

A.D.D. CRAIK

Mr Hopkins' Men

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Cambridge Reform and British Mathematics
in the 19th Century

 Springer

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*To Liz,
who has enriched my life in so many ways.
With much love and gratitude.*

Preface

A few years ago, in the Wren Library of Trinity College, Cambridge, I came across a remarkable but then little-known album of pencil and watercolour portraits. The artist of most (perhaps all) was Thomas Charles Wageman. Created during 1829–1852, these portraits are of pupils of the famous mathematical tutor William Hopkins.

Though I knew much about several of the subjects, the names of others were then unknown to me. I was prompted to discover more about them all, and gradually this interest evolved into the present book. The project has expanded naturally to describe the Cambridge educational milieu of the time, the work of William Hopkins, and the later achievements of his pupils and their contemporaries.

As I have taught applied mathematics in a British university for forty years, during a time of rapid change, the struggles to implement and to resist reform in mid-nineteenth-century Cambridge struck a chord of recognition. So, too, did debates about academic standards of honours degrees. And my own experiences, as a graduate of a Scottish university who proceeded to Cambridge for postgraduate work, gave me a particular interest in those Scots and Irish students who did much the same more than a hundred years earlier. As a mathematician, I sometimes felt frustrated at having to suppress virtually all of the fine mathematics associated with this period: but to have included such technical material would have made this a very different book. Despite this limitation, I hope that I have managed to convey something of the intellectual ferment and stunning achievements of the age.

In the course of researching a work of such wide range, I have benefited much from the writings of others, as the large bibliography attests: my debt to them is obvious. To those who provided more direct assistance or useful comments (sometimes without realising it) I am especially grateful. At my home base of St Andrews University, they are Peter Lindsay, John O'Connor, Eric Priest and Edmund Robertson of the School of Mathematics and Statistics; and the staff, past and present, of the Special Collections Department of

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This work took me to many libraries, where I was assisted by their staff: in London, the British Library, the library of the Royal Society, University College Library and London University's S.O.A.S. Library; in Cambridge, Cambridge University Library, the libraries of Peterhouse, Gonville & Caius College, Trinity College, and Cambridge University's Centre for South Asian Studies; in Edinburgh, Edinburgh University Library.

Various bodies gave permission to quote from books and manuscripts, and to reproduce images. I thank the Master and Fellows of Trinity College, Cambridge; the Master and Fellows of Peterhouse, Cambridge; the Syndics of Cambridge University Library; the Syndics of Cambridge University Press; the Centre of South Asian Studies, University of Cambridge; Special Collections, St Andrews University Library; the School of Mathematics and Statistics of St Andrews University; Library Services, University College, London; Archives and Records Management Services, University of Sydney; Nottingham City Museums and Art Galleries; Higginbotham's Press, Bangalore. Most of the illustrations for which sources are not explicitly acknowledged have been copied from books in St Andrews University Library. (Every effort has been made to seek permissions for quotations and illustrations used in this book: but if any copyright holders have been inadvertently overlooked, the publisher would be glad to hear from them.)

At Springer, Karen Borthwick has been an unfailingly courteous and helpful editor. To her and to her backroom colleagues, I extend my thanks.

Alex Craik

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PART I
Educating the Elite

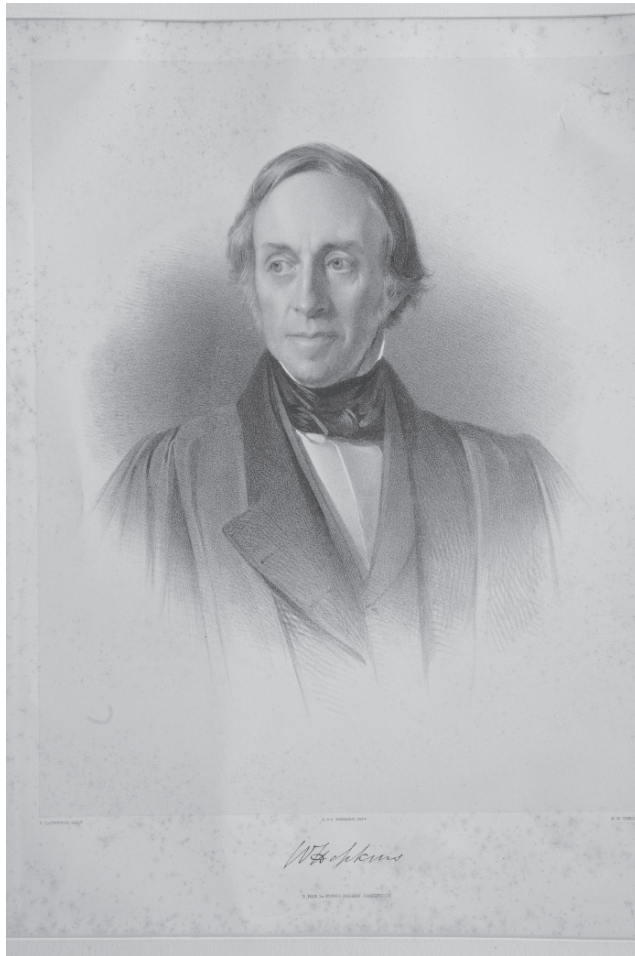


Figure 1. Engraved portrait of William Hopkins circa 1850. (Courtesy of the Master and Fellows, Peterhouse, Cambridge.)

1.

Introducing Hopkins and His Wranglers

William Hopkins (1793–1866) was the first of two remarkable private tutors at Cambridge, who dominated the teaching of the university while remaining detached from the formal tuition provided by the colleges. His outstanding successes were matched only by those of his former student and *de facto* successor Edward J. Routh. Figure 1 shows an engraved portrait of Hopkins, aged perhaps in his mid-fifties. His long face, clean-shaven in a much bewhiskered age, has a rather prominent nose, and his eyes seem clear and piercing below dark brows. An oil portrait of a somewhat older Hopkins, by Henry William Pickersgill R.A. (1782–1875) and now hanging in the Fellows’ Parlour in Peterhouse, Cambridge, is reproduced in Plate 1 of Chapter 6. It is recognisably of the same man, tall, dignified, straight, and slim. This may have been painted to mark Hopkins’ retirement in 1860.

For much of Hopkins’ time, the B.A. (Batchelor of Arts) honours degree was awarded on the sole basis of performance in the Mathematical Tripos examinations. The lists of successful honours candidates were each year divided into three categories, called “Wranglers”, “Senior Optimes” and “Junior Optimes”. In present-day parlance, these categories correspond to first-, second- and third-class honours. Within each category, candidates were listed in order of merit. The senior wrangler was top of the list, followed by the second and third wranglers, etc. These order-of-merit listings began in 1747 and ceased in 1909.¹

Table 1 below lists all the senior, 2nd and 3rd wranglers from 1827 to 1860. The start date is the year when Hopkins himself graduated, and he began

¹ Mathematical prerequisites for taking the Classical Tripos were dropped in 1850—see later. Complete Tripos lists for all years and all subjects were published in every edition of the *Cambridge University Calendar* up to 1913–1914, and in Tanner (1917). These give the candidates’ colleges and the names of Moderators and Examiners. Partial lists can be found also in Wilson (1985); Barrow–Green (1999), who gives Smith’s Prize winners; and Warwick (2003, Appendix A), who supplies the names of the private tutors of many top-ten wranglers, from 1865 to 1909.

Table 1. List of the top three wranglers, and some others, who graduated during 1827–1860

Year	Senior	2nd	3rd	Other
1827	H.P. Gordon	T. Turner	A. Cleasby	A. De Morgan (4th), W. Hopkins (7th)
1828	C. Perry	J. Baily	J.H. Evans	W. Selwyn (6th)
1829	H. Philpott	W. Cavendish	R. Murphy	
1830	C.T. Whitley	J.W.L. Heaviside	E. Steventon	C. Pritchard (4th), J.M. Heath (27th equal)
1831	S. Earnshaw	T. Gaskin	G. Budd	G.E. Paget (8th), C.R. Darwin (poll degree)
1832	D.D. Heath	S. Laing	T. Cotterill	<u>H.W. Cookson</u> (7th), R. Potts (26th)
1833	A. Ellice	J. Bowstead	<u>J.H. Pratt</u>	
1834	P. Kelland	T.R. Birks	R. Stevenson	<u>R. Main</u> (6th)
1835	H. Cotterill	H. Goulburn	R. Rawle	S.S. Greatheed (4th), <u>C. Blackburn</u> (8th)
1836	A. Smith	J.W. Colenso	J.F. Robinson	W. Pirie (5th), W. Walton (8th)
1837	W.N. Griffin	<u>J.J. Sylvester</u>	E. Brumell	G. Green (4th), D.F. Gregory (5th), A.J. Ellis (6th)
1838	T.J. Main	J.G. Mould	M. O'Brien	R. Potter (6th)
1839	B.M. Cowie	P. Frost	C. Colson	D. Thomson (21st SO)
1840	R.L. Ellis	H. Goodwin	J. Woolley	
1841	G.G. Stokes	H.C. Jones	J. Sykes	J. Cockle (33rd)
1842	A. Cayley	C.T. Simpson	R.B. Mayor	<u>F. Fuller</u> (4th)
1843	J.C. Adams	F. Bashforth	B. Gray	
1844	G.W. Hemming	W.B. Hopkins	C.O. Budd	<u>J.W. Stephen</u> (4th), <u>F. Galton</u> (poll degree)
1845	S. Parkinson	W. Thomson	R. Peirson	<u>F.W.L. Fischer</u> (4th), <u>H. Blackburn</u> (5th), J.B. Cherriman (6th)
1846	L. Hensley	<u>J.A.L. Airey</u>	F.J. Roughton, A. Sandeman	
1847	W.P. Wilson	R. Walker	F.W. Vinter	J.B. Phear, 6th
1848	I. Todhunter	C.F. Mackenzie	W. Scott	A. Barry (4th equal & 2nd Smith's Prize)
1849	M.B. Pell	H.C. Phear	W.A. Porter	
1850	W.H. Besant	H.W. Watson	J. Wolstenholme	
1851	N.M. Ferrers	W.C. Evans	G. Yool	<u>J. Porter</u> (9th)
1852	P.G. Tait	W.J. Steele	H. Godfray	
1853	T.B. Sprague	R.B. Batty	C.J. Newbery	
1854	<u>E.J. Routh</u>	<u>J.C. Maxwell</u>	<u>H.R. Droop</u>	

Table 1. *Continued*

Year	Senior	2nd	3rd	Other
1855	J. Savage	L.H. Courtney	C. Elsee	
1856	A.V. Hadley	J. Rigby	C.B. Clarke, J.C.W. Ellis, H.W. Smith	<u>H. Fawcett</u> (7th), B.T. Moore (8th)
1857	G.B. Finch	T. Savage	J.E. Gorst	<u>J. Venn</u> (6th equal)
1858	G.M. Slessor	<u>C.A. Smith</u>	F.C. Wace	
1859	J.M. Wilson	F. Brown, A.W.W. Steel	—	W. Jack (4th), R.B. Clifton (6th), W.G. Adams (12th), W. Besant (18th), A.S. Herschel (20th)
1860	J. Stirling	W. Baily	G. Richardson	

Those in bold were pupils of William Hopkins whose portraits appear in the Wren Library album (and Chapter 6). Other known pupils of Hopkins are underlined.

tutoring soon afterwards. The end date of 1860 is the time of Hopkins' retiral and is eight years after the last entry in the Wren Library portrait album mentioned in the Preface. The names shown in bold type are the forty-two of Hopkins' pupils represented in this album, their images reproduced in the colour plate section of Chapter 6. All came in the first three places, except A. Barry (fourth equal, 1848). We also list some lower wranglers who are mentioned in the following chapters.

No definitive list of Hopkins' pupils has survived, but it is certain that he tutored several others in the Table as well as many lower-ranked wranglers. Those further pupils known (from a variety of sources) to have been taught for a time by Hopkins are underlined, and there are doubtless others. The portrait album contains wranglers for the years 1829–52. But a former University official, H. Gunning, was informed by Hopkins himself that he tutored forty-four senior, second and third wranglers up to 1849, seventeen of whom had been senior wranglers. As five of the forty-one in the album are from after 1849, and assuming that Gunning's information is correct, we have portraits of all seventeen senior wranglers up to 1849, but only nineteen from a possible twenty-seven second and third wranglers.²

² Winstanley (1940), pp.41, 42; Gunning (1854), v.2, p.359.

Hopkins' most successful year was 1854, with seven of the top nine wranglers, following a particularly poor previous year. The Trinity College fellow Joseph Romilly recorded in his diary that "Hopkins' star is in the ascendant this year: the Senior & 2d & 3d Wranglers, the 6th, 7th, 8th & 9th are his pupils:—last January his highest man was 8th, & his servant is reported to have said of him 'Master an't placed this year!'" He had another poor year in 1857, but in 1858 he believed that his top pupil, Smith, could not be beaten. However, E.J. Routh's pupil, Slessor, narrowly did so—an intimation of Routh's later dominance. In 1863, just three years after Hopkins' retirement, Routh coached an unprecedented nine of the top ten wranglers, including the senior wrangler. Routh went on to tutor *all* of the top ten wranglers in both 1865 and 1874, and nine of ten in 1881.³

But Hopkins' influence was far greater than that which a successful private tutor exerts upon his own pupils: he had a profound effect on the teaching of mathematics throughout Cambridge. He influenced the content of the examinable courses, he advocated reforms of the University, and his example as a tutor set the standard to which others aspired. During Hopkins' thirty-year career as the best private tutor for able students, the Mathematical Tripos evolved as an ever more rigorous test of both talent and endurance, and the reputation of Cambridge mathematics rose from mediocrity to rival the best in the world. *All* the wranglers of this period were influenced by Hopkins in one way or another: directly or indirectly, they were all "Mr Hopkins' men". For that reason, the scope of this work is not restricted to those known to have been taught by Hopkins.

As might be expected, a substantial minority of top wranglers went on to become professional mathematicians and scientists, and these include some of the greatest names of their generation. Those who made the greatest mark in research are G. Green, G.G. Stokes (later Sir George Stokes), W. Thomson (later Baron Kelvin of Largs), J.C. Adams, A. Cayley, J.J. Sylvester, P.G. Tait and J.C. Maxwell. Noteworthy contributions were made also by I. Todhunter, P. Kelland, D.F. Gregory, R.L. Ellis, N.M. Ferrers, M. O'Brien, A. Smith and E.J. Routh. Stokes and Thomson both became Presidents of the Royal Society of London; Thomson and Kelland were Presidents of the Royal Society of Edinburgh. H. Phillpott, Ferrers and Stokes became heads of Cambridge colleges, and Ferrers and Phillpott served periods as Vice Chancellor of the University. T.R. Birks became Professor of Moral Philosophy at Cambridge, and G. Budd Professor of Medicine at King's College, London. Several others became

³ Bury & Pickles (2000), pp.167, 269, 306; Warwick (2003), Appendix A.

professors of mathematics, natural philosophy or astronomy in Britain and Australia. W. Cavendish, a member of the nobility, duly became the seventh Duke of Devonshire and served as Chancellor of Cambridge University during 1861–92: his generous donations enabled the establishment of the Cavendish Laboratory and the subsequent rapid growth of experimental science at Cambridge.

Some attained high office in the Church of England, at home or in the Colonies. Of these, H. Philpott, R. Rawle, A. Barry, J.W. Colenso, H. Cotterill, H. Goodwin and C.F. Mackenzie all became bishops—though Colenso was later excommunicated! J.H. Pratt was archdeacon of Calcutta, and several other churchmen were deans of English cathedrals. Other wranglers had prominent legal and political careers, and a few managed to combine religious or legal pursuits with mathematical and scientific interests. Some had less-prominent but worthy lives as vicars and rectors of rural parishes, lawyers, and educators. A few died young, promise unfulfilled. Only one, C.O. Budd, went into “trade”, as a wine merchant.

In the course of this work, many questions arose about Cambridge’s role in preparing these men (or not) for their later careers. Was the all-out competition for success in the Mathematical Tripos examinations a uniquely appropriate training for the struggles of later life? Did the emphasis on mathematics engender a rational, logical and moral attitude of mind, as some claimed? Or did these examinations inhibit creativity and imagination while rewarding memory and parrot repetition? To what extent was later career success attributable to preferment and patronage? Why were so many of the best scientists Scots and Irish? And why did so few contribute to the great trading, industrial and technological expansion of the Victorian age?

Christian belief and observance ordered the lives of these men and interacted with their scientific pursuits: then, most scientists were actively involved in religious affairs, and churchmen were well informed about science. They were among Britain’s brightest students of the mid-nineteenth century, and in later life they debated the scientific and religious controversies of the age. They participated in a web of friendships, collaborations and disputes; and they left a mass of educational, biographical and scholarly writings that define much of the intellectual history of the nineteenth century.

The next three chapters mainly concern Cambridge University: the experiences of its students and fellows, its place in the wider community, the widespread calls for reform that culminated in the 1850 Royal Commission, and the development of the Mathematical Tripos. The scope then widens, both geographically and intellectually. Chapter 5 describes William Hopkins’ life as a teacher and researcher, and examines his writings on science and education. Chapter 6 concerns many of Hopkins’ top pupils, their youthful

portraits preserved in the album that Hopkins once owned. These portraits are reproduced, most of them for the first time, along with brief biographies of the subjects.

Part II (Chapters 7–13) examines the later careers of top wranglers in science, education, the Anglican Church, politics and the law. Perhaps the majority were taught by Hopkins, but Part II is not restricted to those known to have been his students. Many wranglers went on to hold influential positions in universities and colleges throughout England, Scotland, and to lesser extent Ireland (Chapter 9); the activities of others extended beyond Britain to the colonies in Australia, India and Africa (Chapter 10); the most original helped to build a thriving research community in the mathematical and physical sciences (Chapter 11), and many of their scientific and mathematical discoveries remain important today (Chapter 12).

2.

The Student Experience, 1820–1860

Main Contemporary Sources

Evidence of student life in the unreformed university comes from a variety of sources, official and unofficial. Of several first-hand accounts by students, the most notable is that of the American Charles Astor Bristed, whose book, *Five Years in an English University* (Bristed 1852), was published in New York to describe to his compatriots just what university life in England was like. Bristed's book has been described as "the most detailed and the most thoughtful memoir of Cambridge undergraduate life ever penned."⁴ Rather earlier student recollections are those of Solomon Atkinson and his near-contemporary John M.F. Wright, who took the Tripos examinations in 1821 and 1819, respectively.⁵

John Venn was equal sixth wrangler in 1857 and later became the President of Gonville & Caius College, a post second only to the Master. His book *Early Collegiate Life* (Venn 1913) concludes with a delightful appendix on "College Life and Ways Sixty Years Ago", vividly describing his own student experiences in the 1850s. The writer Sir Walter Besant also makes interesting remarks on his education, first at King's College, London and then at Cambridge during the 1850s (Besant 1902). By way of introduction, we use the writings of Atkinson, Wright, Bristed, Venn and Besant to illustrate student life and students' views of the university: two from just before the period of Hopkins' wranglers, and three towards its end.⁶

⁴ Searby (1997), p.585.

⁵ Atkinson (1825a,b,c; 1827); Wright (1827).

⁶ Searby (1997) reviews Bristed's memoir and also the later description by another American, William Everett (1866). Among other contemporary accounts, those of John Delaware Lewis (1850) and Leslie Stephen (1865) were both written to amuse, making fun of wranglers, tutors and rowing men alike: these contain some interesting comments but less factual information. The recently published letters of Alexander Chisholm Gooden, a Trinity student who was Senior Classic in 1840 (Smith & Stray 2003), paint a picture of college life similar to, if less vivid than, that of Bristed.

The more comfortable lives of college fellows and university officials are illuminated by extracts from a rather different contemporary source. Joseph Romilly was a Fellow of Trinity College and, during 1832–61, held the post of Registrary at the University. This important position involved a prominent role at University ceremonies, the collection of fees, and the maintenance of official records. Romilly’s private diaries, never intended for publication, are an invaluable informal source of information and opinion that complements the official university and college records. These diaries fill forty-one notebooks covering the period 1818–64, and copious extracts from them have now been published.⁷ Quotations from Romilly’s diaries are dispersed through several sections of this book. So, too, are extracts from the letters of several students, including William Thomson, Francis Galton and James Clerk Maxwell.

The Struggles of Solomon Atkinson

It is remarkable that Solomon Atkinson got to Cambridge at all, let alone graduate as senior wrangler. His “Struggles of a Poor Student Through Cambridge”, and two more articles, were published in the *London Magazine*.⁸ Even allowing for some literary exaggeration, his background was a disadvantaged one. The son of a poor Cumbrian farm worker, the young Solomon tended sheep and cattle, made hay and gathered potatoes: though getting some education at the village school, he studied mostly on his own. An appeal to his estranged maternal grandfather, “a man of wayward and singular disposition”, gained him £100 to attend university; and Atkinson screwed up his courage to approach Isaac Milner, the Dean of Carlisle who was also the head of Queens’ College, Cambridge. Milner was impressed by the young man, and recommended that he apply to Queens’, rather than to Trinity or St John’s as had been Solomon’s ambition. But he warned him that he had no hope of gaining a fellowship at Queens’.

Atkinson was admitted to Queens’ in June 1816, as a sizar. He soon encountered the rapaciousness of his “gyp” (college servant), cook’s boys, and college tradesmen: “a set of cringing, knavish varlets, that would stoop to any meanness to empty the pockets of a gownsman.”⁹ Nevertheless, for Atkinson “The

⁷ Bury (1967); Bury & Pickles (1994; 2000).

⁸ Atkinson (1825a,b,c).

⁹ A “sizar” was a needy student supported by the college: so too had been Isaac Newton in his first year at Trinity College. In earlier times a sizar had to perform mundane chores for his better-off peers. The term “gyp” is derived from the Greek for “vulture”, in recognition of their notorious habit of soliciting tips and other benefits.

whole scene was . . . an enchantment”, though he was much disappointed by the instruction offered:

I had formed a very high conception of the interest and importance of college lectures. But I was disappointed, wretchedly disappointed, and so I believe is every man who ever heard them. They are in general little more than a kind of desultory conversation,—meagre, unconnected, and barren, as can well be imagined. In nineteen cases, therefore, out of twenty, they are attended merely because attendance is required by the College. . . . To a reading man the lecture-hours are so much time wasted,—to the non-reading men, who merely sit in a corner picking their nails or sketching a caricature, they are a most intolerable nuisance. . . .

Beyond this, I cared little for the matter; I had never relied on the instruction of others, and therefore I did not feel the want of it.

He describes how a student aiming for honours usually seeks private instruction, which adds £100 a year to his expenses; and he suggests that a college tutor who is also a private tutor “must reserve . . . his most valuable information. To act otherwise would take away one half of his pupils.” Though the system was too lucrative to be abandoned, it favoured the rich student over the poor, and gave an unfair advantage in examinations where the tutor was also an examiner.

Furthermore, such “pupilizing” also harmed the tutors, inhibiting them from undertaking original work. On becoming fellows and tutors,

it is a pleasant thing to dictate to a perpetual round of young men of talent and wealth; they are accumulating large fortunes perhaps, if their love of wine parties and gay suppers does not lead them beyond their earnings, which is a very common case, even with the most popular tutors,—they acquire habits of indolence. . . .

After a residence of twenty years, some fellows had gained little learning: instead of a “vigorous, searching, and intelligent mind . . . they are mere undergraduates, mere algebraists”. In his view, the past thirty years had produced no intellectual titans like those of the past, who “have been succeeded by a degenerate and pigmy race”.¹⁰

¹⁰ The above quotations are from Atkinson (1825a), pp.501–503. Some other acute but uncharitable remarks about individual mathematicians are quoted in the next chapter.

Though academically successful, Atkinson's own university career was marred by unwise decisions. After a year at Queens', he migrated to Trinity, forfeiting a Queens' scholarship for his second year. He probably did so in hope of obtaining a Trinity fellowship on graduation, having confirmed Milner's prediction that he would not get one at Queens'. But he quickly fell into debt, and was forced to take private pupils. Even after gaining a scholarship in his third year, he was unable to afford a private tutor to prepare for the Tripos.

The students from St John's were favourites for top honours, and during the summer vacation they "retired together into Wales with Mr G—n [Gwatkin]" to prepare, while Atkinson worked on his own in Cambridge. Atkinson describes how, as the January examinations approached, "when every minute should have been treasured up, I practised on the flute several hours a day" and continued to take private pupils. Nevertheless, to much surprise, he "carried off the single diadem of the Senior Wrangler" and was awarded the second Smith's Prize.

Despite his success, Atkinson quickly became disillusioned:

I had expected that the knowledge which led to these distinctions would have served me when . . . I came to associate with men and take a part in the business of life. That knowledge never has served me. I have found it an useless acquirement, and the period of my academical studies an entire blank in the history of my life. Nor was it merely useless; I imbibed, in common with every other man who engages in the strife of University studies, prejudices that were pernicious, absurd, or ridiculous when put to the touchstone of common sense. I had not therefore merely wasted my time. I had learnt that which it was necessary to unlearn as fast as possible.

Instead of acquiring potentially useful information, he had wasted time "marshalling mathematical symbols, which in the process did not discipline my mind, and which . . . did not prepare it for any useful and active occupation."¹¹

Though exaggerated for journalistic impact, there was much truth in his strictures. At that time, there was no great demand in the world at large for advanced mathematical skills, and the Cambridge system certainly did not encourage development of any others, apart from the classical languages. As a senior wrangler, Atkinson might easily have followed the common route to

¹¹ Atkinson (1825a), pp.501, 492.

a Church living or a headmastership, via a Trinity fellowship; but, soon after graduation, he debarred himself from a fellowship by marrying, and he did not wish to remain as a private tutor. Though his wife's family were fairly well-to-do, they disapproved of the match and refused any support.

Almost penniless, the couple moved to London, where Atkinson joined Lincoln's Inn as a lawyer's apprentice. But his wife developed consumption (tuberculosis) after eight months, and, according to Atkinson's account, was forcibly removed by her family into their care. He turned to writing for magazines and encyclopaedias, but with little success; and then took a steerage passage to New York. After a few months, he returned as poor as before, and virtually begged his way back to his Cumberland home.¹²

Another article in the *London Magazine* (Atkinson? 1827) entitled "The Regrets of a Cantab" is probably also by Atkinson. This is a less autobiographical piece, making general criticisms of the Cambridge system. The author again overstates his claim that too much mathematical study stultifies the mind, and that he has acquired no knowledge of the arts: "All the world except myself, seems to abound in ideas; and I have but one", while "female society is to me a blank." At Cambridge, he alleges, more appropriate and useful objects of study are neglected:

the churchman learns neither theology nor religion; the lawyer neither law, history, ethics, nor that logic which must form his logic; nor do they cultivate their own language . . . far less that rhetoric and that oratory on which the professions, both of the church and of the law so naturally depend. That the future physician learns neither physic, anatomy, botany, chemistry, nor pharmacy, nothing of all that constitutes his science and enables him to practice his art, is more than notorious . . . he must go elsewhere to learn everything that is essential.

He wonders how mathematical science qualifies a man as a statesman, legislator or government officer, while he feels unfit to become even a treasury clerk. If the University will not "reflect that its duty and business . . . is, to educate

¹² Atkinson (1825b). In fact, Atkinson resumed his legal career with some success: he was called to the Bar in 1827 and later published several legal works. These include two short works on the effects of free trade (1827); three editions of J. Chitty's *A Practical Treatise on the Stamp Laws* (1829, 1841, 1850); and several books: *A Practical Treatise on Conveyancing* 2 vols. (1829); *The Conveyancer's Manual* (1830); *The Theory and Practice of Conveyancing* (1839); *An Essay on Marketable Titles* (1833); *The County Court Extension Act . . .* (1850); and *The Law and Practice of the County Courts Under the Insolvency and Protection Acts* (1850). He died in 1865.

young men so that they may be fit to the professions . . . our parents at least might ask themselves this question before they send us to waste our time and money. . . .” Despite the university’s emphasis on mathematics, he asserts that only one in two thousand becomes a *real* mathematician.¹³

Not only was their education deficient: “young men arrive at Cambridge from the public schools, with very doubtful morals . . . it is but too notorious and lamentable that the university is an extensive school of vice and profligacy under all their forms.” Rather than waste their time at Cambridge, young men should seek practical training useful for real life. Declaring that “London is the real university”, the writer means the growing metropolis, the university of life, not the planned London University which had yet to open.

A year later, yet another highly critical article entitled “The Cambridge University Senate-House Examination for Degrees” appeared in the same *London Magazine* (Anon. 1826). The author is unknown: though Atkinson cannot be ruled out, the magazine’s editor seems more likely. The running head for most of the article is “Education of the Many”. The author asserts that, for most Cambridge students, a proficiency in the common rules of arithmetic, the simpler operations of algebra and four books of Euclid’s geometry are all that is expected or required. These, “the Many” or *hoi polloi*, are the “poll men”, whose “mass is nine or ten times greater than those who take honours creditable to them”, and three or four times the number of all honours graduates. For these men, who learn little, cheating and copying in examinations were common in order to scrape a pass: thus “the intellectual interests of more than two hundred students are annually sacrificed to those of some ten, twenty, or, on the most liberal allowance, thirty individuals.” Not only does the University “mistake fellowships and honours for the ends of study, and . . . neglect the majority who resort to her merely to be educated;— she does not appear to consider herself in the slightest degree responsible for their education.”

The writer believed that external criticisms from Scotland had not helped; for, “Aided . . . by the smears of Professor Playfair and his brethern, the calculus has triumphed, and the Edinburgh reviewers may enjoy the consolation

¹³ Atkinson (1825c), quotations from pp.438, 439, 444, 445. His “1 in 2000” estimate seems only slightly ungenerous, if, by a “*real* mathematician” Atkinson means someone who makes a major original advance in the subject. About 300 students then graduated each year, roughly 100 with mathematical honours, high or low. Atkinson’s estimate therefore allows one outstanding and productive talent every seven years, or about six in forty. Which of the researchers from our list of wranglers would qualify? Green, Sylvester, Cayley, Stokes, Thomson, Tait and Maxwell have the strongest claims and they are seven in number.

of having contributed, by their criticisms, to make a bad institution worse than it was before”. But he allowed that education of “the many” was better organised in the Scottish universities. Thus, at Edinburgh, the Athens of the North, “of the great multitude of dingy Athenians who fill the lecture rooms of their clumsy Parthenon, scarcely *fifty* go away [each year] *without* a competent share of philosophical erudition”, while at Cambridge “not above *fifty* leave *with* a competent portion of philosophical, or any other description of knowledge.”

Opponents of the planned London University had claimed that, among potential students from humble backgrounds, not one in fifty could actually succeed; yet Cambridge was no better than this at providing a real education. The writer urged the fledgling London University to “heed the Quarterly Reviewer’s injunction to disdain all ideas of comparison with the English Universities” in favour of the Scottish model. “The aristocracy will then have some chance of arriving at the enviable distinction of being the only ill-informed and ill-educated portion of the community.”¹⁴

The Trinity Hall fellow Leslie Stephen also strongly opposed Cambridge’s concentration on mathematics and classics as a kind of mental gymnastics. He believed that, except for the very best students, “nothing can be more absurd than to make five hundred young men . . . give up three years to read classics and mathematics for their own sake. Perhaps fifty of them may be improved by such a discipline. . . . The ‘gymnastic theory’, as applied to those below first class, is a mere farce.”¹⁵

The extent to which these polemical blasts were justified is a matter addressed in Chapters 3 and 4. They vividly exemplify the discontent with the Cambridge system that eventually led to reform towards the end of our period.

J.M.F. Wright’s “Alma Mater”

John Martin Frederick Wright was admitted to Trinity College in 1813 but did not begin his studies until 1815. Though a competent mathematician who might have been a high wrangler, he fell foul of a regulation that prevented him from competing in the Tripos examinations, and ended up with an *aegrotat* degree in 1819. With no hope of a fellowship, he stayed

¹⁴ Anon. (1826), above quotations from pp.293, 296, 303, 309, 313, 314.

¹⁵ Stephen (1865), p.182.

on in Cambridge, earning what he could as a private tutor and publishing self-help texts of notes and examples.¹⁶ He even launched a weekly magazine, *The Private Tutor and Cambridge Mathematical Repository* (Wright 1830–31) designed for students who could not or did not wish to afford a private tutor. But this probably had little success, for private tutors were becoming indispensable.

His two-volume *Alma Mater*, issued anonymously (Wright 1827), purports to be a comprehensive guide to the University for those who wish to study there or send their children. It is also intended as a defence of the University against some of the criticisms levelled by the popular journals. According to Wright, John Playfair's criticisms in the *Edinburgh Review* revealed his lack of knowledge of Cambridge; but the recent writers in the *London Magazine* deserved greater respect, "being distinguished members of the Institution they have thought fit to calumniate." Aware that Atkinson wrote at least some of these pieces, Wright asserts that the author was, by his "own fault, excluded from the emoluments of the University", and now, without a fellowship, was reduced to deriding the source of all the knowledge he possessed in order to earn a living. Later, Wright criticises "Solomon" (without mentioning his surname) as "gifted with as vigorous an intellect as any I ever fell in with, and yet, as to the imaginative, inventive faculties, as barren as the desert", a fact not to be blamed on the study of mathematics.

But Wright's own polemic undermines his credibility. Trying to establish Cambridge's superiority, he launches a diatribe against Scottish education, Scots generally, and their involvement with the new London University. Yet these overstated views doubtless reflect some attitudes current at this time, and they deserve exposure as such:

Every Cantab . . . knows full well, from the specimens every year exhibiting at College, that the Scotch are a nation of pedants.—They skim the surface of literature, indeed, but never reach its bottom. . . . If you fall in with a Scot, you get hold of a bore and a pedant; who, first taking you for swine, casts his small stock of pearls before you, without mercy; and then, upon

¹⁶ He appears simply as "John Wright" in Venn & Venn (1940) and in Rouse Ball & Venn (1911). Searby's (1997), p.120 account is based on Wright's own [Wright (1827), v.2, pp.46–97]. According to this, Wright missed a preliminary "act" or disputation in his third year, claiming to have been gored by a bull. On learning that this debarred him from taking the full Tripos examinations, he quarreled with Peacock, the examiner, and withdrew from the Tripos. On being "gulphed" by the examiners, he was fortunate to be given an *aegrotat* degree. Warwick (2003), p.547, gives a full list of Wright's self-help texts.

your turning round upon him, and exposing the scantiness of his information, amuses you with a flaming account of the Latinity of ploughboys, and milkmaids wooing in pastorals of Virgil; tells you the story of the admirable Crighton, . . . and ends with a pompous rigmarole, about the wealth, honours, and erudition of Aberdeen, St Andrew's, Dumfries, Glasgow, and Edinbro'.

. . . During the seven years I resided at Cambridge, [I] cannot recall a single instance of a Scotchman, Scottishly educated prior to his entrance here, having succeeded to the honours or emoluments of Trinity.

As for the projected London University, this is “fathered by Campbell [the poet] . . . fostered by Brougham and Dr Birkbeck the physician—Scottish all.” Consequently, all the major posts there will be filled by Scotsmen and dissenters. “Scotticism, Dissenterism, and Radicalism were never so closely united . . . the only learning to be had for your subscription will be a ‘mouthful’, whilst a ‘bellyful’ of disaffection to Church and King will be crammed into you gratuitously.”

Wright padded his two volumes with reprints of college, Tripos and Smith's Prize examination papers, lists of prizes, exhibitions and scholarships, information on the fellowships at each college and their rules, lists of the salaries of lecturers and professors (not always accurate), and headmasterships and Church livings in the gift of each college. He observes that the seventeen colleges had no fewer than 294 Church benefices in their gift, worth about £300 each on average. His estimate of the total of all college receipts for maintenance of professors, fellows, scholarships, benefices, etc. amounted to about £300,000 per annum, which he tellingly observes is equal to the “*principal*, clubbing for by the signatories of the London University.”¹⁷

Wright's book was the subject of a hostile, also anonymous, review in the *London Magazine*. It states that Wright (identified by name), “After an unsuccessful residence at Cambridge . . . has been driven to seek his livelihood among the booksellers of London”; that his book is “the scrapings of the author's life, collected industriously, for the laudable purpose of getting a dinner.” As for Wright's criticisms of the Scots and of London University, “the men whom Alma Mater does not blush to own, would not entertain such opinions.” Surely the reviewer was none other than Solomon Atkinson.¹⁸

¹⁷ Wright (1827); above quotations from v.1, pp.v–vi, 151, 134, 136, 138–140; v.2, p.205.

¹⁸ Atkinson? (1827); quotations from pp.441, 454.

Reminiscences of John Venn, Charles Bristed and Walter Besant

John Venn (1834–1923) graduated in 1857 as equal sixth wrangler. He was an able mathematician and philosopher who made significant contributions to mathematical logic and to what later became known as set theory. He published three treatises on logic, and he was elected a fellow of the Royal Society of London in 1883. From about 1890, he was an indefatigable historian of Cambridge University: he published a six-volume biographical history of Gonville & Caius College (Venn 1898), and he began work, later completed by his son J.A. Venn, on the multi-volume register of Cambridge students, *Alumni Cantabrigienses . . .* (Venn & Venn 1940) which is of great use to historians. His *Early Collegiate Life* (Venn 1913) mainly concerns much earlier times, but concludes with personal reminiscences of “College Life and Ways Sixty Years Ago”.

Walter Besant (1836–1901) was eighteenth wrangler in 1859, and worked briefly as a mathematics master at Leamington College. He moved to become a professor in the exotic location of the Royal College, Mauritius, where he embarked on his writing career. Returning to England after six years, he went on to write several successful novels and many other biographical and historical works, notable for their advocacy of social reform. He was knighted in 1895 for his charitable work. (His older brother, William H. Besant, was the senior wrangler of 1850 and a fellow of St John’s.) Walter Besant’s *Autobiography* (Besant 1902) describes his time as a student at King’s College, London and at Christ’s College, Cambridge.

In contrast, Charles Astor Bristed (1820–74) was an outsider, an American student whose father had emigrated from England in 1806. His time as an undergraduate at Trinity College during 1840–44 provided the material for his book *Five Years in an English University* (Bristed 1852).

On college teaching, Venn (1913) observed that “The inter-collegiate system was as yet unknown. . . . Outside Trinity and St. John’s there was probably not a single College which provided what would now be considered the minimum of necessary instruction, even in Classics and Mathematics.” In his own Gonville & Caius College:

outside this narrow range all was a blank. Theology, for instance, was represented by a good-natured mathematician—his good nature being the cause of his accepting a post declined by his colleagues . . . his grotesque attempts at comment and interpretation . . . were the joke of the College.

In lectures on classics and mathematics, brilliant scholars from the best schools sat next to complete beginners,

and tried to make the most of the lecture, or at any rate of the time during which the lecture was delivered. . . . It compelled every student, practically, to resort to a private tutor, for the lecturers, as a general rule, gave no assistance whatever out of their official hours. In fact, as they were very frequently private tutors as well . . . it could hardly be expected that they should do so. I feel confident that I never received a single word of advice during my whole time from the tutor, unless it was what church I had better attend or avoid.

I feel as certain as one can be that during my first two years I never had a word of private conversation with any authority of this College as to my studies, and equally sure that I never paid an informal visit to any Fellow's rooms.¹⁹

Clearly, nothing much had changed since the days of Atkinson and Wright, more than thirty years earlier.

There was little female company, of course: Venn could recall only three or four occasions when, as a student, he “was introduced to ladies’ society . . . and these were not exactly lively functions.” The formality of university society is exemplified by his visit to two female cousins, briefly staying with William Whewell and his wife at the Master’s Lodge in Trinity College. Despite having already graduated as M.A. some five or six years earlier, Venn was advised to wear his academic gown in the Master’s presence: he refused to do so, and next day “received a serious remonstrance from my cousin, evidently inspired by the Master.”

College accommodation for most undergraduates was spartan and the meals relentlessly unimaginative, apart from those of a few members of the nobility who lived in some luxury at extra expense. Dinner was at 4 or 5p.m., where “Nothing was regularly provided . . . but joints, potatoes and cabbage . . . we did all our carving for ourselves . . . the wasteful hacking . . . which ensued may be conceived. . . . Sweets and cheese had to be specially ordered. Soup, fish and game were absolutely unknown.” But beer, and probably wine, was readily available, and “such a thing as a ‘teetotaller’ was not to be seen or heard of in the whole College.” The college servants, too, risked intoxication, owing to the “pernicious practice . . . of giving beer orders . . . payable (in beer) to the bearer”.²⁰

¹⁹ Venn (1913), pp.256, 258, 259, 263.

²⁰ Venn (1913), pp.266, 270, 271.

Charles Bristed also commented on the crowd and confusion of the student tables at Trinity College dinner, which he likened to steamboat meals in the U.S.A. Except at the Fellows' high table, "The attendance [service at table] is also very deficient and of the roughest sort."²¹

Venn recalls that his college had no running water, the whole supply coming from hand-pumps operated mainly by the gyps or bedmakers. When a piped water supply was eventually introduced on construction of the town water-works, the college experienced its first typhoid epidemic. In winter, the jugs of water delivered to the rooms sometimes froze solid, a situation that lasted for *several weeks* in the hard winter of 1854–55. The construction of partitions between rooms was often flimsy, and Venn remembered a man who had thrown his sponge through the wall of his room, so hard had it frozen. If typhoid was not a risk until piped water arrived, smallpox certainly was: Venn caught a mild dose in college, but thankfully it did not spread though precautions were rudimentary. In addition, scarlet fever, consumption (tuberculosis) and influenza claimed lives, and the possible spread of occasional cholera outbreaks from other parts of England was much feared.²²

The physical activities of students had changed much during Venn's lifetime. When he was a student, walking, not cycling, was the norm, and long afternoon walks were the commonest form of exercise. Some rowed on the river, and there was some cricket. But "Lawn tennis and croquet were unborn. Real tennis and hunting were of course confined to the wealthy few. Hockey and football were left to boys." As a student, Venn never saw rugby played; but he relates his younger brother's account of a new game from Rugby school, where "they all made a circle round a ball and butted each other."²³

Walter Besant entered Christ's College, Cambridge in 1855 after a year at King's College, London. Despite winning several prizes at King's, he had a low opinion of that college: the professor of mathematics [T.G. Hall] "was old and had quite lost all interest in his work", and Besant could "never remember a single word of personal interest or encouragement" from any of the staff. But he believed that "it was much the same thing at most colleges of Oxford and Cambridge at this time. The men were left severely alone; so that, after all, King's was not behind its betters."

At Christ's, Besant enjoyed the close-knit society of a small college, with only fifty or sixty students altogether. He believed that a very large college like Trinity offered fewer social and educational advantages. There,

²¹ Bristed (1852) v.1, p.26.

²² Venn (1913), pp.272, 273.

²³ Venn (1913), p.280.