repays re-reading and studying. Add to this, that Galton's book is more than just a canonic work in psychology; it also makes a contribution to anthropology and is the pioneering work in eugenics and what might be called evolutionary theology. Hence it seems worth being clear about the book's final authorized form.

In the Preface to the Second edition, issued by J. M. Dent (in the Everyman's Library series) in 1907, Galton gives the following bibliographic account of his *Inquiries*:

'After some years had passed subsequent to the publication of this book in 1883, its publishers, Messrs. Macmillan, informed me that the demand for it just,

but only just, warranted a revised issue. I shrank from the great trouble of bringing it up to date because it, or rather many of memoirs out of which it was built up, had become starting points for elaborate investigations both in England and in America, to which it would be difficult and very laborious to do justice in a brief compass. So the question of a Second Edition was then entirely dropped....'

However, as Galton goes on to say: 'Having received a proposal to republish the book in its present convenient and inexpensive form, I gladly accepted it, having first sought and received an obliging assurance from Messrs. Macmillan that they would waive all their claims to the contrary in my favour.' Galton then mentions the changes that have been made in the 1907 edition. The most important as such and for our purposes are, Galton states, that 'Two chapters are omitted, on "Theocratic Intervention" and on the "Objective Efficacy of Prayer."' (p. vii).

But what does not seem to have been noticed then, or subsequently, is that there was a serious error in the actual printing of the 1907 edition. For instead of just the two

chapters mentioned above, a third chapter, on 'Enthusiasm', was also omitted. In his valuable study *Francis Galton: The Life and Work* (1974), Derrick Forrest has noticed the omission (p. 168), but supposed that it was intended by Galton. But on this matter, Forrest and those who follow him - such as Nicolas Gillham, in his recent *A Life of Francis Galton* (2001) p. 207 - are mistaken. That this is so can be shown, not just by the fact that Galton states that he is omitting only two chapters, but also by looking more closely at the text itself. Thus in the case of the omitted chapter on Prayer, Galton inserts a note on page 217 of the 1907 edition, where the chapter on prayer is referred to, which informs the reader that the chapter is 'Not reprinted in this volume.' Conversely, on page 148, where he discusses the enthusiastic or visionary faculties, and says that he will 'recur to this in the chapter on enthusiasm', there is no similar note. Hence I think we can be confident that when Galton prepared the 1907 edition and wrote the Preface, he did not intend to omit the chapter on 'Enthusiasm.' Nor was there any reason to delete it, as it fulfills, as I hope to show below, an important role in the structure or development of Galton's book.

The upshot of all this is that for all its many printings, the *Inquiries* has never been printed in accordance with Galton's intentions. There is no authorized edition. But there should be one. And when, as is likely, such an edition is published, the missing chapter should be re-instated.

I think that the future editor might also consider making at least one other change to the Everyman printing, even though it was not authorized by Galton. At present, there is no easy way of referring to the chapters; whereas Galton's Appendix, on the contrary, has five items, helpfully listed as A to E. I suggest, therefore, that the chapters should be numbered, which, with the re-instated chapter on 'Enthusiasm', would bring the work to 36 chapters.²

Although not a work of philosophy, at least as philosophy is now generally understood, the *Inquiries* has huge philosophical implications and some of its chapters are bordering on the philosophical and (even more) the theological - the omitted chapter on 'Enthusiasm', being one such.³ It sums up the negative evidence against old style religious belief, which Galton had presented in previous chapters. Hence it clears the way for, and also hints at, Galton's proposal for a new naturalistic form of religion.

Galton begins the chapter on 'Enthusiasm' by observing that many people 'from the ablest class of mankind'

take it as 'axiomatic' that there is 'an unseen world', which transcends the natural world and that man has a 'faculty' for communing with this world, or the 'indwelling divine Spirit'. But, he asks, is the evidence for such a belief trustworthy? And his answer is No; although he makes it clear that the negative 'arguments scattered or hinted at throughout' his book 'would be scattered to the winds by solid evidence on the other side' (p. 296). So he believes that this question is still open. Galton then calls attention to the following negative arguments that appear in his book. The first is that religious visions can be understood in a naturalistic way. Here he is adverting to chapter 20, where he describes the visions of sane people. The next negative argument to which he refers is also along similar lines, namely how, in chapter 24, he had shown 'that the fluency of ordinary speakers and writers proceeds in an automatic way, without its being imputed to [supernatural] inspiration'. In short, phenomena that had been interpreted as manifestations of the unseen spiritual world Galton explains p s y c h o l o g i c a l l y .

On a somewhat different tack, he then notes how he had 'also pointed out [in chapter 14] that it is among those hysterical or insane persons in whom the sexual organization is disturbed, that the extreme forms of religious rapture chiefly prevail...with its customary illusions'. Here he anticipates not only Freud's psychopathological account of religion, but, more generally, the pathological accounts of religion put forward by Bentham, Grote, Feuerbach and Marx.⁴ Perhaps following J. S. Mill, Galton then points out how his work shows the weakness of 'axiomatic belief' (p. 297). Here Galton is referring to his pioneering work on synaesthesia and number forms in chapters 18 and 19. The upshot is that chapter 28, on 'Enthusiasm', is crucial and transitional in showing how psychology, and especially the study of imaging, can naturalize the supernatural.

Having opposed supernatural enthusiasm, Galton then moves, in the chapter's final paragraph, to give enthusiasm a more positive and more naturalistic gloss, which probably owes something to the influence of Spinoza: this is the state of mind of the individual who separates himself from society and comes to his own conclusion about the truth of the world, which he forms part of. But Galton takes this one momentous step further than Spinoza, for it is not only that we should realize that we are part of the one world of Nature, which Spinoza stresses, but that 'we possess an influence' to bring about fundamental changes in it, what Galton calls here 'a higher life' (p. 298). Galton spells this hint out in the following chapters, where he

proposes a new religion whose purpose is 'to take a deliberate part in furthering the great work of evolution.' (p. 198). This is the new religion that eventually made the headlines with Nietzsche, Bergson and Shaw, a religion which might be called emergent theology or evolutionary religion, which only became a serious possibility with the work of Galton's cousin, Charles Darwin.

The idea, in short, is that although God or gods did not exist at the beginning, they might be brought into being, or evolved, in the future, with the help of human effort. This is Nietzsche's great theme in *Thus Spoke Zarathustra*, part 1 - intriguingly published in the same year as Galton's *Inquiries*: 'I teach you the overman. Man is something that must be overcome... remain faithful to the earth, and do not believe those who speak to you of otherworldly hopes!'⁵ - an idea that Galton sums up more soberly when in the conclusion of his work he speaks of our 'new duty... to further evolution, especially that of the human race' (p. 220). Thus, while both thinkers are opposed to the belief in a transcendent, unseen, non-earthly being, they nonetheless believe that some elements of that supposed otherworldly reality might be realized in this natural world, in the 'overman' or 'higher humanity' (p. 219)⁶

Notes

1) I am drawing here largely on the *National Union Catalog: Pre-1956 Imprints* (1971), vol. 190, pp. 41-2. A facsimile of the 1883 edition was issued by Thoemmes Press in 1998.

2) In what follows I shall suppose such a numbering, which is set out in the Appendix. All references are to the 1907 edition of the *Inquiries*, except in the case of the omitted chapter (28, according to my numbering), where my references are to the first, 1883 edition.

Perhaps a future editor of the *Inquiries* might also, by way of introducing additional order and unity into the work, divide these 36 chapters into three or four parts: part 1 would comprise the mainly introductory chapters 1-14. Part 2, or chapters 15-24, constitute Galton's main contribution to psychology, which is also probably the most unified part in the book. Then we have chapters 25-27 which could either be grouped on their own, or go with the previous psychological chapters. Then there are the remaining chapters, beginning with 'Enthusiasm' and running to chapter 36; which concluding part might be called 'Eugenics and Evolutionary Religion'.

3) For some of the philosophical implications, see D. Berman, *Berkeley and Irish Philosophy* (2005), pp. 4-16.

4) For some discussion of this tradition, see D. Berman (ed.), *Introduction to Atheism in Britain* (1996), vol. 1, pp. xx-xxv.

- 5) Walter Kaufmann translation, in the *Portable Nietzsche* (1962), pp. 124-5.
 - 6) I am grateful to William Lyons for reading and commenting on an earlier version of this paper.
- Appendix: Galton's Chapters Numbered
- 1 Introduction
 - 2 Variety of Human Nature
 - 3 Features
 - 4 Composite Portraiture
 - 5 Bodily Qualities
 - 6 Energy
 - 7 Sensitivity
 - 8 Sequence of Test Weights
 - 9 Whistles for Audibility of ShriII Notes
 - 10 Anthropometric Registers

- 11 Unconsciousness of Peculiarities
- 12 Statistical Methods
- 13 Character
- 14 Criminals and the Insane
- 15 Gregarious and Slavish Instincts
- 16 Intellectual Differences
- 17 Mental Imagery
- 18 Number-Forms
- 19 Colour Associations
- 20 Visionaries
- 21 Nurture and Nature
- 22 Associations
- 23 Psychometric Experiments
- 24 Antechamber of Consciousness
- 25 Early Sentiments
- 26 History of Twins

- 27 Domestication of Animals
[Possibilities of Theocratic Intervention-omitted]
[Objective Efficacy of Prayer- omitted]
- 28 Enthusiasm [mistakenly omitted]
- 29 The Observed Order of Events
- 30 Selection and Race
- 31 Influence of Man upon Race
- 32 Population
- 33 Early and Late Marriages
- 34 Marks for Family Merit
- 35 Endowments
- 36 Conclusion

The Galton Institute is still able to supply the 1951 hardback reprint of the 1907 second edition at a cost of £5.

JOHN HILTON EDWARDS

1928-2007

Galton Institute Council member
1999-2001

John Edwards, formerly Professor of Genetics at Oxford University, died on October 11 of metastatic cancer of the prostate. Over the last 50 years he was an important contributor to human genetics in a variety of areas, particularly linkage mapping, allelic association with disease predisposition and comparative gene mapping. The son of a London surgeon, Edwards was educated in medicine at Cambridge University, with clinical qualification at Middlesex Hospital Medical School in London. John's physician wife, Felicity, was a medical school classmate, having come to Middlesex from Oxford at the same time that John came there from Cambridge. Paediatrics' was John's specialty within clinical medicine.

On his return from a stint as ship's surgeon on the Antarctic survey vessel *John Biscoe* (1952-53), John was found to have a tuberculous lesion at the apex of one lung. He used the enforced bed rest of several months to teach himself statistical methodology. In 1956, after hospital training Edwards assumed appointments in Thomas McKeown's Department of Social Medicine and The Institute of Child Health at Birmingham University. His associations with Birmingham continued until 1979, with interludes at Oxford (in Alan Stevenson's Medical Research Council (MRC) Unit on Population Genetics, 1958-1960), at Children's Hospital of Philadelphia (1960-1961) as geneticist, and at the New York Blood Center and Cornell medical College (1967-1968). During his time in Birmingham he rose through the ranks, from lecturer to Professor of Human Genetics (1968) and on to head of a new department of clinical genetics (1969). In 1979, he succeeded Walter Bodmer as Professor of Genetics at Oxford. Earlier that year he had been

elected Fellow of the Royal Society for "contributions to human cytogenetics and genetic epidemiology including elucidation of the threshold model for multifactorial traits and pedigree linkage analysis."

One of John's first publications was a letter (*Lancet* 1, 579; 1956) suggesting that antenatal detection of hereditary disorders could be achieved by application of the linkage principle to test material obtained by amniocentesis. Amniocentesis had just been introduced for detection of Rh haemolytic disease of the fetus.

During his time at Oxford, Edwards seized the opportunity to learn about chromosomes from Charles Ford and David Harnden at Harwell. He was spending a morning a month at the Children's Hospital in Birmingham. It was there that he recognised a potential chromosomal aberration in a newborn – he called it "trisomy, type unknown". He obtained post-mortem tissues and delivered them to Harwell, where Harnden demonstrated trisomy 18, or Edwards's syndrome, as it came to be known (*Lancet* 1, 787-790; 1960). He also made major contributions to the delineation of X-linked hydrocephalus. In 1961, he published two back-to-back papers on the topic. One described a large pedigree with 15 affected members and the second was a general discussion delineating the disorder.

Edwards was very productive during his period in Birmingham, and his contributions were wide ranging. He was undoubtedly influenced by Lancelot Hogben, who was in the Department of Social Medicine in Birmingham. He admired Hogben and was amused by his idiosyncrasies, R.A. Fisher referred to John as Hogben's Edwards and to John's younger brother as Fisher's Edwards, according to the latter, the Cambridge statistical geneticist A.W.F. (Anthony) Edwards.

John was a regular and important participant in the international Human Gene

Mapping Workshops held between 1973 and 1991. His input was in relation to linkage analysis and reporting and to comparative mapping, particularly of mouse and man. After he went to Oxford in 1979, he pursued comparative mapping in these two species in collaboration with colleagues at Harwell, including Mary Lyon, Tony Searle and others. This led to the design of his famous Oxford Grid, which gave a graphic representation of conservation of synteny between mouse and man.

Edwards' collaborations in comparative mapping and genetic pathology extended to scientists at The Jackson Laboratory in Bar Harbour, including Thomas Roderick. They also included the Faculty of Veterinary Science at the University of Sydney, specifically Frank Nicholas, who created and maintains OMIA, Online Mendelian Inheritance in Animals, the equivalent of OMIA for farm and companion animals. In Sydney, the extensive "Oxgrid Project" (<http://oxgrid.angis.org.au>), inspired and advised by Edwards, has Oxford grids comparing the human with many other species.

David Weatherall characterises Edwards as "one of the nicest and cleverest of our field." John was of quick wit, in both senses of that word. His humour was rarely if ever malicious or unkind. Among his colleagues his absentmindedness was legendary; 'John Edwards stories' abound. These characteristics enhanced rather than detracted from the respect in which his colleagues held him.

John maintained an exceptionally vigorous life until a year or so before he died. This vigorous activity included gliding and skiing and even taking down trees and chopping them up for firewood. John is survived by Felicity, his wife of 54 years, and by their four talented offspring.

Obituary taken with permission from *Nature Genetics* (Vol. 39, No. 12, December 2007), written by Victor A McKusick

The Powers of Natural Selection

14. The Random Fallacy

W.M.S. Russell

We owe to the American theorist Sewall Wright (1948) the valuable concept of cellulation, discussed in the last two sections. But unfortunately he spoiled this good idea by adding a complete fallacy, which has enjoyed a surprisingly long life. His starting-point is that the Hardy-Weinberg equation, and indeed Mendel's segregation and assortment laws, are statistical predictions, subject to sampling error. In large populations, this effect is negligible, but if a population becomes very small that generation may receive a randomly deviant sample of the previous generation's gene pool. Nobody denies this; it is a matter of simple arithmetic.

But Wright goes on to suppose that the sub-populations of a cellulated species will always come to diverge in random ways, that these random differences will continue when split – speciation occurs, and *will then persist* in the new phyletic lines. So the differences between modern species will be largely random, and random divergence, called by Wright *drift*, will play a large part in evolution. A corollary of this is the presence of large numbers of characters which are selectively neutral, neither advantageous nor disadvantageous.

We must note, first, that Wright was mainly a theorist, and, second, that he had his idea when selection strengths were thought to be far less than they actually are, as discussed in my first section. His notion that drift is important in evolution has been totally demolished by the evidence of actual *facts*, mainly discovered and assembled by Fisher and by Ford and his associates, especially Kettlewell and Sheppard. In spite of this, drift has continued to be referred to as an important evolutionary factor long after the demolition. For instance, it is so treated in the otherwise magnificent recent book of Cavalli-Sforza (2000), all the more surprisingly as this author was for a time a pupil of Fisher. In view of this, it is worth outlining the overwhelming objections to the idea that the random factor is important in evolution.

First, *'every example cited as a case of random drift has been shown to be the*

result of selection'. (Russell, 1959) In all these cases the different characters had been supposed neutral by Wright and in every case they have been found to have selection advantages. The cases so fallaciously cited by Wright may be listed as follows:- chromosomal inversions in the fruit-flies *Drosophila pseudoobscura* and *persimilis*, various characters in the moth *Panaxia dominula*, the Pacific snail genera *Partula* and *Achatinella*, and the European snail *Cepaea nemoralis* (Sheppard, 1954), the human blood groups (Ford, 1975), and even the sickle-cell trait! (Sheppard, 1975) There is also a case of a plant, *Linanthus parryae*. (Hovanitz, 1953)

There are other considerations. As we have seen, polygenes are generally linked on one chromosome, 'which makes it questionable whether a gene having very small effects can be appreciably influenced by random genetic drift'. (Ford 1975) The strengths of selection now known are decisive against the Wright theory. The astonishing events in the colony of *Panaxia* at Tring were described in an earlier section. 'Selective evolution on the scale encountered in the Tring colony of *Panaxia dominula* would completely override the effects of random drift even in very small populations'. (Ford, 1975) This was confirmed in a study of the butterfly *Maniola jurtina* on the Scilly island of Tresco. These results, 'demonstrating the over-mastering effect of selection in populations reduced to a total of perhaps a hundred or less, are probably quite normal'. (Ford, 1975) 'It will be realised' writes Ford, with perhaps ironic understatement, 'how restricted is the field in which random genetic drift is of importance'.

Now as regards supposedly neutral characters, Fisher showed that we can exclude such selective neutrality as very exceptional. For he demonstrated that the neutrality of a gene requires for its maintenance a remarkably exact balance of advantage and disadvantage compared with its allele. He showed also that a neutral gene can only displace its allele at an exceedingly low rate; so slowly indeed that before it has advanced to any considerable degree, the delicate equipoise required for its neutrality will have been upset by genetic or environmental change'. (Ford, 1976) 'Consequently... genes can seldom be neutral in effect for more than a very short period of time.' (Sheppard, 1975) And finally, as we saw in the previous section, Fisher showed that natural selection is a mechanism for generating high improbability, and that random processes could not possibly have achieved what natural selection has achieved in some four billion years.

In the 1960s the Japanese theorist Motoo Kimura applied a theory of random process to the evolution of proteins. His elaborate theoretical arguments have been demolished by Sheppard (1975), who concludes on the theoretical points: 'most of the premises or deductions on which the theory of protein evolution by neutral mutations rests do not hold'. It is perfectly obvious that the human haemoglobins are not selectively neutral, and Sheppard produces other examples of protein varieties with selective advantage or disadvantage. An example is the presence in geographical varieties of *Drosophila melanogaster* of two forms of the enzyme alcohol dehydrogenase, each appropriate in terms of its temperature reactions to the local climate. It is interesting that 39% of the enzymes of *Drosophila pseudoobscura* and about 30% of human enzymes are polymorphic, and we know that both transient and balanced polymorphism can be analysed in terms of natural selection. (Sheppard, 1975) Finally, even in the case of a single molecule, the improbability principle applies. 'The number of possible combinations of amino acids in a structure the size of whale myoglobin is twenty raised to the power of a hundred and fifty-three. The figure... is far more than all the proteins in all the animals and all the plants that have every lived. Such a molecule could never arise by accident. Instead... natural selection has carved out not just myoglobin but millions of other proteins and the organisms they build.' (Jones, 1999) In spite of all this, protein evolution by neutral mutations is still to be found in modern books. (e.g. Creighton, 1984, Cavalli-Sforza, 2000).

From all this we may conclude, with Sheppard (1954) that drift, 'though frequently invoked as an important agent in evolution, must be judged of negligible significance as compared with selection'. (Sheppard, 1954) If it exists at all, it is 'a rare and temporary event'. (Ford, 1975) For suppose drift occurs in a very small population of well under a hundred. One of two things must happen. It will be corrected by selection as soon as the population increases – we have seen at Tring how rapidly inadaptable changes can be corrected. If some alleles have been lost, they will be provided anew, for selection to spread, by recurrent mutation, whose rate is quite rapid in a large population (Ford, 1975), and anyway under genetic control. (Ford, 1976)

Alternatively, the tiny population will become extinct, being too small to be viable, especially if it is carrying inadaptable alleles. So, either way, drift cannot possibly have long-term evolutionary effects.

The European Human Behaviour and Evolution Conference

2007

Sima Sandhu
(University of East London)

The European Human Behaviour and Evolution (EHBE) Conferences were begun in 2006 by Tom Dickins (University of East London), in order to provide a much needed interdisciplinary European forum for discussing evolutionary research applied to the behavioural sciences, broadly interpreted. After the success of the first conference, held at the London School of Economics, the 2007 conference was designed to attract a much larger and more diverse audience and succeeded in drawing 130 delegates from 15 different countries, including the United States and New Zealand, as well as 13 European countries. This was a testament to the need for a European meeting of evolutionary behavioural scientists to exchange ideas and form collaborations. The 2007 conference was held again at the London School of Economics, organised by Rebecca Sear (London School of Economics), Tom Dickins and David Lawson (University College London), and was supported by the generosity of the **Galton Institute** and the British Academy. These conferences will continue to run annually, and this year will see the first continental EHBE conference, organised at Montpellier University in France by Michel Raymond and Charlotte Faurie. All information about EHBE conferences past, present and future can be found at the link: <http://www.ehbes.com/>

EHBE 2007

The success of this conference was largely due to the genuinely interdisciplinary nature of the programme, ensuring that equal focus, consideration and discussion was given to the three main evolutionary perspectives in studying human behaviour; human behaviour ecology, evolutionary psychology and cultural evolution. In accordance with this, the three plenary sessions were given by three established academics working within one of these three approaches to the study of human behaviour. Many of the papers were presented by researchers working in these three fields, but other disciplines were also represented including evolutionary archaeology, sociology and medicine. This commitment to providing a multidisciplinary

forum for this meeting was reflected in the diverse subject backgrounds of the attending delegates. The programme also managed to incorporate presentations and posters from researchers at different stages in their academic careers, from post-graduate students to leading academics and professors in their field. To promote communication and interaction between the disciplines, the conference was serial, rather than parallel, and coffee breaks were long to encourage discussion.

A selection of papers from this conference will appear in a special issue of the *Journal of Cultural and Evolutionary Psychology*, together with an introductory article exploring the history and potential future of the application of evolutionary theory to human affairs by the conference organisers (Dickins, Lawson and Sear). Below, we provide a summary of the 31 thought-provoking papers presented at EHBE 2007. In addition to these oral presentations, 31 posters were presented.

Day 1: Human Behavioural Ecology

The first day of the conference focused on human behavioural ecology approaches to investigating various aspects of human behaviour. The plenary session was given by Ruth Mace (University College London) on the evolutionary puzzle of the demographic transition. Reflection was made on the current paradoxical decline in fertility in countries where wealth is abundant. Consideration was given to how an evolved psychology could have shaped a consistent trend towards a reduction in family size, by applying the principles of optimisation to the study of cultural diversity in reproductive decline, and illustrated explicitly with examples from the Gambia, Ethiopia and Europe. Ruth drew heavily on parental investment theory, and argued that competition was the key driver to investment in offspring: as our offspring will ultimately compete with their peers, so we do the same. Ruth concluded by discussing where this decline in fertility would ultimately end.

The morning session consisted of research papers themed around mothering and maternal influences. Beginning with the subject of "helping at the nest", Alexander Pashos (Free University, Berlin) presented research on a US population suggesting that maternal aunts had a particular role as caregivers for children, in particular the mother's last born or younger sister, irrespective of her emotional closeness to the mother. Moving on to the unusually long post-

reproductive life of human females, Rufus Johnstone (University of Cambridge) proposed an explanation for the evolution of menopause based on the female-biased dispersal of great apes, together with non-local mating. Local relatedness increases with female age in species with female-biased dispersal and/or non-local mating, supporting the evolution of late-life helping in long-lived social mammals. Valerie Grant (University of Auckland) then changed the subject to sex ratios, by presenting evidence supporting the possible influence of mammalian maternal follicular testosterone on the consequent sex of offspring (see e.g. Grant 1998 for her previous work on sex ratio).

Following the plenary on fertility decline, the first of the afternoon sessions centred on life history theory and, in particular, our understanding of trade-offs in human reproductive strategies. Among the presentations was one of the first research studies to demonstrate a link between a development intervention and an increase in both birth rates and childhood malnutrition. Mhairi Gibson (University of Bristol) used demographic and anthropometric data from rural Ethiopia to explore the unintended consequences such labour saving devices can have on nutritional status and demographic rates, as energetic trade-offs shift: in this case, energy appeared to be diverted to high birth rates (Gibson and Mace 2006). In contrast, Ilona Nenko (Jagiellonian University, Krakow) presented data in this session from rural Poland, suggesting that such energetic trade-offs may not necessarily be found in well-nourished populations. She found that women may not always pay a high cost for high reproductive effort. In her population, well-nourished women, with good nutritional status during development, could maintain a high number and weight of offspring, without showing deterioration in nutritional status during and after reproduction. The final paper in this session took a different tack at understanding reproductive behaviour by investigating the effects of perceived uncertainty. Based on longitudinal data from the US, Jeffrey Davis (California State University, Long Beach) showed that uncertainty about acquisition of resources was positively associated with fertility, while uncertainty about adult social status and quality of life for future generations were negatively associated with fertility.

The final afternoon session of the day concentrated on various aspects of group interaction and status. Steven Platek

(University of Liverpool) discussed his recent findings which lend support to facial resemblance as a likely mechanism for kin recognition. The preliminary research presented indicated the impact of facial resemblance on decisions regarding sexual infidelity, and also used neuroimaging data to confirm that facial resemblance adjusts brain responses towards different groups of individuals. The benefits of applying evolutionary theory to understanding modern organisational behaviour also emerged in this session. Martin Fieder (University of Vienna) reported findings on the positive correlation between male reproductive success and status within an institutional hierarchy well known to conference delegates, that of a university (Fieder, Huber et al. 2005). There was no such positive correlation between the number of children women in this hierarchy had; if anything, women higher up the hierarchy had fewer children. This paper highlighted the significance of evolutionary predictions in the theoretical understanding of economic and administrative structures. Further analysis of hierarchies continued in this session with the discussion of the evolution of inequality by Eric Alden Smith (University of Washington), who used game theoretical and simulation models to develop an understanding of the processes by which socioeconomic inequality has come to emerge in egalitarian societies (Smith and Choi 2007). Plausible scenarios were presented showing how relatively small asymmetries can lead to larger inequality based on resource control and knowledge.

Day 2: Evolutionary Psychology

The second day of the conference was devoted to evolutionary psychology. The plenary was given by Daniel Nettle (University of Newcastle), who effectively validated the case for the study of individual differences in evolutionary psychology. Heritable variation was discussed as ubiquitous, with abundant relevance to fitness in humans. Examples were given of the high heritability coefficients in intelligence, psychopathology and personality. Daniel focussed particularly on variations in handedness and empathy, with respect to their relationship with other traits and behaviours. He then suggested how these observations could generate hypotheses to explain observed variation based on trade-offs between differences in fitness costs and benefits.

The morning session centred on particular aspects of human cooperation and reciprocity. First, evidence highlighting

human sensitivity to maintaining a good reputation was presented by Melissa Bateson (University of Newcastle). She used a naturalistic experiment on the significance of cues for being observed, in this case a picture of a pair of eyes, on the extent of cooperation (Bateson, Nettle et al. 2006). This research again demonstrated the applications of evolutionary theory outside the academic domain, as it has attracted considerable attention from potential users in both commercial and publicly funded bodies (e.g. manufacturers who use honesty boxes to sell their products; police keen to use such methods to cut crime). Masanori Takezawa (Tilburg University) changed the focus from empirical research to theoretical work, by presenting a mathematical model that attempted to challenge the Boyd and Richardson (1988) suggestion that reciprocity could not have evolved in sizeable groups. Tamás Bereczkei (University of Pécs) ended the session with evidence from Hungary which supports the hypothesis that generous actions are a form of costly signalling of trustworthiness in modern industrial societies.

The relationship between physical and behavioural displays of attractiveness and preference was the emphasis of the middle session of the day. This session showcased new methods in studying physical attractiveness, beyond the static composite images which are usually used in attractiveness studies. With advances in motion-capture software, bodily and facial movements can now also be studied for associations with behavioural and psychological traits. Will Brown (Brunel University) presented a study in rural Jamaica which involved participants evaluating athletic ability, dance ability and attractiveness from facial photographs, including themselves, to provide a measure of self-deception (see Brown, Cronk et al. 2005 for a similar study on dance and asymmetry). The results indicated that male fluctuating asymmetry has a positive association with inflated self-perception, and were used to discuss the hypothesis that self-deception plays a role in deceit. Female bodily attractiveness was then addressed by Boguslaw Pawlowski (University of Wroclaw), who is interested in condition-dependent mate preferences. Using Polish data, he showed that a woman's phenotype does indeed influence her preferences for particular characteristics in sexual partners. Ed Morrison (University of Bristol) continued the theme of movement and attractiveness, this time focussing on facial movement. He extended the ecological

validity of attractiveness research by examining mobile, rather than static, faces. He found evidence that facial movements distinguish male from female faces, and also evidence for a positive association between feminine motions and attractiveness (Morrison, Gralewski et al. 2007).

The late afternoon session included papers addressing a diverse array of psychological phenomena from an evolutionary perspective. Randy Nesse (University of Michigan) promoted an evolutionary explanation for understanding mood disorders. His argument revolved around the gaps between available resources and aspirations, and has the ultimate intention of developing knowledge of motivational structures (Nesse 2006). Mark Sergeant (Nottingham Trent University) applied an evolutionary approach to understanding the effects of sexual orientation on social dominance and forms of aggression. Finally, Anna Rotkirch (Family Federation of Finland) presented an exploratory investigation of the phenomenon of "baby fever" in Finland, suggesting it may be an evolved mechanism to test and persuade male partners to commit.

The day ended with a rousing keynote speech from Robin Dunbar on the social brain and multilevel societies, reflecting the substantial body of work on this subject produced throughout his career. Starting with a whistle-stop account of brain size in relation to mean group size among different species, focusing particularly on monogamous species and primates, network and grouping data were used to understand the hierarchical structure present in human groupings. Robin then discussed the social brain hypothesis, presenting evidence that primates form behaviourally different social bonds, involving two distant components. The first of these was described as an emotionally intense component, mediated, for example, by the release of endorphins during grooming. The second was described as a cognitive component, creating a psycho-pharmacological environment for building trust. By extending bonding to non-reproductive relationships a hierarchically embedded group structure is created, though this produces a potential 'free-rider problem', particularly in dispersed social systems. Social time in humans (i.e. the equivalent interaction to grooming and contact time) involves conversations, but language does not produce endorphins in the same way that grooming does. In our

species, laughter, music, dance and religion instead provide the same experience as grooming. During interactions which involve singing, dancing and laughter, endorphins are released, triggering oxytocins to create a sense of "euphoric love". Then Robin moved on to theory of mind, and here raised the significance of fifth order intentionality, which he suggested might be necessary for religion. He concluded with a discussion of how inequality in groups could solve individual fitness problems. This wide-ranging keynote demonstrated neatly how the disparate strands of the evolutionary analysis of behaviour (e.g. evolutionary psychology, primatology, endocrinology) can be brought together to shed light on a particular problem in the field.

Day 3: Cultural Evolution

The final day of the conference brought cultural evolution to the forum: the investigation of human cultural development and transition using processes parallel to those underlying biological evolution. The plenary was given by Kevin Laland (University of St Andrews), exploring gene-culture interactions. The discussion was based on recent statistical analyses of genetic data, revealing numerous human genes showing signals of strong and recent selection, for example in response to malaria and dairy farming. The assertion was made that humans have undergone strong recent selection for many different phenotypes. Based largely on the observation that most of these selective events were likely to have occurred in the last 10,000-40,000 years, Kevin suggested that gene-culture interactions, directly or indirectly, shaped our genomic architecture. He then addressed various applications of gene-culture models. In particular, he focussed on handedness, a behavioural trait which was addressed in the previous plenary from an evolutionary psychological perspective. This model attempted to account for the lower frequencies of left handedness in certain societies, were it is associated with negative qualities, such as clumsiness, evil or dirtiness. The model of handedness incorporated both genetic and cultural processes, based on assumptions that handedness has two phenotypic states; that the probability of becoming either left or right handed is influenced by alleles for dexterity and chance at a single locus; and that culturally transmitted biases also affect hand-

edness. Models for sexual selection with culturally transmitted preferences and cultural niche construction were also presented to exemplify gene-culture co-evolution.

The first session of papers of the day epitomized methods for studying the transmission of culture. Laura Fortunato (University College London) presented the first of these papers, on "Galton's problem". This problem has been addressed by evolutionary researchers by applying phylogenetic comparative methods to cross-cultural data, to control for historical relatedness. However, Laura discussed the limitations of this approach, and proposed the solution of a web-based interface for collation of cross-cultural databases that could then be analysed using phylogenetic methods (see the Ethnographic Database Project: <http://www.ucl.ac.uk/~ucsalf/EDP/Welcome.html>). Fiona Jordan (University College London) presented an empirical analysis that used a Bayesian phylogenetic approach, to support the hypothesis that changes in post-marital residence systems would result in changes to descent, using a sample of 67 Austronesian societies in the Pacific. Her analysis suggested that changes in descent practices lag behind changes in residence patterns over a thousand year time period. The final paper in this session, by Ben Jones (University of Aberdeen), proposed social transmission of mate preference helps perpetuate sexual selection of male traits. Observing positive attention from other women increased female preference for a male face, but decreased male preference for that man. These findings suggest that social transmission of mate preferences may influence judgements of facial attractiveness (Jones, DeBruine et al. 2007).

Conformity bias and the extent of conformist transmission in cultural traits was the theme running through the first of the afternoon sessions. Jamie Tehrani (University of Durham) began the session with a paper on the co-evolution of craft traditions and ethno-linguistic groups in rural Iran, using a cladistic analysis of 150 craft traits to explore the processes that generate cultural variation among populations. This approach concluded that patterns of cultural diversity may arise by branching processes of descent, but their relationship to ethno-linguistic differences are a reflection of more complex processes of inheritance, not just population history. Peter

Schauer (University College London) then moved on to evolutionary archaeology and presented research on drift and selection in the evolution of Greek pottery motifs. A neutral model approach was applied to over 3,000 painted cups from 600 to 300 BC. The findings suggested that drift (rather than selection) could explain the distribution of motifs in early and late periods, with a strong conformity bias in the middle period. This supports conformist transmission in selection in the middle period, and a trade-off between risk and invention during the periods where drift predominated. In the final presentation, however, Kimmo Eriksson (Mälardalen University, Sweden) cast doubt on the existence of a generalised conformity bias. He discussed the adaptive value of conformity bias in cumulative culture by reviewing mathematical models of frequency dependent transmission. His synthesis suggests that conformist bias is adaptive when cultural traits are already common, but otherwise other adaptive processes are needed to explain how the dominant culture came about.

The final session of the conference brought together three quite diverse papers. Michel Raymond (Montpellier University) presented a stimulation model which incorporated cultural factors to explain the evolution of male homosexuality. His model suggested that where male primogeniture and female hypergyny are common, the cost of the two known biological determinants of homosexuality are probably reduced, therefore supporting their evolution. Jeroen Smaers (University of Cambridge) then presented a paper which provided support for the social brain hypothesis in a study of comparative socioecology of primate brain component evolution. Findings supported an association between overall relative brain size and different periods of developmental timing, a different locomotion pattern and different behavioural traits. Andy Wells (London School of Economics) ended the session and the conference with a stimulating presentation exploring the interactions between evolved capacities in humans and the cultural resources developed since the invention of writing. In this particular treatise of the new framework of ecological functionalism, he discussed the successes and failures of human cultural development as being underpinned by an interplay between Darwinian and formal types of rationality (see Wells 2006).