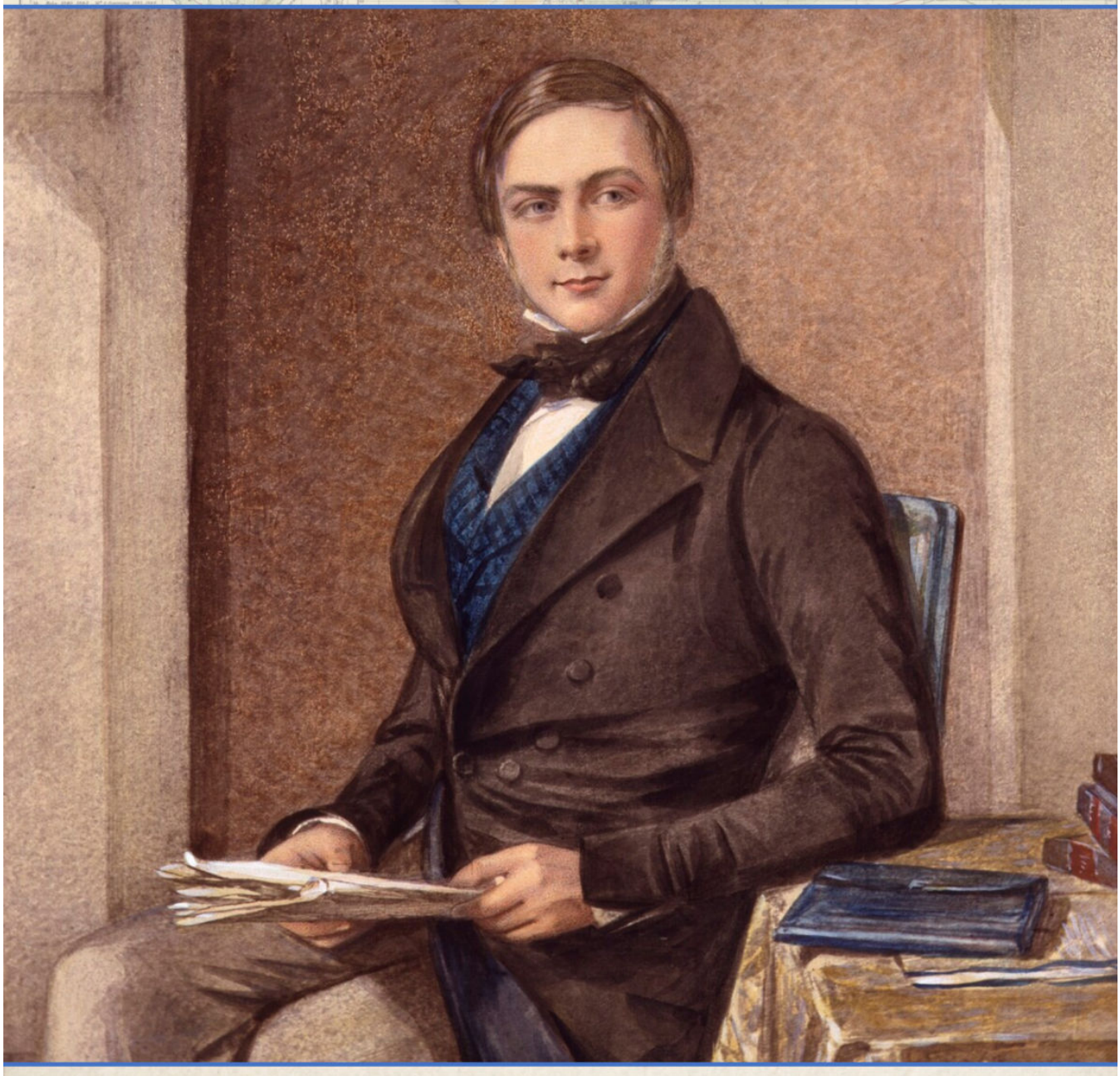
Francis Galton

Nature and Nurture: 1822-1865

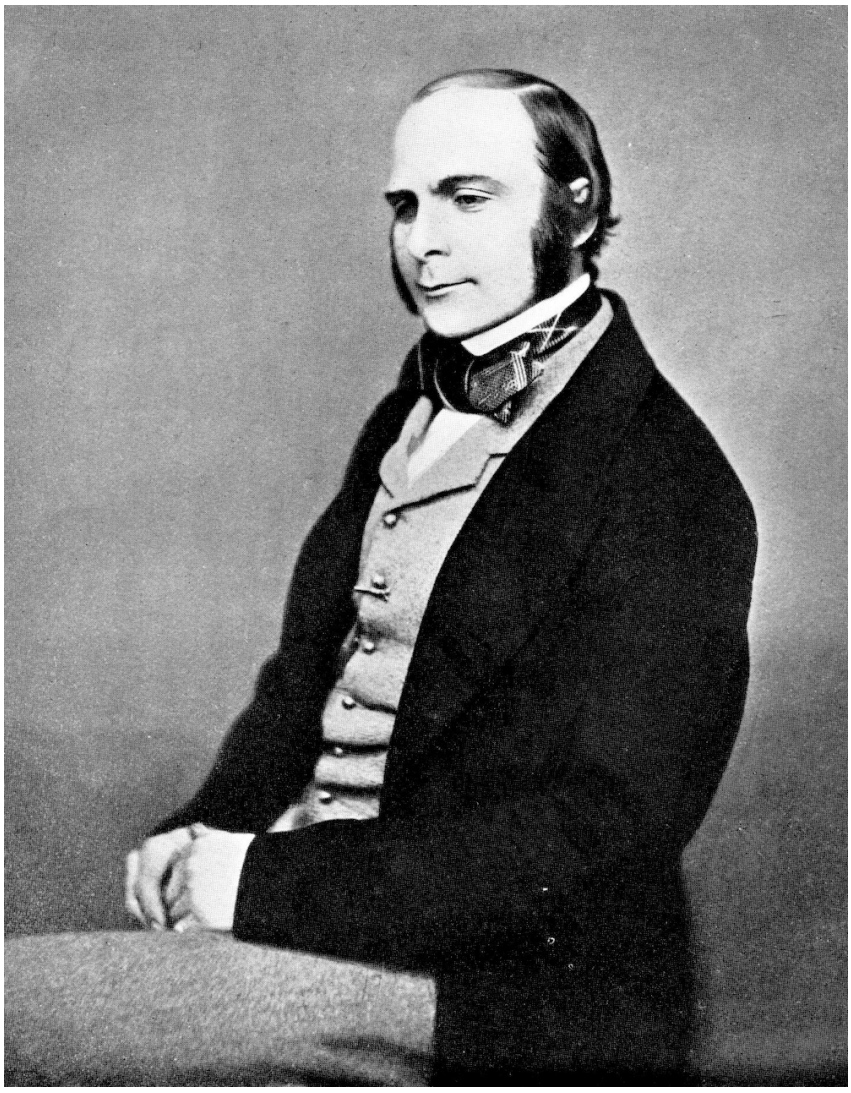


Gavan Tredoux

FRANCIS GALTON'S NATURE AND NURTURE: 1822–1865

blank

Francis Galton's Nature and Nurture: 1822–1865



Gavan Tredoux

galton.org

I am disposed then, like a great many anthropologists, to believe more in nature than in nurture, more in heredity than in education. Once, at a soiree of the Royal Society, I spied, near together, two of my friends—Francis Galton, apostle of heredity, and Sir Joshua Fitch, prominent educationist. A wicked idea entered my head. I introduced the two, and stood by to watch the inevitable conflict. It was most instructive and diverting. The last thing I heard was Fitch saying in a plaintive tone, "But if all you say is correct, what's the use of me?"

— John Beddoe, *Memories of Eighty Years* (1910).

blank

Francis Galton: a Lifetime of Exploration

1. Francis Galton's Nature and Nurture: 1822–1865.
2. Francis Galton's Genius: 1865–1911.

Supplements:

1. Sir Francis Sacheverel Darwin.
2. Francis Galton at Cambridge: Letters and Diaries, 1840–1844.
3. The Diary of Charles John Andersson: 1850–1851.
4. Francis Galton on Mars: the Discontinuous Variation Notebook.
5. Francis Galton and Alphonse de Candolle: Notes and Correspondence.
6. Francis Galton and Alfred Binet: Correspondence.
7. Francis Galton: Selected Papers, Notebooks and Diaries.

Contents

Synopsis

In January of 1885, Francis Galton wrote to the council of the city of Lichfield. The scientist urged the elders to erect a 'suitable memorial' to one of their most storied residents, his grandfather Dr. Erasmus Darwin—fellow of the Royal Society, poet, physician, inventor and early evolutionist. What Galton had in mind was inexpensive and unpretentious, a drinking fountain with a medallion above it, enlarged from the famous design in porcelain by Josiah Wedgwood. Visitors—Americans, even—were continually surprised to find that there was none. Surely the 'world at large and much less single English towns, is not so rich in eminent men as to be able, without loss, to forget their existence'? Thanks to that other grandson of Erasmus, Charles Darwin, evolution had become 'a doctrine which had 'permeated and leavened modern thought, and effected more profound transformation of opinion in a single generation than probably any other scientific doctrine has ever done'. Galton even offered to collect funds for the monument himself.[1] The council accepted.

From then on Lichfield could bracket Darwin with that other famous son, Samuel 'Dictionary' Johnson, as another man who worked with his head rather than his hands—unlike their neighbours, 'the boobies of Birmingham'. Today you can visit the houses of both Erasmus and Johnson in the town, even hire rooms there to host conferences in. They are remembered. But is there any country so rich in eminent men that it can afford to forget the likes of Sir Francis Galton, 1822–1911?

Galton's achievements are bewildering at first. He invented the scientific study of fingerprints and the technique for matching single-prints forensically using minutiae. He discovered anti-cyclones after devising the world's first weather maps, including the forms we see in newspapers today. Every victim of *Statistics 101* is familiar with techniques that Galton invented, including regression and the correlation coefficient, by far the most widely

[1] *Lichfield Mercury*, Friday 30 January 1885, 5, where Galton is consistently given as 'Galtin'.

used of all statistical methods. They may not realise that he also invented non-parametric methods using percentiles of the Normal Distribution, and the Galton-Watson branching process. Before that he had pioneered pedigree analysis, including twin studies, even pointing to adoption designs too. He had kicked off the search for intelligence tests using physical-instrument methods that were only fully appreciated a hundred years later. Word association tests, visualized 'number forms' and synaesthesia emerged from his innovative survey of differential psychology. Not to mention Population Genetics, which traces one leg to Mendel but the other to the biometric school that Galton helped to found, which studies the evolution of continuous rather than discrete traits.

He was past middle age when he started on all that. Before, he had made a name as a technical expert on the *Art of Travel* (1855), a perennial-seller of a book that accompanied Richard Francis Burton and John Hanning Speke on their momentous East African expedition of 1857–9—in search of the sources of the Nile and the mountains of the moon—for which Galton had drafted the instructions. His travel expertise was founded on his own experiences as a pioneering explorer, surveyor and ethnographer of South-West Africa in 1850-2—the Ovambo and the Bushmen of the Kalahari he came to admire so much.

There is an underlying framework to these apparently-disconnected investigations, as Galton himself tried to point out more than once. It includes the research programme of modern behavior genetics, which did not exist in 1864 when he started off in earnest. At bedrock, it is the application to human behavior of the doctrine of evolution devised by his half-cousin Charles Darwin. If humans are animals, then they evolved their traits through natural selection. Therefore humans can be subjected to artificial selection, the practice which had inspired Darwin's analogy in the first place. Conscious direction of the evolution of the human race was staring mankind in the face.

Perhaps human nature could be greatly improved through selection—later he would call that 'eugenics'. It is in a state of original sin, no longer matched to the new demands placed on it by the civilization it had invented. But to get there, we have to first understand the inheritance of traits. Which traits should we select for? How can they be defined and measured objectively? How are we to gather the data? Once gathered, how are we to analyze and understand its associations and implications? That had all to be invented from scratch.

Wherever historical data appeared, Galton greedily accepted it: heights and weights of noblemen from a tailor's records, the coat colours of basset hounds from a hunting stable, eight hundred estimates of the weight of

a dressed ox at an agricultural show, speeds of registered trotting horses and homing pigeons, lists of Royal Society members, Tripos exam marks at Cambridge, records of church property—even photographs from prisons.

Mostly he had to gather novel data himself. He would scan whole libraries of biographical dictionaries and reams of newspapers to find the pedigrees of eminent men, comparing frequencies within families to population frequencies—until that triggered his 'regular breakdown'. Surveys for eminent men of science were constructed and sent out to his colleagues at the Royal Society, to discover their 'nature and nurture'—not 'nature *versus* nurture', an opposition he did not subscribe to. Another survey located twins, already known to be either identical or fraternal, and ascertained their traits—defying slings and arrows, identical twins did not diverge, fraternal twins did not converge. Schoolmasters would weigh and measure their boys for him, allowing comparisons between town and country. He would grow peas experimentally and discover that their seed sizes regressed to the mean by the generation. The heights of parents and their sons, obtained from 'prize records' of family faculties that he gathered, and his own Anthropometric Laboratories, showed the same phenomenon. Dividing by variances turned those regression coefficients into a single measure of association, the correlation. The Anthropometric laboratories, starting at the International Health Exhibition of 1884 and continuing at the South Kensington Museum until 1895, landed more measurements than he could possibly analyze. It would be 1985 before they were finally treated in full.

Then there were the long-running experiments. He had blood transfusions performed on generations of rabbits bred at Down House to test Darwin's theory of 'pangenesis'—the theory held that heredity-determining particles were transmitted in the blood, but the transfusions failed to transmit coat colours. It was a loss of face to Darwin, who reacted defensively—not to his credit—with some post-hoc changes to his theory. Galton gamely played along, anxious not to give offence. Experiments in moth breeding, to determine the true laws of heredity, proved too complicated. He had to make do after that with experimenting on the cabbies who drove him home, to either 'Rutland Gate 42' or '42 Rutland Gate', to see which was more memorable (the latter).

Where others daydreamed, or worse, Galton would quietly record and count: leaves on the trees in Bushey Park, by means of a mental grid (there were far fewer of these than many might suppose); worms on the ground at Hyde Park after the rain; the number of pigeons at St Mark's in Venice; the number of brush strokes devoted to his own oil portrait, as a measure of resemblance; fidgets during invariably dull lectures at the scientific societies,

indexing boredom. Nervousness of the lecturers could be measured by means of a 'pneumo-cardiograph' worn under the clothes (he tried it on himself, for comfort, while lecturing). Naturally shy, he preferred not to be noticed while he recorded data, so he carried a paper 'pocket registrator' to discreetly prick observations on as he circulated. He marked a 'beauty map of Britain' in this way, as he passed the ladies on his travels, pricking his ratings left, right or middle. When the pricks were counted, Aberdeen came last, London first.

But counting was just one way of reducing data from observations, and Galton was always watching. At the processions he loved, in the crowds he frequented, he would carry a brick wrapped in brown paper, to be lowered down inside his trouser leg on a string, and quietly stepped on to improve his view. A 'hyperscopic' stovepipe hat, with a periscope emerging from the crown, scanned over piled-up Victorian hair-dos. At the horse races observation was much easier: he could watch the crowd from a hill. Faces flushed noticeably red as the horses neared the finish—*tint* measured their aggregate excitement.

Noticing was almost involuntary. Large crowds drawn to the speeches of the charismatic preacher Charles Spurgeon—he counted them on successive nights—showed the instant command of an excited multitude that force of personality can afford. The mere appearance of Garibaldi in London had a similar effect; like the crowd around him, he felt the overwhelming urge to worship. Curious then about slavishness and hero-worship, he rigorously conditioned himself to venerate the lumpen image of Mr. Punch (it took a while to lose that feeling). This kind of self-experimentation meant that other subjects could be replaced by introspection. Thus 'word associations', instantly seized upon and recorded while sauntering down Pall Mall, after fixing his attention on this or that object, provided an inventory of his own mental furniture (surprisingly sparse, he thought).

In essence, Galton was the world's first 'Data Scientist'. There seemed to be no bounds to what he would attempt to measure and reduce to stochastic order. General observation and measurement underlaid and preceded his behaviour genetics research programme, as can be seen from his meteorological researches. *Maps* formed the connection. He had learned to map territory in the Namib desert in the early 1850s, by use of the sextant, developing an affection for the process of smoothing and triangulating data, protected by redundancy, understanding its distribution and spatial regularities through isoclines. When he turned his attention to meteorology a decade later, it was through broad data collection and tracing *changes* in smoothed spatial distributions that he made his breakthrough discovery of the anti-cyclone. Even regression was first suggested to him when he mapped his height data and re-

alised that the 'isobars' in it formed an ellipse shape, only half-remembered from his days at Cambridge under the famed mathematics tutor William Hopkins. The algebraic proof followed later.

Allied to zeal for mapping was a fondness for precision instruments. When Galton was not calibrating them at Kew Observatory, an activity he found strangely gratifying, he was inventing his own. This had started as early as his Cambridge years. Letters home show that he was more interested then in unpickable padlocks than he was in partial differential equations. During his 'lost years', after his mental breakdown at Cambridge, he developed a digital printing electric telegraph, the Telotype—based ternary trits rather than binary bits, with an automatic encryption/decryption module to boot. (Many years later he would devise a scheme for transmitting digital pictures efficiently by telegraph, using a technique that anticipated vector graphics.) The Telotype was only partially manufactured when he fled to Africa in 1850, perhaps to escape his recurring mental discombobulation. After his return he invented a heliograph for precisely directing sun-signals, which ultimately went into broad use within the navy up until the next century.

The annals of the Meteorological Office are decorated with Galton's instruments for automatically recording and reducing weather data. Precision dog whistles; an altazimuth for measuring angles when surveying; the instruments for measuring sight, hearing, strength and reactions of all kinds which made up the Anthropometric laboratories; pocket registrators for recording observations—all these and more were manufactured. Sometimes they acted as aids to thinking. His marvellous 'quincunx' device demonstrated the statistical normal/binomial distribution in action: lead shot dropped down a funnel through a fruit orchard of pins, each representing a left/right random event, scattered neatly into that form. Intermediate stages showed a proof of regression to the mean, obvious to the eye–once released, the little normal stages recombined to form a large normal.

Much of Galton's mature life was spent in the formal institutions that Victorian Science was conducted through, often by energetic men who had day jobs as captains of industry, and only turned to their vocations after hours. He held influential positions in the Royal Society, to which he was admitted in 1860, the Geographical, the Ethnological (which first split from then reunified with the Anthropological) and the British Association, then an open forum for the scientifically-minded public to engage in. As a practical matter, he could follow his interests as he wished because, aside from his extraordinary natural abilities, he had the money.

After the death in 1844 of his father Samuel Tertius—who had married

Violetta Darwin, daughter of Erasmus—Galton inherited sufficient funds to sustain himself in comfort, provided he lived sensibly. The cash came from the family banking and manufacturing nexus. The Galtons had started out in the early 1700s as iron manufacturers at Taunton, then moved into more lucrative gun manufacturing at Birmingham. The Napoleonic wars boosted their growing fortune so much that they could progressively move into banking instead. As Quakers—noticeably inbred, yielding not so much a family tree as a graph, with Barclays, Lloyds, Farmers and Camerons as relations—they were ideologically more suited to finance than gun-smithing.

At Birmingham, Galton's paternal grandfather Samuel chafed at the constraints of industry. He had wider interests anyway, spending many hours with the Lunar Society of like-minded midlanders—naturalists, inventors, chemists, industrialists and freethinkers. At various times the 'Lunaticks' could boast the likes of Matthew Boulton, James Watt, William Withering, Josiah Wedgwood, Erasmus Darwin, Joseph Priestley, Samuel Galton and Richard Edgeworth. They met at the full moon for conversation. However the club did not function as a venue for corporate science so much as a breeding meetup—for ideas and people. From the union of the Galton and Darwin families came Francis Galton. From the union of the Darwin and Wedgwood families came Charles Darwin. It was a distinguished pedigree, with fellows of the Royal Society, writers and inventors in every direction.

The ancient universities were less important then, outside of fusty mathematics and classics, and Galton only had loose ties to them. In truth the subjects he chose were little developed. Usually he started afresh, ignoring most of what had gone before after a cursory survey. He was conducting forays into virgin territory, establishing the lie of the land, moving on when the first seams played out, leaving the more tedious details to others—playing the fox to Charles Darwin's hedgehog.

In his day he received broad and lasting international recognition—the Gold, Darwin and Copley Medals of the Royal Society, the Huxley Medal of the Anthropological, the Geographical Gold Medal, the Linnean Society Medal, along with many honorary degrees and fellowships—culminating with a knighthood in 1908 from a Liberal government. But there are now no stone monuments to this curious talent—one of the most interesting men who ever lived—aside from a plaque at 42 Rutland Gate, his old house in Kensington. He is all but forgotten to most. Monuments to Charles Darwin are common. New biographies and studies of the Down recluse appear every other year, but his half-cousin is buried, as if under cumulative castings from the earthworms that fascinated Darwin so much in later years. They pile higher and deeper all the time.

Yet there is a *digital* monument. Beginning in 1998 I started to gather together facsimiles of all of Galton's published work—including memoirs in journals, books, pamphlets, and the massive three-volume *Life, Letters and Labours* by Karl Pearson—at galton.org. Research libraries were ransacked on both sides of the Atlantic. By 2001 the collection was complete, with the bibliography greatly expanded and corrected, and many rare items made available. At least, *nearly* complete—every now and then something else pops up. Unsigned or merely initialled pieces surely slumber all over, undisturbed.

Though it is a rich source for scholarship, galton.org does not contain many copies of holograph manuscripts. Archives jealously guard their holdings, complicating wholesale reproduction. But out of web sight, I have been engaged on a world-wide search for copies and transcriptions of manuscript material since 2001. The major holding is at University College London (UCL) which has over 10,000 items, now largely digitized by the Wellcome Institute. But there are important caches elsewhere: the Smithsonian, Library of Congress, Linda Lee Library in Kansas City, American Philosophical Society, Royal Geographical Society, Royal Anthropological Institute, Cape Archives, McGill University, Keele University, British Library, Wren Library at Trinity College, King's College, Cambridge University Library, Wellcome Institute collection, and many others. Add to those the extensive archives of digitized newspapers from that era. These sources have been searched over, gleaned from, even ransacked. The material that they have yielded has formed the basis for a new biography of Francis Galton, which is now drawing close to completion.

There have been only a few biographies. Perhaps this is because of that energetic Galton collaborator and acolyte Karl Pearson, who produced one of the monoliths of all scientific biographies, *The Life, Letters and Labours of Francis Galton* (1914–30, 3 volumes in 4 parts). It is vastly swollen by the inclusion of many reproductions of published material by Galton—now unnecessary given galton.org. Pearson's own strong opinions coil round it like a boa constrictor. Inside are the crushed remains of not a few of Pearson's own rivals—or worse, no sign that they ever existed. It is a vestige from the long Victorian era of dutiful tributes, labours to read as well as to write. For all its length—including lavish reproductions for no obvious reason of many fingerprint sets, composite photographs and other ephemera—Pearson left a wealth of manuscript material unused. Many questions are left unexamined.

Most of all, Karl Pearson was not in a position to understand the relationship between Galton's work and the later efflorescence of behavior genetics—advances that Pearson had already lost touch with himself. Many

other lines of research that Galton initiated are still very much alive today. in an era when many biosocial questions have withdrawn into deep artificial shade, his untrammelled perspective is still vital—consider 'slavishness' as a heritable personality trait, the notion of types revealed by composite portraits, intelligence as sheer mental alacrity, and measures for imagination and character. His notebooks bustle with ideas like these, long undisturbed but still radiant with suggestion. And as the Lazy Susan of ideas revolves, who ever took the idea that everything is heritable, or that genes fashion their own environments more seriously than Francis Galton?

A new life based entirely on primary sources is badly needed. The tattered hand-me-down anecdotes must be granted a dignified retirement, if not burial. Notebooks must be opened and patiently transcribed. Letters must be unearthed and pieced together; connections drawn; assumptions carefully checked; contexts established.

But then why not apply to biography itself the methods that Galton discovered and which have been confirmed and expanded by over a century of behavior-genetic evidence? Young Frank altered the world at least as much as it altered him. His genes sought out and carved a niche within it, an adapted environment. They created novel concepts which took on a life of their own, an extended phenotype. His siblings shared the same home life and cultural heritage, but each took rather different directions than their youngest member. The weight of evidence from his pedigree must be taken into account using improved methods.

A campaign of comprehensive archaeological digs has been preferred to the classical idea of biography as practised by say Samuel Johnson, Isaak Walton or John Aubrey. Johnson would hold his hat out if it was raining knowledge, but not trouble himself to search for it. We now want far more than just the essence of Francis Galton the man—though that emerges clearly—nor simply some heroic reason to find him interesting. We want to know absolutely everything we can find out about this phenomenon. Hats expecting rain will not do. Because a Galton only comes along once every few centuries.

There is a trove of new material from this extended exercise in personal archaeology. Many opinions must be overturned or reconsidered. Take Galton's (invariably silent) politics. He was a Liberal Unionist, *not* a conservative, much as that will disappoint those who would interpret the Victorians in terms of the inversions of the 1960s. His views about race were thoroughly modern. He was a cosmopolitan in all respects. He did *not* believe in eternal regression to the mean as a statistical phenomenon. Current evidence shows that he was right about the heritability of personality, intelligence and other

traits—right even where Pearson thought him wrong, about the relationship between reaction time and intelligence, and about the link between head size (or brain volume) and intelligence.

With new information we can learn much more. There is the full story of his solo trip before going up to Cambridge—down the Danube to Istanbul and Greece in mind of Byron, inspired by his adventurous uncles Theodore Galton and Francis Darwin, who had hobnobbed with the troubled poet in Athens and Smyrna during the Napoleonic wars. Much light is thrown on the nature and etiology of the debilitating mental breakdowns of 1844-9 and 1865-8. The Cambridge years reveal the signs of a breakdown from the very first, but we learn that it was a condition that would plague him repeatedly throughout his life. The 'lost years' of 1845–49, which had driven Pearson to despair, can be fleshed out at last from contemporary sources. The expedition to the Namib and the Kalahari can be reconstructed in detail from the manuscripts and archive records, charging it with renewed interest. The troubled friendship with the Anglo-Swede Charles John Andersson, his companion on that journey, gives rare insight into Galton's character. His work with the coven of Darwinians on the *Reader* magazine, which he was a part owner of along with his cousin and John Stuart Mill, is accurately flaked open for the first time, revealing the fraught world of the mid-1860s when the new science appeared to be under constant threat. The ethnographic notebook from 1864—in which human differences in personality and intelligence demisted, and the pedigree analysis of *Hereditary Genius* (1869) was born—is rehydrated.

Galton's influence on the psychometricians Alfred Binet, Charles Spearman and Cyril Burt can be delineated, likewise his influence on the quantitative geneticist R.A. Fisher. The early history of the Sociological Society, which Galton helped to found, and which spawned the eugenics movement, can be dissected. And what about that attractive but gullible Fabian, Beatrice Webb née Potter, who developed a crush on Galton that she confided only to her diary? Every topic has yielded new surprises, even the humble quincunx—we now know that Galton actually built the two-stage version of it, that it was not just a thought experiment. Not to mention the dispute with Norton Shaw at the Royal Geographical Society; the traumatic break with Captain Richard Francis Burton over the true Nile sources; the close friendship and encouragement of Victoria Lady Welby. And ... well—you'll just have to *read* it to find out.

Preface

This volume, the first of two, examines Francis Galton's start, using primary sources: letters, diaries, notebooks. Published sources, often very obscure, are used where the primary material can no longer be located. Throughout, there is a wealth of fresh matter of every sort. There are new facts and corrections of old 'facts', yielding startling new insights.

We unearth Galton's prodigious childhood, boyhood and youth. The extraordinarily rich detail of his ancestry. The schooldays in Birmingham at the Free School (King Edward's). The medical school years at Birmingham General Hospital and King's College London.

Then there is his trip down the Danube to Constantinople before going up to Cambridge. His education at Cambridge and nervous breakdown there. His trip to and sojourn in the Middle East, down the Nile to Khartoum and over to Lebanon and Syria. The lost years after that, in Leamington and the Orkneys, pursued by demons.

Much new light is shone on his African exploration of 1850-2, which marked the start of Galton's scientific career. For the first time we are able to trace his friendship with Charles John Andersson in all its emotional rawness, a rare insight into Galton's personality.

As the leading technician of travel for decades after, we see Galton involved in the Burton and Speke controversy over the sources of the Nile, weather maps and Captain FitzRoy's storm forecasts. Butting heads with Norton Shaw of the RGS. The 'animal spirits' and mysterious mental maladies which plagued him throughout the 1850s and 60s are now on full display.

The volume closes with Galton's role on the influential Darwinian magazine *The Reader*, the precursor to *Nature*. We leave him on the threshold of his research programme into behavior genetics, for which see the second volume, *Francis Galton's Genius: 1865–1911. Nature untangled from Nurture*.

Gavan Tredoux

galton.org
February 2023