

THE FOUNTAIN

TRINITY COLLEGE CAMBRIDGE

Trinity: Campaign
and Book

An Official Poet

Beer and Science

Genetics and
Epigenetics

From Bells to Ducks

Coming up Twice

New Fellows

Triumph at
Tiddlywinks

Introducing China

More Trinity Trivia



EDITORIAL

This issue of *The Fountain* is largely about time. Andrew Francis compares time long past and time more recently spent as a junior member of the College. Chandrahas Choudhry finds he is almost able to suspend time, not quite coming down from Trinity. In a frozen Cumbria Emma Jones was inspired by time stopped. Edward Holroyde-Pearce had presentiments of time future, to be spent in China after graduation. Charles Relle represents time extended, possibly the world's longest-serving international sportsman, if Tiddlywinks be a sport. Our two senior scholars in this issue, Professors Shankar Balasubramanian and David Baulcombe, reflect on the costly time spent in fundamental research before DNA, and what is not in our DNA, could be usefully decoded.

Higher Education, like all education, is an investment that times past and present make in time future. At Trinity its profitable returns are most clearly embodied in our eight new Title 'A' or Junior Research Fellows. These are introduced all too briefly in this issue, together with the College's other new Fellows and more temporary members of High Table. Products of past investment by others and of their own intellectual hard labour, the election of these Research Fellows also demonstrates Trinity's faith in their future potential—whether to revise understandings of the past or to change the possibilities of the future. Emerging from a long and costly learning process they are nonetheless only at its beginning.

To interrupt that process, that investment of time, is risky. It puts in question our mastery of future challenges and opportunities. And yet an interruption of educational time—or, certainly, a popular apprehension of its interruption—is upon us. The United Kingdom government appears to be about to cut out the larger part of all public support for undergraduate teaching. Increased student fees will be expected to fill the gap. There is certainly room for reasoned debate on the balance between the public and private benefits of higher education and on the balance, therefore, between its public and private costs. That argument will no doubt run and run, within the government as well as among the public.

But the young lack the time needed for a hundred indecisions, for a hundred visions and revisions. They have but one opportunity to squeeze their universe into a ball, to face the overwhelming question, 'do I apply for University?'¹ Nor can research halt in mid-project. To heal any interruption—to both private youthful aspiration and public investment in knowledge—demands our restorative action.

Trinity has done much in the past, in the University as also within the College, to fund student ambition and the researches of those who teach them. It continues to do so, helped increasingly by our members' generosity. This proud record of responsibility must now stimulate still greater effort to ensure that the

¹ *With thanks to T S Eliot.*



future ambitions of the young are not frustrated, nor the processes of learning and research interrupted.

That is why Tony Bannard-Smith, our new Head of Alumni Relations and Development, summarises the aims and means of our continuing Trinity Campaign for the future. It is entirely appropriate that he shares a page with Edward Stourton's call to invest in a sumptuous representation of our past.

Look out for more Trinity Trivia on the following pages. Answers on the back page.

*Professor John Lonsdale (1958), Fellow,
Editor-in-Chief*

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THE TRINITY CAMPAIGN

By Tony Bannard-Smith

The University has reached its initial 800th Anniversary target. This is great news but is only a start. Trinity's Campaign supported the University's Campaign but always aimed to outlast it. Trinity pioneered new University initiatives long before the 800 Campaign; we will do so long after—besides, of course, ensuring that in the present hard and uncertain times Trinity itself remains a pioneer in student access, supervision, and research, while helping Cambridge to remain at the top. In this ambition our members' support is vital.

Trinity is hugely grateful to all who give to our Annual Fund, our

bedrock. Its chief beneficiaries are our undergraduates, graduates, and College teaching. You have already given or pledged £10m to help meet these immediate needs—but the needs of our junior members are bound to rise. We mailed the 2011 Annual Fund appeal in January. Some members will not have received this because we intend, shortly, to ask you if you are willing to receive a telephone call from a current student—an opportunity we hope you will enjoy.

Most encouragingly, over ninety members have told us they will remember Trinity in their Will. We look forward to seeing them and their guests at the fourth Great Court Circle

luncheon in May.

Do please come to one of our many events (see back page calendar). You will be relieved to know that September's Annual Buffet Lunch will be under one big roof: no more risk of rigours under the Wren!

Our Associations continue to offer opportunities for networking. This year we look to launch one for the Engineers and, next year, another for all with a theological interest.

We will soon move to new Alumni Relations Offices, with a reception area. Alumni and friends are welcome to drop in for a coffee and chat whenever you are next in Cambridge.

TRINITY, A PORTRAIT

Trinity is 'like other colleges... It is also like no other. Trinity's size, distinction and wealth equip it to be a leader..., and its innovative and generous spirit lead it to act like one... [T]he College is a brilliant asset, not only to Cambridge, but to the world.' This flattering preface by the former Vice-Chancellor, Dame Alison Richard, is a challenge. Here is a sample of the material we have gathered to meet it.

Of the College's place in history Philip Allott writes that 'it was at Trinity College in 1571 that a first volley was fired in an unholy holy war that would have big consequences—a Puritan exodus to settlements in North America, a civil war leading to the

execution of a king and a short-lived theocratic Cromwellian republic...'

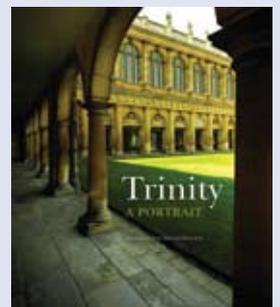
The late, much missed, Gordon Squires tells us: 'By common consent the four greatest physicists in history are Archimedes, Newton, Maxwell, and Einstein. Two of these were at Trinity. No doubt Archimedes would have come had Henry VIII lived before him, but Einstein was a late developer and would not have been admitted with the present admission standards.' Simon Blackburn pays tribute to Wittgenstein; 'After meeting Wittgenstein at Cambridge station, Keynes wrote to his wife "Well, God has arrived. I met him on the 5.15 train."'

Those who recall their time at Trinity include The Prince of Wales who finds 'the same magic' in 'the

tranquillity of Great Court' as when he came up over forty years ago. And the Bishop of London, whose bedder 'turned a blind eye to "young gentlemen who had young ladies in their rooms"' and was easy about "young gentlemen who preferred young gentlemen—if you get my meaning" but drew the line at vegetarians.

And there is so much more—as always at Trinity.

Edward Stourton (1976), Editor of Trinity, a Portrait.



Return the order form enclosed with this issue to Third Millennium Information before 1 July in order to enjoy the pre-publication discount.

COMING UP

By Andrew Francis

In the suitcase I had brought from Brussels by train and ferry was the claw-hammer needed to remove the nails from the lid of the War Department crate. Sent during the summer from my parents' previous posting, the porters had brought it to the foot of C staircase, Angel Court. 'FOR DELIVERY 4 OCT '69' it still reads. Containing amongst other things my few books, a Hacker radio, some mugs, and a 'huswife' (or hussif) deemed necessary by home, it made a storage facility each vac and in my subsequent rooms, A4 Angel Court and C5 Bishop's Hostel.

I remember most an intense excitement at being able to study English, the delight of reading and reading, of writing, of discussing, feeling I was doing something that mattered. My first sight of Trinity and Cambridge had been at the choral trials in September 1968, but I had come again in September 1969 when the Chapel Choir assembled for an Annual Gathering to sing for the service and at the dinner, music sacred and saucy. The choir, which only took women 'volunteers' in 1973, was to be a thread of camaraderie and activity.

My being at Trinity felt improbable for some time. My ninth and final school sent pupils to Oxbridge only occasionally, and my seventh term in the sixth form, preparing for the entrance and scholarship exams, had consisted of one hour's teaching a week. I do not believe I felt much of the anxiety associated with applying nowadays, nor did family expectations tend anxiously in that direction. Though not literary, my family were

committed letter-writers, perhaps partly because of being so often far from home. A letter came from each of my parents every week for many years, letters which addressed themselves to the everyday or the momentous, as necessary. I was surprised later to discover a distant relationship to an unremarkable seventeenth-century vice-master of Trinity, and to a Senior Wrangler (of Earnshaw's Theorem) at John's in the nineteenth.

Meetings with my Tutor and Director of Studies began the term, as now; the matriculation photograph, a disorganized affair, gives no names. At a sherry party in the Old Kitchen, I wondered at that mausoleum of turtle shells on the walls, each shell bearing the crudely painted date of consumption. To my mind this was of a piece with a certain aspect of College, that of a somewhat fusty association of older, rather hesitant, men. When the Master referred at a feast to the fact that Trinity had more Nobel Prize winners than France, I felt this to be unbecoming and rather silly score-keeping.¹

There were few signs and notices, and the only key needed was to one's room. Cambridge was then harder to reach, with few tourists, and in its isolation it seemed quite natural for there to be easy passage about the colleges, that one would walk across courts to baths such as those off I, Great Court. A summer cycle-ride to Ely beside the dykes was peaceful. Trinity's booklet of regulations had only thirty pages (48 today). It told of mending and shoe-cleaning services;

¹ *And in any case untrue (Ed).*



of the recently opened first bar, in Q, Great Court (which the *Annual Record* stated could be a meeting place for fellows and students); of the kitchens 'being happy to provide food and wine for private parties throughout the college'— 'reasonable notice should be given, especially when any exotic courses are chosen'; post was delivered to staircases. There was a white-jacketed waiter at breakfast in Hall in my first year, some of the few undergraduates there reading a newspaper. Trinity May Balls were included in *The Times*' 'Court and Social' list of 'Dances and Cocktail Parties', debutantes and their family parties seated in the cloister beneath the Wren, even then an anachronistic presence. The Trinity Foot Beagles featured in the *Annual Record*.

But it was also a time of unrest, of modernity. The Master's Foreword to Trinity's 1969 undergraduate *Introduction for Freshmen* referred to 'possible alterations in rules and regulations' and to the formation



TWICE



a year before of a joint working party of students and dons 'to make recommendations on the running of the college', noting that gate and guest hours had been 'considerably relaxed'. A section entitled 'Women' referred to 'the 9:1 men/women ratio' at Cambridge, noting archly 'the cunning common to their sex' and that 'perspicacity, perspiration and patience are required to obtain these luxury goods'; this, and more from this section, would sit well in a cultural history. There were words of warm, possibly appeasing, welcome to the officials of the College Union Committee attending annual Commemoration Feasts. There was unrest too in Faculties; students' open meetings were determined to reform the English Faculty, for example, and I like to think that today's notices forbidding the disruption of lectures stem from those days. When the Garden House riot occurred in February 1970 against the Greek junta I remember also the shouts of

support for the junta along Trinity Street. Much information will lie in the detailed letters that I wrote home out of long habit, and in the letters to my now wife then at Oxford. These, the essays I wrote, the lecture notes I took, and the diaries I kept, are still, I found, in the attic, and would give the texture of Trinity life.

My Director of Studies encouraged me to study for a Ph.D, but it was not to be, and, after a postgraduate year as a married B.A. studying education, I went into commerce. In 2002 I returned to Trinity to take a two-year Master's in Modernism (English Literature). I had a warm welcome from Douglas Kennedy, Senior Tutor. Informed that I would continue to be on Side E, I asked the office whether I should have received an introduction pack of some sort, and was told not, as I was a 'continuing student', a pleasing conception of continuity. I then studied for a Ph.D from 2005, on the Asian fiction of Joseph Conrad (1857–1924) in the light of commercial practice and economic, business and other histories, focusing on the Dutch East Indies. As someone married with three grown-up children and living out of College, my return to Trinity was naturally a different experience from my first time there. There were new buildings, rooms were warmer, the atmosphere more informal. Yet some things seemed hardly to have changed. The doors of the screens passage, the paving in Nevile's Court, felt deeply familiar, and Great Court in its evening stillness, yellow lamps at the staircases. But notices are no longer pinned on the S, Great Court

stair en route to the vanished JCR, though pins and staples remain, and the termly *Trinity Review*, with its reviews, illustrations, original writing, and much else, is no more.

And what would I have liked to see change that has not? Among them are, first, as in at least one college, information in the *Annual Record* for everyone's interest about where new students have come from, and their subjects, which would also show Trinity's continuing diversity. Secondly, after my hours spent in Chapel, the removal of Bentley's baldacchino and the re-opening of the east window—its tracery visible from Trinity Street—to recover more of the original design and light of Queen Mary's building.

If as a research student my centre of gravity had moved to the English Faculty, this was only to be expected. It was a rich intellectual diet, being able to take University courses and exams in Polish and Dutch, attend lectures or seminars on French and German literature, History, and History of Art, visit south-east Asia and The Netherlands for research, and at Trinity to benefit from and enjoy symposia, a film society, a discussion group, concerts, singing, and so on. Now, as well as seeking publication of my thesis, there are further Dutch studies at the University, learning Indonesian, teaching, and three more books to be written. I am grateful for my ten years at Trinity. And the excitement and challenges of literature and the imagination have held.

Andrew Francis (1969)

IT'S NOT ALL

By David Baulcombe



A person's foibles used to be put down to their 'nature' but today it would be 'in their DNA'. A Google search for 'it's in my DNA' reveals that the sequence of A, C, G and T is used as an excuse for all sorts of idiosyncrasies including falling in love. The successes of modern genetics and the technology of DNA analysis (see Shankar Balasubramanian's article) seems to have turned the man in the street into a hardline genetic determinist.

However, the technology that has so effectively identified genes affecting Huntington's chorea, various cancers, and other diseases has also revealed that there is a complex relationship between the nature of an organism and its DNA sequence. There is, apparently, another layer of information, additional to the DNA sequence and genetics.

The term 'epigenetics' is often used to describe this second informational layer. Epigenetics was originally an abstract concept but now we know that the epigenetic status of a gene is influenced

by the types of protein that are associated with DNA in chromosomes. When the chromosomes divide, this epigenetic status is replicated. Epigenetic information is therefore similar to genetic information in that it is carried from one cell generation to the next, but it is not directly associated with particular motifs in the DNA sequence. This new understanding has implications throughout biology. It affects our understanding of disease in people, it will allow new approaches to the improvement of food crops, and will revolutionise thinking about evolution.

As a botanist I have selected cases from plant research to illustrate the phenomenon of epigenetics because they may be useful indicators of epigenetics in animals. We know what is true for peas is also true for people in genetics. The same is likely to apply in epigenetics.

A classic example comes from the toadflax populations studied by Linnaeus in the eighteenth century. The normal toadflax has flowers like those of the snapdragon, with bilateral symmetry, but Linnaeus identified a variant form with radially symmetric flowers (Figure 1). Two hundred years later Enrico Coen at the John Innes Centre in Norwich used modern molecular biology to identify a gene that affects floral symmetry. He named it *cycloidea*. Surprisingly the sequence of the *cycloidea* DNA is exactly the same in the two different plant types. The crucial difference is epigenetic rather than genetic: the variant flowers had an epigenetic mutation or 'epimutation' that alters the expression of the *cycloidea* gene without changing



Figure 1: Epimutant forms of toadflax—the epimutant on the right was given the Greek name for monster—Peloria.

the DNA sequence.

A second example is from my own laboratory. It involves plants that fluoresce green under ultraviolet (UV) light. Chlorophyll in normal plants is red-fluorescent under UV but our experimental plants were genetically modified and carried a gene for a green-fluorescent protein from jellyfish. The green fluorescence in these plants masked the chlorophyll (Figure 2). The fluorescence is a traffic light for gene expression. If the plants were green under UV light the gene was active; if they were red, the gene was silent.

The green fluorescence was lost when we infected these plants with a special type of virus. This did not surprise us since the virus was designed to silence the jellyfish gene. However, when we collected seed, we were surprised to find that the gene remained silent in several subsequent generations. This persistent silencing came about not because the virus was carried between generations. We could also rule out the idea that the gene was lost or that its DNA sequence had changed. Again, the effect was epigenetic: the virus caused a silencing epimutation in the jellyfish gene



IN MY DNA

that remained stable through several generations.

When we first carried out these experiments I thought that heritable epimutations would be restricted to rare examples in nature and to contrived laboratory situations. But it turns out that varieties of the same species may have many epigenetic differences affecting many genes. Consequently the fitness of plants in the wild is affected by both genetic mutations and epimutations. There would be selection for plants with beneficial epimutations and selection against those with a damaging effect—just as with genetic mutations.

The involvement of epimutations in evolution has major implications for the way that evolution might operate because, unlike genetic mutations, they may not be random. The experiment with the jellyfish gene showed how a virus can target an epimutation to a particular gene and it is possible that the same type of targeting can occur with natural epimutations. One could envision, for example, that stressed plants might accumulate epimutations

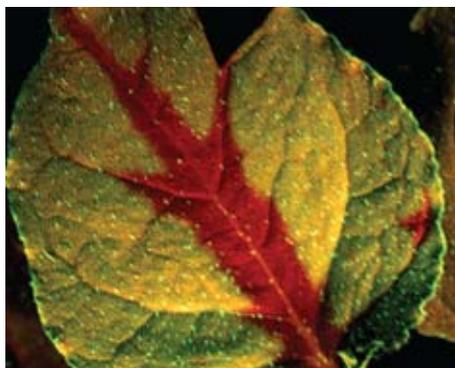


Figure 2: Traffic light leaves—a *Nicotiana* leaf under UV with different regions in which the jellyfish gene is either active (green) or silent (red).

in genes affecting resistance to stress. These epimutations could act as a ‘memory’ of the stressful time and could be passed on to subsequent generations. If that is the case then evolution of stress-resistant plants would accelerate. My laboratory is now searching for evidence that such targeted epimutation occurs with natural genes.

Daniel Dennett in *Darwin’s Dangerous Idea* described how different types of evolutionist invoke either skyhooks or cranes as the machinery of evolution. Skyhooks have a purpose: they raise evolution from one level to the next. Cranes, by contrast, do not have a driver and they are not directed: they raise evolution randomly and there is an advance only if there happens to be a platform in a suitably elevated place. It is important to point out that targeted epimutations do not imply skyhooks. The molecules that target the epimutations will have been genetically determined and their existence will have been a consequence of random genetic mutation and natural selection. Epimutations, therefore, are extensions to the arm of a crane and epigenetics is a derivative of conventional genetics.

Aside from this academic discussion about evolution, there are also practical consequences of epimutations. In medicine, for example, it is now necessary to look for both epimutations and genetic mutations to explain diseases and complex conditions that do not correlate with simple genetic markers. Similarly a crop-plant breeder may choose to develop new varieties by selecting for both genetic and epigenetic markers.

In the longer term I expect further understanding of epigenetics to influence thinking about the distinction between nature and nurture. Epimutations can be induced by the environment and so result from nurture but, because they persist through cell divisions or even across multiple generations, they are also a component of nature. I hope that, eventually, we will be able to use our understanding to identify and avoid environments in which damaging epimutations are introduced.

Epigenetics might also change popular song. Instead of ‘I love you because it’s in my DNA’ it would be more appropriate to sing ‘because I am epimutated’. The lyrics could explain, for example, that a visit to Birmingham in 1959 had affected the epigenetics of a neural stem cell, and that this had altered brain circuitry to create, finally, an obsession with Aston Villa, sad-eyed ladies of the lowland, or whatever else the song is about. The scope for poetic expression is vast. Lyricists will be surely grateful although the rhyming might prove tricky.

Cambridge has an excellent track record of epigenetics research and there is an Epigenetics Club that meets two or three times each term. There are normally two international or local speakers followed by informal discussions. Details are available from <http://tinyurl.com/64tjjuu> and <http://tinyurl.com/6g6yk9m>. All are welcome.

Professor Sir David Baulcombe (elected 2009) FRS, is Regius Professor of Botany and a Royal Society Research Professor.

FROM BLUE BOA

By Edward Holroyd Pearce



'Don't learn Japanese, learn Chinese' said a friend's father on seeing my *Get by in Japanese* as we unpacked our luggage on the first day of secondary school. Being an impressionable 13 year old, I replaced the offending text book with its Chinese equivalent. I was fortunate when it turned out that my Greek teacher had spent time in Taiwan and was willing to teach me Mandarin twice a week in my free time.

The Chinese have a saying *you yuan fen*—it is predestined—which certainly seemed true when I correctly guessed from which part of China my Cambridge interviewer came. One day I'll tell him that it was simply the province where my closest Chinese friend lived. But it got me admitted to Trinity, to read Oriental studies.

While some degree choices have little bearing on one's future, mine appeared to have the opposite effect. I soon found my interest grew so much that I could contemplate no career that did not include China. A

year in the London office of a Chinese airline gave me the chance to brush up my spoken Chinese: 'The flight is full, no you cannot upgrade, no you cannot have a refund.' It also gave me insights into the culture of Chinese State Owned Enterprises. My manager would tell me: 'Take your phone off the hook at 4.50, otherwise if you get a troublesome call you won't go home on time.'

With a Masters in Chinese Management from SOAS, and another year of work experience analysing Chinese stocks for a small fund, I felt able to advise UK businesses wanting to get into China. With Oxford graduate and SOAS classmate Daniel Nivern, I set up a consultancy.

Our first clients were a group of British Indian businessmen in Insurance brokering. We arranged meetings for them with fifteen potential partner firms all over China. The ensuing trip was full of clashes in business culture. So we decided to create our own cultural training material, using real-life cases. There were some successes even on this early trip. For instance it turns out that a well known pizza chain in Shanghai was genuinely vegetarian (keeping our Hindu executives happy) and yet was expensive enough for the Chinese partners to accept it as a dinner venue.

It is all too easy to stereotype Chinese business encounters, and so to make impractical rules of behaviour. I encourage people to think of China in the same way as Europe. Just because things have gone well in Spain is no reason to feel confident in Latvia. An unpredictable number of factors will

change the nature of negotiations and how one handles them. A basic understanding of core elements of the Chinese psyche can nonetheless make situations far less daunting.

Guanxi—one's personal network—is something China experts love to go on about, and *guanxi* are undoubtedly important. But there is little difference between *guanxi* and our own understanding of 'not what you know, but who you know'. Stories to illustrate *guanxi* tell not of a helpful uncle in The City who takes in a nephew but of a helpful uncle in the electricity bureau who guarantees a stable power supply to his nephew's factory.

The Chinese are also changing their business habits. Five or ten years ago, people might openly refer to their *guanxi* and, with pride, tell you of some of their key contacts. Today businessmen are more modest, quietly using terms like *zi yuan*—resources—



The new face of Beijing.



R T O B E I J I N G



The financial district in Shanghai.

when explaining who might be persuaded to pull strings for them and in what circumstances.

Another famous element of Chinese culture is *Mianzi*—‘face’ or the display of mutual respect. While *guanxi* may be waning, *Mianzi* is not. It is impossible to exaggerate its importance. If Chinese etiquette sometimes seems too intricate to navigate, to remember *Mianzi* should enable one to behave appropriately in most situations.

Part of our business, starting as a sideline, is to arrange internships in China for UK and US graduates. This seems to have captured the imagination of many undergraduates and recent graduates—and their parents. In 2010 we arranged over 500 graduate internships in China. Typically, we help high-flying students without the time or contacts to find Chinese internships themselves. We provide visas and find accommodation

so that, with our cultural training and introductory social events, students can make the most of the one or two months spent in a Chinese business environment.

It is encouraging that UK students are seeing the importance of understanding China, and it is important that non-Chinese speakers are enabled to participate. While my Chinese studies were enjoyable, the huge drop-out rate and the small numbers overall mean that the UK cannot possibly expect all its cooperation with China to be conducted by fluent Mandarin speakers.

Even in our internship programmes we encounter ‘cultural’ issues. Some Chinese companies unashamedly ask for a ‘real English’ intern when we propose a British Asian or Afro-Caribbean candidate, and our Beijing team has become adept at making a suitable response! If our expansion from Beijing to Shanghai goes as planned, we aim to provide 1000 UK and US graduates with internships in 2011. With any luck this will make a significant contribution not only to the next generation’s understanding of China, but also to the understanding that Chinese companies have of international markets and their driving forces, thanks to the bright and internationally-minded interns we place with them.

For the interns themselves, time in Beijing can be an enormous culture shock, demanding a steep learning curve. Some flourish, others struggle, but all come away from the experience stronger and better placed to deal

with the world into which they are graduating—one where China holds increasing sway, where Chinese manufactured parts are found in almost any supply-chain, and Chinese consumers are for many companies the holy grail.

Fortunately there is no shortage of friendly Cambridge alumni around China, especially in Beijing. There is a flourishing Oxford and Cambridge Club there which hosts regular functions, including a Christmas ball and the well-attended annual boat race event! China has also begun to attract overseas start-ups and entrepreneurs in many industries, although those without a China background are rare. My Classical Chinese supervisor, Fongyee Walker, of Cambridge’s Oriental Studies Faculty, has set up a wine consultancy in Beijing—perhaps proving that ancient scrolls are not quite as captivating as a good Bordeaux—and a fellow Cambridge graduate in Chinese, Alexa Morris, runs the flourishing Lollipop Bakery, making London-style cupcakes for discerning Chinese consumers. With any luck cupcakes will displace the less appetising but traditional Mooncakes as corporate gifts!

Of course the best known member of Trinity involved with China is Sir William Ehrman, under whose watchful gaze as British Ambassador to the PRC, UK-China relations flourished between 2006 and 2010. The post has now been handed on to an Oxford man, Sebastian Wood; we hope he will do as good a job.

Edward Holroyd Pearce (2001)

Trinity Trivia 1: *Who were the only Masters of Trinity known to have been imprisoned and why? (See p16 for answers)*

SEQUENCING

By Shankar Balasubramanian



John Holman

mainly by breaking down and analyzing naturally derived material and then applying synthetic organic chemistry to prepare DNA components which were identical to their naturally derived counterparts. Alexander Todd at the University Chemical Laboratories in Cambridge, later Baron Todd of Trumpington, was a leader in this area. Having helped to elucidate the chemical structure of DNA and RNA, in the early 1950s Todd felt that the determination of this structure would not be complete until one knew the exact sequence of its building blocks. Some noble attempts followed to develop a chemistry that would enable this.

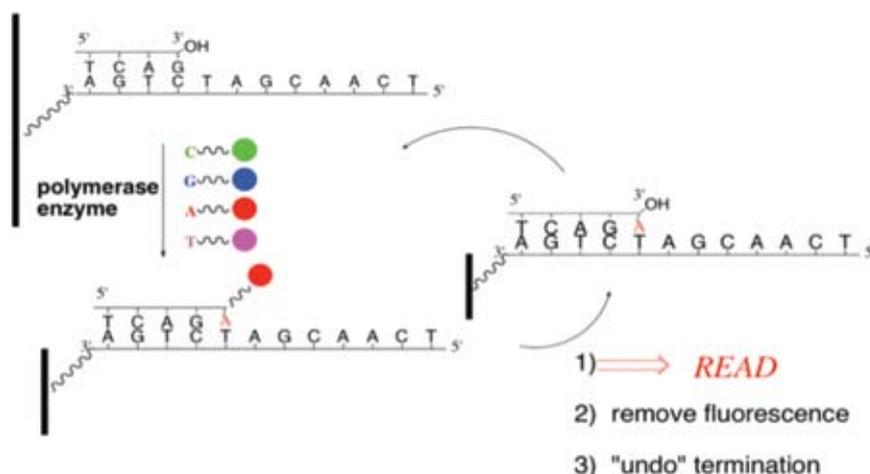
It was not until much later, in the 1970s, that a practical method for sequencing DNA was achieved. At Harvard, in Cambridge USA, Allan Maxam and Walter Gilbert developed one approach while, closer to home, in Cambridge UK, Fred Sanger invented another. Thousands of laboratories

around the world then used 'Sanger sequencing' to determine the sequence of individual genes and ultimately the entire genomes of organisms. The Human Genome Project was the best known programme to use the Sanger method. A major player in the international consortium which carried out the research was the appropriately named Wellcome Trust Sanger Institute, at Hinxton Hall. This mammoth effort provided a new foundation for human genetics and modern medicine. It was, however, only the first human genome.

In my early career at the University's Chemical Laboratories in Lensfield Road, in the mid-1990s, I worked with David Klenerman. Using a highly sensitive single molecule imaging method, we explored how we might visualize the synthesis of a strand of DNA, immobilized on a glass surface, one building block at a time. In 1997 these fundamental experiments

DNA is a natural polymer composed of four building blocks, called bases, which we commonly refer to by their abbreviated forms G, C, A and T. The sequence in which they are arranged makes up the genetic code that defines all living things. The sequence of the entire DNA of a cell or organism is called the genome. A single copy of the human genome comprises just over 3 billion bases of sequence information. This sequence holds much of the fundamental information that governs the normal functioning of living systems. It can also be highly relevant to biological processes that malfunction, so causing disease. It is essential to determine the precise sequence in which DNA building blocks are arranged in order to elucidate the features of an individual gene or indeed to define the complete genome.

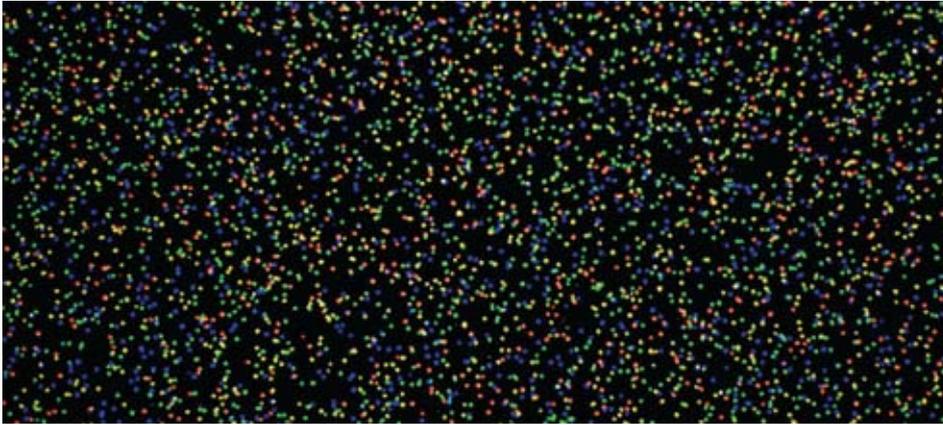
In the early twentieth century a number of chemists worked to find out the chemical constituents of DNA and its close relative RNA. They did so



During each sequencing cycle a colour-coded building block is incorporated onto an immobilized DNA sample and imaged to decode the base. Removal of the colour and blocking group allow repeated cycles to decode the sequence in steps.



G D N A



Many (now over a billion) DNA fragments are sequenced simultaneously on the surface of a chip. In any one cycle, the colour at each site provides the identity of the base at that step in the sequencing cycle.

inspired many animated discussions. One particular discussion, assisted by beers in The Panton Arms, behind the department, led us to conceive a new way to decode the sequence of DNA. First, we isolate the DNA of a cell and split it into fragments that are immobilized onto a surface. We can then decode each immobilized DNA sequence by incorporating, in turn, the four building blocks, each of which we colour-code with a fluorescent dye.

This incorporation can be carried out with the help of nature's own DNA synthesis machine, called a polymerase. This will only incorporate a 'C' opposite a 'G', and an 'A' opposite a 'T'—or vice versa in each case. Only one building block is incorporated per reaction since a chemical block prevents the incorporation of the next one. By imaging the surface of the chip we can read the colour at each DNA site. This colour decodes the corresponding building block. We can then chemically remove the coloured dye, and so unblock the growing chain to allow a second cycle of incorporation.

Many cycles of this incorporation and imaging lead to the progressive decoding of the DNA sequence at each position on the surface.

The main advantage of this method over existing ones is its potential to massively parallelize the sequencing process. This is because many different DNA sequences can be immobilised at discrete positions on the surface and so be decoded simultaneously. In late 1997 we predicted that the method could one day sequence as many as a billion bases of DNA on a single instrument system, at an affordable price and relatively quickly. After some basic experiments to prove our concept, we and the University decided to set up a small spin-out company, which we named Solexa, to develop the technology into a robust system that researchers could use. By 2006 the technology had evolved into a commercial product called the genome analyzer. This could indeed sequence a billion bases of DNA per experiment. Illumina acquired Solexa in 2007 and have evolved the technology further

into a system that will sequence more than 200 billion bases of DNA in just a few days. This is about a million-fold improvement on the state of the art at the time of our original inventions in 1997. During the same period the level of parallelization—measured by the number of features that can be sequenced in parallel—has increased by about 10 million-fold, somewhat surpassing Moore's Law for the doubling of the number of transistors per integrated circuit every two years.

The price of sequencing a human genome has fallen below 10,000 US\$ and will continue to fall. The number of human (and other) genomes being sequenced is growing at an exponential rate; thousands of human genomes will be sequenced in 2011. This technology-inspired transformation offers the prospect of understanding the genetic basis of diseases to an extent that will change the management of health care. The next few years will reveal the extent of what is possible, together with their associated ethical problems.

The conception of Solexa sequencing was a serendipitous outcome of government grant-funded (BBSRC) blue skies research inspired and guided by the intellectual and entrepreneurial ecosystem that exists in Cambridge. Long may this linkage continue.

Shankar Balasubramanian (elected 1994) is Herchel Smith Professor of Medicinal Chemistry. Named by The Times as among the 100 most important people in British science and engineering, in March last year he was given the Innovator of the Year Award by the Biotechnology and Biological Sciences Research Council.

Trinity Trivia 2: *Which Master allegedly asked to be buried in the Ante-Chapel, to enable Fellows to tread on him when dead as they had done when he was alive? (See p16 for answers)*

NEW FELLOWS AND OF HIGH TABLE



Fiona McConnell



Tim Gibbs



Dmitri Levitin



Krisztina Szilágyi



Peter Kreuzaler



George Booth



James Newton



Wójczech Samotij

At the Fellowship Admission dinner the Master reminded us that ancient institutions must always renew themselves. Trinity renews itself with the best. This year we welcomed eleven new Fellows, together with other, transient, members of High Table.

Eight new Junior Research Fellows represent our main investment in future knowledge, elected under Title 'A' for a four-year term. They bring Trinity's total of JRFs to twenty-nine. We elected four from Cambridge, four from the rest of the world; four in the humanities, four in science or mathematics; six men and two women—not, of course, to meet any target.

Fiona McConnell, an historical geographer from Queen Mary, University of London, studies the Tibetan government in exile—a 'quasi state' managing 35 Tibetan settlements across India, taxing and regulating them, staffing hospitals and schools, running elections and representing Tibet internationally. Fiona shows how entities enjoying neither *de jure* sovereignty nor international recognition can nonetheless exercise 'tacit sovereignty'.

Tim Gibbs, an historian from St Antony's College, Oxford, promises to revolutionise our understanding of South Africa's recent politics by cutting through the conventional dichotomy between 'comrades' who resisted *apartheid* and 'sell-outs', to show how black politics linked town and country, chiefs and rebels. Kin and ethnic, church and school allegiances bridged these divides, enabling the 'rainbow nation' to be born without the bloodshed many feared.

Dmitri Levitin, from Russia but a Cambridge man, works on seventeenth-century intellectual history—when Galileo and Newton applied mathematics to the natural sciences and, in the human sciences, Hobbes and Pufendorf rethought the claims of the state. Some Christian doctrines were also questioned. Dimitri shows that often very ancient philosophy was used to challenge contemporary orthodoxies. Another historiographical revision looks to be under way.

Krisztina Szilágyi, from Princeton, studies early Islam, using Hebrew, various Arabics, Aramaic, Syriac, Latin, Greek, German, French, Russian, Ukrainian, English, and

her native Hungarian. Historians have presumed that the story that Muhammad's dead body was left to the dogs was Christian propaganda. Krisztina shows that it stemmed from the Muslim dispute in which some awaited a Christ-like resurrection while others wanted to show that even the Prophet was mortal. So Muslims could scarcely refute the Christians' claim. The medieval Middle East's inter-faith relations were more complex than previously believed.

Peter Kreuzaler works in Cambridge's Pathology department on the molecular mechanism underlying the mammary gland: specifically the dying off of milk-producing cells when offspring are weaned and lactation ceases. It had been thought that apoptosis—'programmed cell death'—was responsible. Not so. Peter has discovered a different pathway, in which the cell's 'rubbish bins', lysosomes, release enzymes to digest vital cellular structures. This suggests a new approach to pathological conditions and, possibly, new therapies.

George Booth, a theoretical chemist, came from Nottingham to work with Ali Alavi. According to Schroedinger's



D MEMBERS



Joe Moshenska

Alexandra Walsham

Nicole Roughan

Delphine Moraldo

Joan Richards

Jean Dalibard

Ira Ellman

equation, quantum mechanics rules everything material. To understand their properties, we must solve this equation for a system containing many electrons—a towering computational challenge. Ali had proposed a new approach which George developed into the field's most powerful numerical technique, so we can now study the previously elusive electronic properties of important molecules and materials. With other Fellows like Ali Alavi and Daan Frenkel George may ensure that Cambridge's theoretical chemistry maintains its leadership.

We also welcome two new mathematicians. Their work can be opaque to all outside the priesthood, but here goes: **James Newton**, from Imperial College, works in a frontier area of pure mathematics notorious for its depth and complexity: the arithmetic of automorphic forms. His subject has strong Trinity connections, through the legacy of Ramanujan and, later, Peter Swinnerton Dyer. James's results have surprised today's leaders in his field.

Our second mathematician, **Wojciech Samotij**, comes from Poland via a PhD at the University of Illinois. He works in combinatorics—another area of mathematics well represented

here. He has solved several problems that resisted previous attacks by first-class mathematicians. His referees acclaimed the power and complexity of his results.

A new Teaching Fellow under Title 'C' **Joe Moshenska**, our new College Lecturer in English, went from Sidney Sussex to Princeton, where he was judged the best graduate student in the humanities. Working on bodily experience in early-modern literature, he has wide interests—in the history of science, medicine and psychology. What also recommended him to our Education Committee is his high repute as a teacher.

Our new Professorial Fellow under Title 'D', **Alexandra Walsham**, is Cambridge's new Professor of Modern History. After her first degree at Melbourne Alex came to Trinity to research into early modern Britain's religious culture, in the tradition set by one of our senior Fellows, her supervisor, Patrick Collinson. Since then she has directed the University of Exeter's Centre for Early Modern Studies. Her distinction, with its rare combination of great intellectual productivity and administrative energy, won her election to the British Academy at an exceptionally early age.

New members of High Table for varying periods of time:

Nicole Roughan is a two-year Lecturer in Law. A New Zealander, her first degree was from the University of Auckland, her doctorate in Jurisprudence is from Yale. Women are still under-represented in the Fellowship generally but not among our lawyers, where they have taken over!

Delphine Moraldo is this year's French Lectrice. A sociologist from the Ecole Normale Supérieure, she compares French and British alpinism. Spending last year at the LSE, she knows the peculiarities of the English, if not yet those of Cambridge.

Finally, three Visiting Fellow Commoners. **Joan Richards**, an historian of mathematics from Brown University, USA, works on Trinity's mathematics in the eighteenth century. Two VFCs came for the Michaelmas term only. **Jean Dalibard**, atomic physicist, director of research in the CNRS, came to experiment on two-dimensional gases. **Ira Ellman**, a lawyer from the Arizona State University, studied recent UK legislation on issues arising in divorce and other relationship breakdowns.

Trinity Trivia 3: Which Master discovered the electron?
(See p16 for answers)

ON NOT COMING DOWN FROM TRINITY

By Chandrahas Choudhury



I came up in 2000, a raw, nervous, wide-eyed undergraduate in a foreign land. I remember the beautiful reds and pinks of autumn leaves (India has no autumn) and their rustle underfoot; the crooked look of cobbled streets; waking on Sundays to the church bells in Market Square; and the pleasure of using my first debit card.

I was immediately set to read three Shakespeare plays a week under the eye of the formidable Shakespeare scholar Anne Barton – the intellectual equivalent of a student cricketer having to show off his cover drives to the MCC. My literary-critical progress was sluggish. The swiftest I moved that Michaelmas term was to chase one of Dr Barton's famous cats when I carelessly left her door open. Whenever I enter New Court I still beat back panic at the thought of a precious cat on the loose.

My second year at Trinity was perhaps the best year of my life. My rooms overlooked the pond in sylvan Burrell's Field; not bells but ducks sounded the start of day. With greater self-confidence came a growing sense of a future working life, even of a vocation. My rooms, beautiful in themselves and with lovely views, also housed a serendipitous collection of fine books, most of them bought for a pound from Galloway & Porter, alas now closed. The University Library was just two minutes away, and I could have any book in half an hour—an ease of access to intellectual riches I miss today. The circle of lectures, supervisions, and friendships deepened my comprehension of Things That Must Be Understood, and set up a life of dialogue that I continue today in essays and reviews, as well as in my own books.

That year I also bought, with savings from my scholarship, a second-hand IBM laptop, a hardy little machine which allowed me the luxury of typing out my essays in my room (previously I had used the computer room) and the thrill of reading the world's journals online. This laptop held up for seven years, till 2008, and early drafts of my novel *Arzee the Dwarf* were composed on it. 2002 was also the year I began my adventures in book-reviewing—a necessary part of any writer's trade if he is to live by words alone. Today the pleasure of fat packages of books arriving by post always stirs memories of books lying in my college pigeonhole.

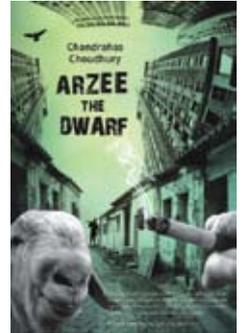
I also began to play cricket seriously after a hiatus of several years, and I still feel a twitch whenever May comes around and the memories return:

green grass, open skies, wood, red leather, and cricket whites.

The captaincy of the Trinity Third chess team led to several pitched battles in the university leagues from

which our band of five emerged with distinction—except for one disastrous encounter with the ruthless mathmos and natscis of Trinity Seconds.

All this seems far away now, but it was at Trinity that I first glimpsed the attractions of a life in literature, and the means to this end. I came away with both the confidence to work independently, and the sense that a degree, taken on one knee in Senate House, was not so much the culmination of student life as the beginning of life itself. In *Arzee the Dwarf* Arzee, full of good feelings on a big day in his life, jumps over a wheelbarrow lying on the street, and 'almost does not come down'. My three years at Trinity were, similarly, a big leap for me, one from which I feel I have not yet come down.



Chandras Choudhury (2000) read English and then took an M.Phil in American Literature. His first novel, *Arzee the Dwarf*, (HarperCollins, India 2009) was shortlisted for the Commonwealth First Book Award. He has edited an introduction to *Indian literature: India: A Traveler's Literary Companion* (Whereabouts Press, 2010) and reviews books widely in the international press. He can be reached at chandrahas.choudhury@gmail.com



POETS IN RESIDENCE

By Emma Jones



I finished my PhD in English in 2006. I then drifted away from academia but, already, throughout my PhD years, my own writing had played a counterpoint to my academic work. I was lucky to be able to play out my preoccupation with poetry in these two different keys. The balance was always going to fall on one side or another, and towards the end of my time at Trinity a decision was made, unknown to me at the time, when I accepted a year-long grant for writers under thirty, administered by St John's College. This allowed me to write in Germany and the United States. I spent a formative summer in Berlin and a brilliant, biting winter in Provincetown, Massachusetts. I wrote new poems, edited old ones, and put together what became my first book.

Thinking of my poetry in terms of a book was a process that began at Trinity. There I had the good fortune to meet Jacob Polley, the poet and novelist who held Trinity's Fellow

Commonership in the Creative Arts from 2005 to 2007. He read one of my poems, asked to see more, and showed them to some editors he knew. So my book came to be published by Faber. Its publication in early 2009 brought that mix of excitement and strangeness familiar to any writer or academic who suddenly finds part of their mind and years of their work in someone else's hands. I discovered I was officially a Poet and wondered what that might mean.

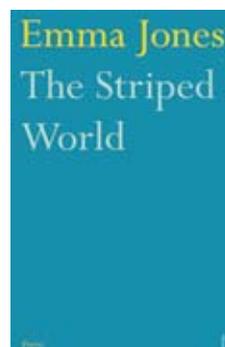
Some friends suggested an Official Poet should apply to be Poet-in-Residence at the Wordsworth Trust in Grasmere, Cumbria. One February day I was summoned for interview. It was that portion of the year when the world slows and stops. Cumbria seemed very beautiful, all sheeted lakes and rigid trees. To a kind panel of interviewers I read some of my poems, and answered questions about my plans and my thoughts on the Romantics. Wordsworth is interesting, I said, but I prefer Coleridge and de Quincey. Luckily, they didn't hold these opinions against me.

The next day they offered me a year's residency with a monthly stipend and a cottage, ten metres down the road from Dove Cottage, where Wordsworth had written *The Prelude* and other famous poems. Being an appreciative reader of Wordsworth, rather than an avid Wordsworthian, this was exciting rather than intimidating, as some had worried it might be. My new study, for the first time, was separate from my bedroom, overlooking the gloomily-

named but very lovely Coffin Path, down which villagers from Rydal and Ambleside used to carry their dead, to be buried in the consecrated ground at St Oswald's Church.

The kindness that institutions and individuals show to writers—normally told to find useful employment—has helped sustain me as a so-called professional poet. In September 2010 I took up the Baltic Writing Residency in Riga. This was a miraculous arrangement. I got to read, write, live in a hotel and get acquainted with a city, things for which I'd usually happily pay. My younger sister thinks this my greatest scam so far. I then spent the autumn writing in Tuscany, thanks to the Comtessa Beatrice Von Rezzori, who hosts writers and botanists at her home, near Florence. I'm spending the first half of this year in Rome on a residency for poets. After that, who knows? The life of a young poet is similar to that of the young academic, with periods of support interspersed with periods of uncertainty. It is, I find, a fruitful uncertainty.

Emma Jones (2002) won three prizes for her first book of poetry, The Striped World: the 2009 Forward Prize for Best First Collection, the Queensland Premier's Award for Best Collection, and the Anne Elder Award for Best First Collection. It was shortlisted for other prizes.



Trinity Trivia 4: Which Master coined the terms: scientist, physicist, cathode and anode? (See p16 for answers)

FORTHCOMING EVENTS

Saturday 7 May 2011 Trinity in the Arts & Media Association panel discussion and **Trinity Medics Association** talk, both followed by a joint drinks reception to be held in Trinity College.

Saturday 21 May 2011 Great Court Circle luncheon in the Old Kitchen followed by two afternoon activities and tea in the Master's Garden. This event is by invitation only.

Friday 24 June 2011 Annual Benefactors' Concert and Dinner in the Master's Lodge. This event is by invitation only.

Tuesday 28 June 2011 Garden Party for Graduands on the Fellows' Bowling Green.

Wednesday 6 July 2011 Trinity: A Portrait Book Launch in London.

Saturday 16 July 2011 Trinity: A Portrait Book Launch in the Fellows' Garden, Trinity College

Sunday 17 July 2011 Third Annual Trinity Family BBQ. This popular event will take place in the Fellows' Garden with musical entertainment, puppet shows and more. Please see the enclosed application form.

Sunday 25 September 2011 Seventh Annual Members' Luncheon in Nevile's Court. Lunch is preceded by a drinks reception and followed by a selection of afternoon activities. Please see the enclosed application form.

To help keep members in touch with each other and the College we are currently considering the implementation of a Year Group Representative Scheme. If you are interested in becoming a Year Group Representative, please contact Paula Lowdell in the Alumni Relations Office by email at alumni@trin.cam.ac.uk or by telephone on 01223 338548.

TIDDLY WINKS

By Charles Relle



Geoffrey Thorpe, Charles Relle and Matthew Fayers.

Last year three members of Trinity—Matthew Fayers (1995), Geoffrey Thorpe (1972) and Charles Relle (1960), all experienced international players—were in the eight-man English team that, at an away match in Washington, beat the USA at Tiddlywinks by 125 points to 99, so shaming England's World Cup footballers. Matthew and Geoffrey, like many tiddlywinks players, read Mathematics; Charles, exceptionally, read Classics.

The world's first Tiddlywinks Club was founded at Cambridge in 1955 by eight students, two of them Trinity

men, who thought that a Blue as well as a degree was useful in seeking a job. Not being sporty types, they had to invent a game—and their number, eight, became the size of a university or international team.

Tiddlywinks, once a children's pastime, requires strategic thought as challenging as Bridge or Chess. And it is fun to stir incredulity by announcing, 'I play Tiddlywinks for England.'

Charles Relle (1960). To learn more about the English Tiddlywinks Association visit www.etwa.org.

ANNUAL GATHERINGS 2011

Tuesday 5 July 2011—(up to and including 1952 & 1954)

Choral Evensong at 6.30pm
Dinner at 8.00pm

Friday 22 July 2011—(1998–1999)

Choral Evensong at 6.30pm
Dinner at 8.00pm

Tuesday 20 September 2011—(1958–1961)

Choral Evensong at 6.30pm
Dinner at 8.00pm

Please note that the College Chapel will be closed for renovations during much of this period. We are hopeful, however, that alternative arrangements for Evensong will be in place.

Invitations for Annual Gatherings will be sent out at least three months in advance.

For further information about Annual Gatherings or any of our other events, please contact the Alumni Relations Office at alumni@trin.cam.ac.uk or on +44 (0)1223 761527.

Trinity Trivia Answers: Trinity Trivia 1: Samuel Brooke, Master 1629–31, for assisting an elopement; and Thomas Comber, 1631–43, for sending College silver to help the Royalist cause in the civil war. Trinity Trivia 2: The Hon Dr John North, Master 1677–83. Trinity Trivia 3: Sir Joseph Thomson, Master 1918–40. Trinity Trivia 4: Professor William Whewell, Master 1866–86. We owe this second edition of Trinity Trivia to Michael Farrow (1954).