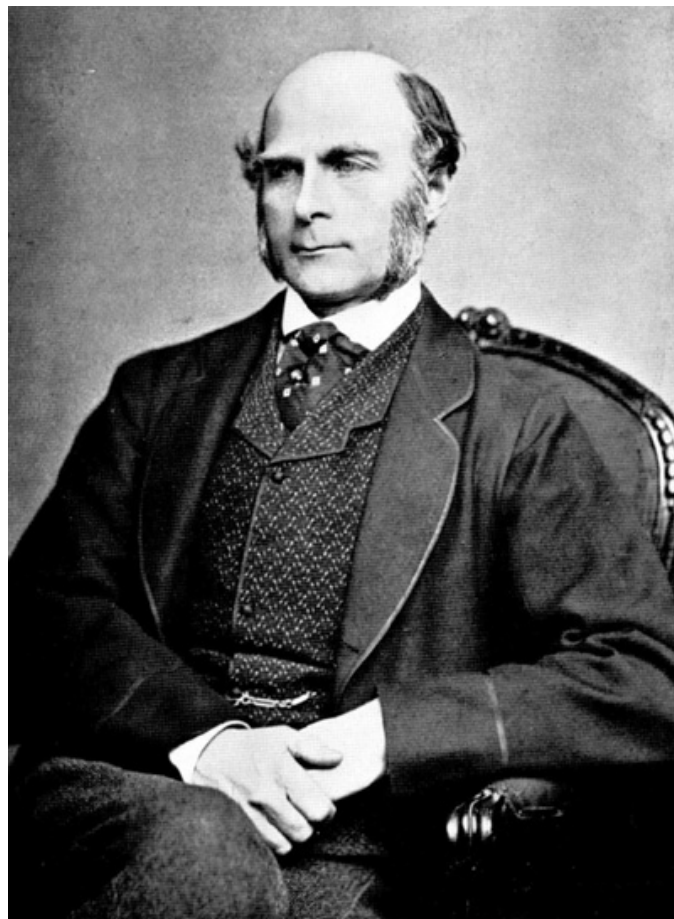


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Galton
Institute
Exploring Human Heredity

The Galton Review



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Front Cover Image: Sir Francis Galton

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EDITORIAL

Francis Galton's numerous contributions to science have often been overshadowed by his perceived connections with coercive eugenics. This year, the Galton Institute is hoping to have an honest debate about the man himself and what his legacy truly is.

Our conference in November is entitled 'Surveying Galton's Legacy' and promises to be a fascinating occasion. The last time conference considered Galton's work was in 1999 so it's high time we revisited the topic. To whet your appetite for the event, our President **Veronica van Heyningen** has written an essay considering Galton's wide-ranging contribution to so many areas of science. You can read her article on page 4. Details of how to apply for tickets for November can be found on the back of this issue.

The 'popular science' genre of book has become much more widely read in recent years, some becoming best sellers. **Subhadra Das**, curator of the Galton Collection at UCL, has written a review of *The Gene: an Intimate History* by **Siddhartha Mukherjee**. As a non-scientist, this was quite a challenge for her, but one she accepted with gusto. Book reviews, by their nature, are very personal interpretations and two reviewers may come to totally different conclusions. In this instance, her account certainly makes for interesting reading and can be found on page 17. I should be interested to know if you agree or disagree with her analysis.

Finally, I should like to thank those who have written to me in recent months and invite any of you to produce an article, book review or whatever takes your fancy for publication in future issues. It's important that members of the Institute and others share their views and opinions. I look forward to receiving your contributions.

Robert Johnston

SURVEYING GALTON'S LEGACY IN 2017

In 1907, when Francis Galton was 85 and well recognized as a scientist with very broad interests, the Eugenics Education Society, which metamorphosed into the Galton Institute (GI) in 1989, was founded in his honour. Galton made many contributions to the inception and advancement of what today we call human genetics, particularly quantitative aspects. The coining of the term "eugenics" is one of Galton's most documented, and derided, contributions. He proposed a major role for heredity in defining personality and intelligence, though willing to acknowledge the possible influence of both "nature and nurture" in this most complex of phenotypic characteristics. The study of physiognomy fascinated him and he developed new ways to study it, suggesting that criminality was linked to recognisable facial characteristics.

The study of behaviour was another line he pursued vigorously and psychologists regard him as one of the founders of their subject. With all the new advances in genetics and genomics and increasing insight into their role in biology, it seems timely for the Galton Institute to look back at Galton's work and how some of his major themes have developed to this day. At the 2017 annual Conference, we shall explore Francis Galton's many outputs in the late 19th and early 20th centuries, so that recent developments, including those in some ethically complex areas, can be assessed as we approach the bicentenary of his birth in five years' time.

Galton, born into a wealthy Birmingham family in 1822, was a grandson of Erasmus Darwin and cousin of Charles Darwin. Both his grandfathers were members of the Birmingham-based Lunar Society with interests in scientific and

technological progress. Young Francis was a precocious child. His father encouraged him to study medicine, but, influenced by Charles Darwin, Galton went to Cambridge to study mathematics, some aspects of which he made his own, though he did not shine in the Tripos. Nevertheless, in all his subsequent investigations, quantitative and mathematical approaches predominated and became his hallmark.

Galton's lifetime studies can be divided into an early travelling and geographical exploration phase, followed by the better known multi-faceted studies of genetics. The major common theme between the two areas of endeavour is Galton's introduction and development of quantitative and statistical approaches to the documentation of weather and, more extensively, to biological measurement and prediction. His travels in Africa brought him into contact with fascinating local populations and sparked an interest in anthropology and linguistics. Voyaging elicited a need to understand weather patterns leading Galton to the first presentation of weather data on a map, and the concept of isobars leading to the discovery of anticyclones. Galton was assiduous in collecting data: he performed calibration exercises on instruments and used statistics to define their precision. His long-range travels ceased when he married in 1853 but this early experience culminated in the publication of a very successful book entitled "The Art of Travel". His enthusiasm for quantitation continued: he "*believed in the power of numerical data whether they related to longitudes, latitudes, or altitudes; measurements of arm, leg length, etc., which led him to the concept of correlation; or counting the frequency of fidgets of his friends and colleagues*" [Gilham, *Ann Rev Genet* 35: 83, 2001]. In the course of such preliminary work he developed and demonstrated the concepts of normal distribution, correlation and regression to the mean – all in widespread use to this day.

Charles Darwin's "*On the Origin of Species.....*" was published in 1859, immedi-

ately capturing the imagination of his cousin, Francis Galton. Prompted by his own intellectual success, the somewhat immodest Galton embarked on studies to explore the heritability of intelligence by comparing the general frequency of very clever high-achieving men (women were not considered!) with their occurrence in the families of celebrated great men. In his 1869 book "*Hereditary Genius*" he expounded his theory that the closest male relatives of a high ability individual would be most likely to inherit his talents, and the level of ability would be reduced increasingly as the relationship moves further from the founder. The data, gleaned from more than 600 published pedigrees spanning the centuries from 1453-1853 revealed 102 eminent descendants – a rate of 1 in 6. As a control, Galton estimated that of all the men educated at universities in Europe over the same four centuries only 1 in 3000 became notable. He concluded that high achieving men were produced by nature rather than nurture, though he did concede that family circumstances could improve the outcome. It was to this insubstantial evidence for the major influence of genes (in today's terms) that Galton coupled the ideas of selective breeding, again from Darwin's writings, to create the concept of eugenics.

The idea of encouraging the most successful to breed while 'undesirable' people were discouraged or even coerced into not producing offspring, held wide appeal. Many who were regarded as liberal spirits and even benign social reformers, such as Sidney and Beatrice Webb, HG Wells, Bernard Shaw, Bertrand Russell, William Beveridge and Naomi Mitchison were sometime members of the Eugenics Society and supporters of its tenets. However, the understanding of genetic mechanisms was extremely rudimentary at the time when the concept of eugenics was promulgated in the 1870s. Mendel's work had not yet been rediscovered at this stage. There was fundamental ignorance and disagreement about blending versus discrete inheritance mechanisms. Even now, 150 years on, when we know that both co-exist, we do not fully understand polygenic inheritance. Additionally, it is increasingly evident that for Men-

delian genes of major influence, the same discrete variant or allele can lead to different outcomes depending on both genetic and environmental factors. There is now very strong evidence that environmental factors can exert enormous effects on the functioning of defined gene variants. For example: the increasing frequency of two highly heritable conditions, obesity/diabetes and myopia, must be due to altered lifestyles, that is environmental factors, since the gene frequencies could not have altered so quickly.

Many quantitative tools first introduced by Galton to study genetics are still in everyday use: biometry generally is routine; humans and many other organisms are constantly surveyed and measured, from in utero ultrasound scans to monitor the developing foetus to satellite counting of albatross nesting sites. The data collected are subjected to statistical analysis techniques, some of which were introduced by Galton. Twin studies, first carried out systematically by Galton, have been a mainstay for the study of disease occurrence, particularly where continuous variables are involved.

Photographic documentation to define the criminal face was another Galton endeavour. Today, imaging and measuring variable physiognomy is critical for facial recognition and for the definition of normal and pathological diversity as well as forensic data gathering. Clinicians recognise a large number of complex syndromes, partly by noting often subtly abnormal facial features. Now machines are able to provide such clinical and forensic information.

With his passion for observation Galton noted that individual fingerprints, which he found ways to document systematically, are unique and fingerprint recognition could be used to identify individuals. Now, however, major developments in DNA variant analysis have allowed completely new methods for personal identi-

fication to be developed, still using the term “fingerprinting” to define the similar pattern-recognition utility.

The concept of “hereditary talent and character” remains at the heart of the Galtonian controversy. The idea that it may be possible to improve the quality of human populations by selective and perhaps coercive control of reproduction is today totally unacceptable throughout most of the globe. However, in the face of much new evidence about the genetic causes of intellectual disability, it is difficult to dismiss the idea that there are many genetic components to the normal development of intelligence and cognitive functioning in humans and animals, including invertebrates, such as fruitflies. We shall be exploring genetic studies of individual intellectual disability and declining cognitive functioning. A pertinent feature of very recent findings in severe intellectual disability is that many of the causative DNA changes arise anew in one or other parent and often are not genetically transmissible because the mutation carrier fails to, or cannot, reproduce. In such cases the disease is genetic, but not heritable! It is therefore timely to review ideas about genetics and intelligence. One of the huge areas of ongoing study is on environmental modulation of gene expression. Epigenetic mechanisms are certainly implicated.

Given that we now recognise that environmental effects are a key part of what we regard as genetic heritage, there are clearly powerful new possibilities to mitigate some of the adverse effects of heredity.

Veronica van Heyningen
President of the Galton Institute

**Population and Ethics:
Informing and Improving the Quality of Debate
26 September 2016 at Cumberland Lodge, Windsor**

Following the annual Colloquium, a group of 21 attendees reconvened to consider how to pursue some of the issues raised to stimulate better policy making and public debate around the issue of a changing human population.

Diana Coole, Professor of Political Theory at Birkbeck College, University of London, presented on *"Overpopulation: Urgent Issue or Taboo?"*. She has conducted an extensive critical analysis of political debates about population issues and concluded that there are many powerful silencing arguments that are embedded in contemporary political discourse and that tend to prevent useful discussion on these issues taking place. Amongst these are "population shaming" (it is wrong even to discuss population), "population scepticism" (there is no problem associated with population), "population declinism" (population growth is currently too low), "population growing" (this specific country, region or ethnic group requires more people), "population-decomposing" (there is no single population issue, only specific issues with birth rate, life expectancy, population density or micro issues at the individual or household level) and "population fatalism" (whilst there may or may not be a problem, there is nothing we can do about it).

David Cope, a fellow of Clare Hall, University of Cambridge highlighted the many complexities of demographic debates around the world, such as a public backlash against recent 'pronatalist' advertising in Italy. However, he also offered an inspiring insight into the role that academics can play in informing and improving policy and the need to provide better evidence to policy makers about how and why population matters.

The workshop ended with a participatory session; all those present were asked to try and move beyond the academic arguments that divided them and consider what might be agreed upon and whether it would be beneficial to share with others who may not have considered all these issues. Following this, practical ways were considered in which academics could get involved in public debate and engage with policy making, from finding out what questions policy makers were interested in when considering what should be researched, to responding directly to public consultations, or even running for office.

A joint statement was then produced that highlighted some of the key points of convergence of researchers at the conference. We are grateful to the **Galton Institute** for helping to fund this event.

Simon Beard
University of Cambridge

Genetic Alliance UK
Successful Partnerships Conference
Tuesday 27 September, 2016
at Amnesty International in London

This is the flagship event in Genetic Alliance UK's calendar and is an excellent opportunity to bring our members together to hear about our achievements for the previous year, what's going on in the research and policy world relating to genetics and to announce plans for the year ahead.

126 people attended the event, over 88 of them representing the patient group-

members, with other attendees being researchers, clinicians, industry, trustees and staff.

Presentations covered a variety of issues: **Dr Gina Radford**, Deputy Chief Medical Officer discussed the impact of genomics on healthcare; **Sarah Rickwood** (IMSHealth) covered the new challenges of Orphan Drugs in Europe. With the focus of our conference being partnerships, we heard from **Jan Mather**, Chair of Behcet's Patients Centres on their partnerships with clinicians. Our members were also at the centre of our event: **David White** (Cavernoma Alliance UK), **Heather Band** (Batten Disease Family Association) and **Gillian Thomas**, a carer for a patient with myeloma, shared their experiences of partnerships with a variety of stakeholders such as researchers, patients and policy makers.

Feedback of the conference through an evaluation survey to all delegates was positive; all of the speakers were rated 'Good or Excellent' by 96% of attendees while 92% said they would be interested in attending the conference next year.

Comments from attendees included: "This was wonderful. Thank you for giving us the opportunity to meet and talk to each other" and "Good programme, with a nice diversity of talks, both patient group examples and policy points." Positive feedback was received on our conference pack, which included a booklet containing all the information for the day, including names of attendees and also our annual report and accounts for 2015-16, which may also be accessed at : <https://www.geneticalliance.org.uk/media/2503/genetic-alliance-uk-annual-report-2015-2016.pdf>

The conference was supported by the **Galton Institute**, for which the charity is very grateful.

Mariana Campos
Genetic Alliance UK

European Molecular Biology Laboratory PhD Symposium

17-19 November 2016 Heidelberg

This annual symposium is held for PhD students studying in different fields of molecular biology. This year's was titled "*Life by Numb3rs: Towards Quantitative Biology*", reflecting the increasing interest in quantitative analysis across different areas of biology. The symposium was comprised of four sessions: 1. Multilevel System Regulation, 2. Data Management and Interpretation, 3. From Genome to Proteome and 4. Cell Communication Shaping Tissues. Speakers were from different fields of life sciences, and they presented their work in relation to our broad theme of Quantitative Biology.

Each day started with a keynote lecture, and on the first day we welcomed **Professor Mahadevan** from the USA, with **Dr Serrano** from Spain on the second day, and **Professor Goldstein** from the UK on the third day. Following each talk from these world-leading scientists, lectures and short talks were presented by young scientists and PhD students. These talks were organised so that junior and senior researchers could exchange their scientific interests.

Later each day, we had blackboard sessions in which participants split into smaller groups, each with a speaker who discussed his or her area of expertise. Participants really enjoyed those sessions where informal discussions took place.

During our poster sessions, more than 60 posters were presented by the participants. These sessions were very energetic, with many discussions following. On the final day, awards were given to the best short talk and the best poster

presenters. We believe having these awards encouraged students to become more involved throughout the symposium.

As the symposium was a rare occasion where PhD students from different locations and with different background come together, we organized panel deliberations to discuss science and doctorates in a broader perspective with senior colleagues.

Science is not only a concern of scientists, but it also has a huge impact on society. We wanted to bring out this important aspect during the symposium by inviting some non-scientist speakers. Nowadays, understanding biology is closely linked to the progress of imaging, presentation and communication within the scientific community and between scientists and society. We welcomed three speakers to show Biology in a bigger picture. **Mr Hartmann** presented *"Science in relation to philosophy"*, **Mr Lieber** discussed *"Artistic visualization of biological compounds"*, and **Mr Hodge** told us about *"Writing stories of science"*.

The symposium was a huge success with around 180 participants coming from different parts of the world and 15 speakers with various areas of expertise. In addition to the registered participants, many EMBL staff members came to listen to talks and to join poster and coffee sessions. Without the sponsors, the symposium would have been impossible, and we thank the **Galton Institute** for its support which enabled us to invite speakers from around the world.

Anna Sueki
18th EMBL PhD Symposium Organiser

**New Directions in the Evolutionary Social Sciences
Conference 13-14 December 2016, University of Cambridge**

The conference examined the nature of human culture and its dynamics over time. The central aim of the conference was to introduce new empirical and conceptual tools for investigating phenomena involved in the evolution of human culture. As a result, the conference was interdisciplinary, with speakers and participants representing a range of approaches in the humanities, social sciences and natural sciences.

The conference began with **Dr Mathieu Charbonneau** (Central European University) discussing *'The structure of cumulative cultural evolution'*. He brought a philosophical perspective to bear on the nature of cultural units and discussed how such units have factored into empirical research. He also suggested the utility of adopting a perspective that groups cultural units together in virtue of the recipes for its construction. Dr Charbonneau's presentation was commented upon by **Dr Enza Spinapolice** (Sapienza University of Rome) who brought a helpful paleoanthropological and paleoarchaeological counterpoint to Dr Charbonneau's arguments.

The second session had two speakers: **Dr Oliver Morin** (Max Planck Institute for the Science of Human History) and **Dr Andrew Buskell** (London School of Economics and Political Science). Dr Morin's talk was entitled *'How to say things with things: the evolution of graphic codes'* and introduced philosophical reflections and a new empirical paradigm for investigating the evolution of arbitrary, strongly communicate codes. Dr Buskell spoke on *'Explanation and cultural attractor theory'*, one of several 'package deal' approaches for studying cultural phenomena in an evolutionary manner. He argued that at least one strategy for discounting cultural attractor theory, based on adherence to a modular account of the mind, does not work.

The last session of the day was **Dr Christine Caldwell** (University of Stirling), who gave a talk, entitled *'Methods for investigating cumulative cultural evolution in humans and nonhumans'*. She reviewed key topics in the experimental study of cumulative cultural evolution, and gave a preview of new methods for studying the psychological capacities for cumulative culture in primates. **Dr Corina Logan** (University of Cambridge) then gave a commentary on this research, connecting work on cumulative cultural evolution to her on-going investigation into avian cognition.

On the second day, **Dr Anne Kandler** (Max Planck Institute for Evolutionary Anthropology) spoke about statistical methods and generative modelling in her talk *'Linking models with data in cultural evolution: analysis of the archaeological record'*. A familiar tool in population genetics, Dr. Kandler showed how such statistics could be used to determine how much information one can expect to acquire from a data set, and how one can use generative models to extract information about the likely causes of cultural transmission. **Dr Adam Powell** (Max Planck Institute for the Science of Human History) then commented on Dr. Kandler's work, and argued that such statistical and generative modelling has been and continues to be an effective tool in paleogenetics.

In the second session **Dr Heidi Colleran** (Max Planck Institute for the Science of Human History) began by introducing new anthropological work from Vanuatu in her talk titled *'Bridging micro and macro level approaches to the coevolution of culture and demography'*. She went on to make a number of compelling claims about the need for an integration of demographic tools and knowledge into the study of cultural evolution. Following this, **Dr Fortunato** (University of Oxford) spoke about her research into the purported effect of the colour red on human competition. Marshalling a range of mathematical models and an extraordinary depth of knowledge into the tournament structure of competitive sport, Dr Fortunato provided conclusive evidence against some central claims about the evolutionary role of the colour red in humans.

The final session was by **Dr Nicole Creanza** (Vanderbilt University) who discussed a range of mathematical models she and her colleagues had developed in her talk *'Large-scale cultural change as a feature of cultural evolution itself'*. Starting with the premise that there is a range of means by which large-scale cultural change can happen, Dr Creanza introduced several new models articulating how lucky innovations, and artful combinations of innovations can drive the dynamics of cultural change irrespective of other external factors. Closing the conference, **Dr Neeltje Boogert** (University of Cambridge) summarised the views of the various speakers and posed a range of pertinent questions.

For their support in making this conference and the subsequent conversations happen, we sincerely thank the **Galton Institute**, the British Society for the Philosophy of Science, and CRASSH (Centre for Research in the Arts, Social Sciences and Humanities at the University of Cambridge). We extend particular thanks to Oliver Wright, Conference and Events Manager at CRASSH for all of his help in organising this conference.

Andrew Buskell
University of Cambridge

BOOK REVIEW

Siddhartha Mukherjee: *The Gene: An Intimate History*
Pub. Scribner, 2016 pp.592

The actual science in most popular science books is often hard going. As a science historian, it is typical that when reading books about the history of genetics, I rollick through the 19th Century until the unit of inheritance is realised to be a molecule and I have to sit down and have a rest. Show me someone who claims to have read Siddhartha Mukherjee's *The Gene: An Intimate History* from start to

finish in one sitting, and I will show you a liar or a geneticist on holiday. For the purposes of this review, I will assume that the award-winning writer, cancer physician, stem cell researcher and cancer geneticist knows what he's talking about as far as the science is concerned.

The rest of this book – the majority of it – is about the history of science and is consistently engaging to read. Whether or not you believe that great writing is an end in itself is, as always, up to you. For me, no application of aesthetically satisfying wit, rhetoric or pathos is enough to make up for poor history writing. This is where *Gene* fails to live up to the hype.

What makes this especially disappointing is that I was rooting for this writer from the start. He's a Bengali American (I'm Bengali British), he has won a Pulitzer Prize (one of my life goals until I realised you had to be American to qualify), and he makes clear from the start his preoccupation with a genetic time bomb in his family history that may or may not be ticking inside him (schizophrenia for him; hypertrophic cardiomegaly for me). It's likely that this is the case for any reader of this book; our bodies, coded and constructed by our genes, are the one thing we all have in common, as is the knowledge that one day they will go wrong and we will die.

One jacket review describes *Gene* as a 'kind' book, and it is. Mukherjee's willingness to take a political and moral position makes it all the more so. Where women are noted, they are portrayed sympathetically -- this is particularly true in the case of Rosalind Franklin. Mukherjee dedicates the book to two women: his grandmother and Carrie Buck. Both feature at regular points throughout the narrative; the former, a woman who spent her life managing the outputs of a burdensome genetic inheritance, the latter was the first woman in the United States to be sterilised without her consent because of what was perceived to be hers. Mukherjee's ability to intermingle the personal story with the historical and political is what makes this such a compelling book to read.

How, then, in this dramatic, political, moralistic and powerful telling of the story of the history of genetics, does Francis Galton fare? Galton does appear in this book, and, in the broader context of the history of science, this is a point worth commending. Beyond this, while Mukherjee gives Galton more coverage than most, his depiction and overarching narrative break no new ground.

Francis Galton appears, once again, in the role of 'Bad Victorian Scientist No. 1', and in this book his performance is hammy. His pomposity: "Galton -- who never blanched from the recognition of his own genius," is contrasted and combined with "...an acute sense of scientific inadequacy". *On the Origin of Species* has both a paralysing and galvanising effect, having effected 'envy, pride and admiration'. There is a long-running comparison with Mendel (both men were born in the same year) and in the end Galton is dismissed as an abysmal experimentalist. This is accompanied by the usual sanctification of Charles Darwin, e.g. "...while Darwin's encounter with the "natives" of South America in the 1830s had strengthened his belief in the common ancestry of humans, Galton only saw difference: "I saw enough of savage races to give me material to think about all the rest of my life.""

Eugenics is a key story that runs through this book. Mukherjee places Galton at the launch of the eugenics movement in Britain, and peoples the event with a who's who of Edwardian society: George Bernard Shaw and H.G. Wells are name-checked along with the social reformer Alice Drysdale-Vickery and notable scientists: Karl Pearson, Walter Weldon and William Bateson. Reference to the colonial context is confident and unambiguous, which is excellent.

The overall effect of the narrative is less so.

There is no attempt to problematize anything, or anyone, here. There is no mention of when Galton successfully demonstrated through experiment, that Darwin's theory of the mechanism of heredity (what he called 'gemmules') was wrong. Galton's most important contribution to, and essentially the founding of,

mathematical biology, is relegated to a footnote. From here, further cracks begin to show. A letter from Darwin to Galton is quoted selectively and, as a result, misrepresented. The one photo reference to Galton is inaccurately described and the reference is misattributed. For a writer who makes such efforts to cover his position there is a footnote on every other page, it is reasonable to assume that this is not only sloppy research but an active attempt to twist historical fact to fit an overarching narrative.

The result means that the book, for all its scale and ambition, is little more than history by caricature (a fact evident in the 3-word portraits Mukherjee regularly uses when introducing new characters: William Bateson is "dogged and imperious with a handlebar moustache", Craig Venter "pugnacious, single-minded, and belligerent"). Mukherjee sets up science as a game with winners and losers, and Galton, as a loser, may be dismissed as no scientist at all. The mere notion of science as orthodoxy should be anathema to any writer with claims to be progressive or liberal, let alone one who is himself a scientist. If Galton's story has been misrepresented, how can we be sure the same thing hasn't been done elsewhere in the story? What else of this story has been left out?

I applaud and commend Mukherjee's desire to bring the story of genetics in general and eugenics in particular to a wider audience. I cannot condone the way he has chosen to go about doing it. His approach perpetuates a black and white picture of history, contains blame to the usual suspects, and lets far too many people, inside and outside the book, off the hook far too easily. There is a greater story to be uncovered here, part of greater work which needs to be done. This book, as rollicking as it is, takes us only a little of the distance to being able to do that.

Subhadra Das
Curator, UCL Galton Collection

THE GALTON INSTITUTE

Conference 2017

Surveying Galton's Legacy

Wednesday 15 November, 2017

To be held at

The Royal Society
6-9 Carlton House Terrace
London, SW1Y 5AG

Admission is free, but strictly by ticket available from:

www.eventbrite.co.uk

or

The General Secretary, the Galton Institute,
19 Northfields Prospect, London, SW18 1PE

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