

Airy's Greenwich Staff

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One major research development in the history of astronomy, pioneered in particular by the SHA, is a shift from the concern with what the 'giants', such as Galileo or Newton, achieved to an examination of the wider spectrum of astronomical personnel. And one rich field of inquiry here is that body of men, and later of women, who earned their livings as assistant astronomers. It is, in fact, an abundantly documented area, including figures employed in Grand Amateur, university, and civic observatories, though without doubt the richest and longest-running body of data pertaining to what might be called the 'Astronomers' Gentlemen' comes from the archives of the Royal Observatory, Greenwich, especially for the years 1835 to 1881, when Sir George Biddell Airy was Astronomer Royal.



G. B. Airy

Fig.1 George Biddell Airy, Astronomer Royal.

Lithograph, by J. K. Maguire, by George
Ransome of Ipswich, 1852

By courtesy of the Science Museum, London & SSPL

I have spent many years working on this rich mine of astronomical history, as part of a projected biography of Airy; and from the well-documented decades-long Greenwich careers of many of his Assistants, and his often complex relations with them, one can reconstruct a good score of astronomical biographies, which in some cases span a life pretty well from first employment in late teens to retirement pension negotiations.



Fig.2 The Royal Observatory, Greenwich, c. 1860s. Note the Time Ball on the roof.

Dunkin, Edwin, *The Midnight Sky* (Religious Tract Society, London, 1879)

By courtesy of Kevin Johnson

But let me start by demolishing a hoary old myth. Airy's Assistant Astronomers were *not* drudges. Yes, the routine work of nightly Right Ascension and Declination measuring, followed by daylight hours of formulaic mathematical reduction at the desk, could be wearisome; but the brunt of this routine calculation was borne by the more junior staff, though it is true that all Assistants were expected to do their share. Moreover, when one offsets this routine work against what was expected of a City clerk, working in a bank, accountant's, or solicitor's office, it had its own manifest advantages in terms of salary, prestige, holidays, and pension at 65, as will be seen shortly. And some of those men who spent their careers as Greenwich Assistants became active Fellows, and sometimes Medallists, of the Royal Astronomical Society (RAS), members of the prestigious RAS Dining Club (Edwin Dunkin served as Club President from 1880 to 1884 and also as RAS President from 1884 to 1886), and even Fellows of the Royal Society. And all with Airy's support. Men who, as Greenwich Assistants, had often progressed from being local with letters after their names! For a Greenwich Assistantship could open up a variety of doors and social

connections that would never have been available to Uriah Heep, Bob Cratchit, Nicholas Nickleby, and the numerous other clerks who populate Dickens's novels, nor to real-life office workers in a bank or 'commercial situation'. (Nicholas Nickleby, in the novel of the same name (1838), feels that he has landed in clover when the genial Cheeryble brothers take him on as their clerk on the magnificent salary of £120 p.a.)

So what kind of men became Greenwich Assistants? This is, in fact, a very easy question to answer, for in many cases their entire working life histories are available in the RGO 6 (Airy) files of the Royal Observatory, now preserved as a department of Cambridge University Library, and in other surviving documents. For when Airy became Astronomer Royal in 1835, he inherited six Warrant Assistants, and a fluctuating body of non-Warranted casual 'computers' from his predecessor John Pond. The permanent staff members of the Observatory held an official Royal Warrant, like the Astronomer Royal himself, and in accordance with the old naval custom of a ship's executive (or specialist skills) officers – such as the Master, Surgeon, Purser, Chaplain, Gunner; whereas a ship's fighting officers – Lieutenant, Commander, Captain, Admiral – were commissioned. Airy was not impressed by most of his six inherited Assistants, but the security of tenure bestowed by their Warrants meant that he could not sack them. More will be said about them later.

To strengthen what he saw as an indifferent team, therefore, Airy brought down from the Cambridge University Observatory the 24-year-old James Glaisher, a first-rate young man who would later come to rival Airy himself as far as scientific distinction went. But Glaisher – the son of a Rotherhithe tailor who also seems to have made watches – was not a university man, but had served his scientific apprenticeship on the Irish Ordnance Survey. Wanting a 'high Cambridge Wrangler' for his Chief Assistant, or immediate deputy, however, Airy brought in the Revd Robert Main, a former mathematics don, and Fellow of The Queen's College, Cambridge.

But for the rest of the junior staff thereafter, the new Astronomer Royal instituted a policy of appointing bright 15- or 16-year-old school leavers to 'computerships': young men who did the routine computational slog of the Observatory. It was demanding work, but it served as an excellent apprenticeship in practical astronomy, and from the best of their ranks the new Warrant Assistants were appointed whenever a vacancy arose. In 1835 the Computers could earn between twopence and

sixpence an hour, depending on age and seniority, for a twelve-hour day with a midday dinner hour on a piece-work basis, which was rather better than an ordinary office clerk of the same age might expect. In the early 1840s, however, Airy overhauled the system inherited from Pond by introducing an 8-hour day, and a fixed monthly salary, which proved popular with the staff. Those Computers who failed to win promotion to Warrant rank were encouraged to seek permanent employment elsewhere: perhaps in a university or Grand Amateur observatory or in a Government or commercial office, or as mathematics masters in schools. For a good reference from the Astronomer Royal could carry quite a cachet.

Airy preferred to train his staff young, when they were 'tractable' and unmarried. Many letters from fathers and from potential candidates themselves survive, seeking employment, and asserting that the young Master X was a very bright lad, recently of the Revd Mr Y's school, and good at mathematics, Latin, Greek, and French, and loved looking at the heavens. Young men of such a level of intelligence and commitment would at a later date have gone to university, but only a small percentage of bright boys went on to formal higher education in 1850. This might be for religious reasons: Methodists, Baptists, or Roman Catholics could not subscribe to the 39 Articles of the Church of England, which would have been essential for an Oxford or Cambridge Scholarship, though not for University College, London. Airy had quite a number of such non-Anglican Christian 'Dissenters' on his staff over the decades, as Observatory records make clear.

At any one time there would have been a dozen or more Computers on the Observatory staff, many working at desks in the Octagon Room. The youngest might be 15, and they could expect to be there for 10 or 12 years, until either the lucky ones got their permanent Warrants as the older men retired, or else they left for jobs elsewhere. Not infrequently there were a few much older, semi-permanent 'casual' Computers who got on quietly with their jobs and could keep the youngsters in check. But computing was a young man's trade. Airy, however, was always keen that these men should better themselves, especially educationally, and the Observatory had a good scientific library which they were encouraged to use.

Airy made it very clear to aspiring Computers and their parents, however, that successful candidates were *not* going to spend their time gazing through telescopes, pondering the secrets of the universe, and making great discoveries. They would, rather, find themselves engaged in routine work, performed as

part of a team, and directed towards the slow and patient accumulation of accurate data about the motions of the sun, moon, stars, and planets that would be of use to navigators and theoretical astronomers outside Greenwich undertaking independent research into celestial mechanics. (Adams's Neptune work would have been a case of the latter). Indeed, the routine nature of the Assistants' work was even spelled out to the Revd Robert Main upon his appointment as Chief Assistant in August 1835, when Airy told him in a letter: 'The employment[s] in general will be more like those of a head clerk in a bank than any other that I can compare them with.' On the other hand, he had only a five-hour official working day, with occasional night observing duties.

And why, one might ask, should a gifted 27-year-old Cambridge don in Holy Orders want such a job in the first place? It was very simple, given the employment and career conditions of 1835. For clever as Robert Main might have been, his Queen's College Fellowship could only be retained so long as he remained a bachelor, and he clearly desired to take a wife. To obtain a college ecclesiastical benefice, or parish, which would have enabled him to resign his Fellowship and marry, and to settle into the comfortable life of a country vicar, he would have had to patiently await his turn by seniority for a good college living to fall vacant – which might take many years, especially if he lacked a landowning or commercial patron who could short-circuit the system for him and independently present him right away with a 'fat living' within his personal gift. At Greenwich, however, he obtained £400 p.a., with a £70 p.a. rent allowance, which enabled him and then Mrs Main (he married in 1838) to have a comfortable home of their own. He had a five-hour working day (with some night observing duties), absolute security of tenure for life, and an assurance of a good pension on retirement. His total income was better than that enjoyed by many parish clergy of the day, and all that he lacked, and would have desired, was a religious 'cure of souls', or a parish: for Robert Main was a sincerely devout Anglican priest, who regretted that this Observatory position allowed him no formal Christian ministry. On the other hand, he was involved with a variety of charities, was invited to preach in other clergymen's churches on Sundays, collected a large private library of theological books, and wrote on Christian subjects.

And as for the other Assistants, as indicated above, we must remember that, at Greenwich, they too, if they became full Warrant Assistants, could hope for a decent salary better than that of most office workers, a commensurate housing allowance, legally-

protected security of tenure, an official six-hour working day but with some night-shift observing duties, and a pension at 65. Moreover, Greenwich's Warrant staff were also far better blessed with holidays than most in the private sector, with between a month and six weeks leave a year, depending on seniority and season of the year during which one wished to be absent. And additionally, each man had a 'no moon' day off each month, for as so much of the Observatory's work involved observing the moon in the meridian, they could claim a day off when there was no moon to see. And while Computers were employed casually, Warrant Assistants, on annual salaries, got all of their holidays on full pay, as well as any necessary sick leave. Indeed, to put it bluntly, this was living the life of Reilly for a man whose teenage career expectation was to sit on an office stool until he fell off from old age! But more about salaries anon.

But surely, one might ask, were these men not *scientists* rather than office workers, entrusted as they were with operating some of the most exact astronomical instruments in the world? We should remember, though, that the term 'scientist' was only coined in 1840, and that in early Victorian England very few men earned their living doing science. By far the greater part of cutting-edge British research, especially in astronomy – cosmology, lunar and planetary studies, binary star gravitational physics, and big telescope design and manufacture – was firmly in the hands of the independent 'Grand Amateurs': people like Sir John Herschel, Lord Rosse, and William Lassell. 'Professional' astronomers, by contrast, who received a stipend for doing astronomy, such as the Astronomer Royal and his staff, a handful of academics in the English, Scottish, and Irish universities, and those professional assistants employed in Grand Amateur and university observatories, were either under-resourced or else kept too busy with routine or teaching or administrative duties to think seriously of research. In fact, the ex-Royal Navy officer Grand Amateur, Admiral William Henry Smyth (who had worked his way up from the ranks during the Napoleonic Wars, and had done well with prize money, marrying an Ambassador's daughter), likened amateurs such as himself – who did astronomy for love – to the initiative-taking officers in the armed forces; whilst the professionals – who needed a job and a salary – resembled the 'other ranks', who obediently followed where the officers led! A profoundly different situation from that prevailing today.

And let us not forget that self-funded, independent gentlemen, including large numbers of Anglican

clergymen, dominated the Royal Society, the Geological Society, and other learned societies; and when that body which would become the RAS (the Astronomical Society of London) held its founding dinner meeting on 12 January 1820, it was chaired by a clergyman, the Revd Dr William Pearson, and attended by fourteen gentlemen. Indeed, only two professional men of science were present at that inaugural meeting: Olinthus Gregory, Professor at the Woolwich Military Academy, and Peter Slawinski, who was visiting from Russia. Both were less wealthy and had rather less social clout than the Amateurs.

So in 1840 there was no 'scientific profession' as such in Britain, and a young man from a modest middle-class background with a grammar-school education behind him would not have had the same kind of aspirations as a modern-day person in similar circumstances. Rather, at that time, a man who was on the staff of the Royal Observatory, going to work in a good black suit and wearing a gold watch-chain, earning £350 p.a. for a 6-hour official working day in a job protected by Royal Warrant, living in a comfortable house, able to employ two servants, having a month or more of paid holiday by the sea each year, and knowing that he would retire on a good pension at 65, was considered to have attained a truly enviable status.

But who were the six men whom Airy inherited as Assistants from his Astronomer Royal predecessor, John Pond, in 1835? They were a mixed bag, and did not please Airy. Yet because of their Warrant status, they could not be easily sacked. Most had entered the Observatory not as youths, but as mature men, and hence had ideas of their own. What is more, Mr Pond had been in declining health for some years prior to retirement, and the Assistants had become something of a law unto themselves.

Heading the ranks was Chief Assistant Thomas Taylor, aged 63. Judging from remarks by Airy, Taylor could have been a former sailing master or navigating officer, in the Royal Navy – 'an old Master of the Navy' – and as Taylor joined the Observatory staff in 1807, I have wondered whether he retired ashore in the wake of the cutbacks that followed the victory at Trafalgar. Alternatively, Taylor may have been a ship's schoolmaster. Such persons were often carried by first- or second-rate battleships, or 'ships of the line' with a dozen or more 'young gentlemen' or midshipmen on board. They were there to give their charges both a technical and a gentlemanly education, in astronomy, navigation, Latin, and general culture. And even if a schoolmaster at sea was not Warranted, he would have messed with the officers. For a master

– whether a sailing or a school master – had by definition to be highly skilled in mathematics and astronomy, and hence could have been deemed well qualified to work at the Royal Observatory. Taylor also seems to have been a colourful character, coming from the late-eighteenth-century Nelsonian world that did not see public honesty in quite the same way as did the very Victorian Airy. For fierce, brave, and initiative-taking as Nelson's navy certainly had been, it was nonetheless appallingly corrupt by the new, reformed standards of 1840, and ships' officers, contractors, dock officials, and others often ran their own lucrative private 'fiddles' to which officialdom turned a blind eye (think of Nelson's holding a telescope to his blind eye when *not* wanting to see an inconvenient order). For what really mattered was that we always thrashed Bonaparte's navy, prevented French invasion, and kept global trade open to ships flying the Union Jack. Opportunities for private graft, just like prize money, were simply an additional inducement to zeal!

Airy, however, was appalled at Taylor's 'fiddles', seeming lack of modern methodical efficiency, and partiality for strong spirits: a 'drunkard', no less, as Airy described Taylor in his 1835 letter of complaint to the Admiralty! But Taylor was a survivor, and no stiff, high-minded, ex-scholarship boy cum Cambridge don was going to put him out of work, nor, if he could help it, other members of the Taylor clan who worked either for the Observatory or for the Navy. I have often wondered what verbal exchanges took place, and how blue the air may have become, as Airy (himself the son of a hard-fighting Excise Officer and maternal Suffolk farmers) and the confident, clever old salt exchanged views. A compromise was reached in that very modern procedure of Taylor's taking slightly early retirement, on a handsome government pension based on his salary of £370 p.a., in order to get him out of the Observatory.

Then there were a pair of Yorkshiremen, Mr William Rogerson and Mr William Richardson. Airy did not think they were up to much (although Richardson was a skilled astronomer and had won the RAS Medal in 1830), but he could not shift them, though in 1845 Richardson fulfilled Airy's prophecy that he was a 'bad 'un', when he was arrested in a shameful sex and murder scandal. For Richardson, who passed so easily as a respectable gentleman in Greenwich that he was not even asked to sign the poison book when purchasing rat poison from a local apothecary, first got his own adult daughter pregnant, and then poisoned the poor baby, the corpse being discovered when workmen were digging a trench.

The Observatory was rocked by the ensuing scandal and trial at Maidstone Assizes, though either by sweet-talking or legal fluke, both man and daughter were acquitted, only to instantly vanish from the historical record. Perhaps they took the next ship to America! Yet as Judith Flanders points out in her book on murder in Victorian England, many middle-class killers got acquitted, for it was unseemly to hang a lady or a gentleman.

Indeed, the only 'inherited' Assistant that Airy had any time for was John Henry Belville (1795–1856) – known in the Observatory as 'Mr Henry' – who may have been a child refugee from Revolutionary France and had largely grown up at the Observatory as a ward of Mr Pond from the age of sixteen in 1811. As one might expect, given his background, John Henry Belville had been brought up a proper gentleman, albeit not university-educated, but certainly cultured and refined, and had originally been intended for the Church. He had been employed at the Observatory all his working life, being 40 years old in 1835, and was a steady observer and calculator, and a good general influence. When he died in 1856 he was sincerely mourned. One of his daughters, Miss Ruth Belville, lived well into the twentieth century, and would become the lady who took Greenwich Mean Time around to the shops of the London chronometer makers. His daughter Cecilia Louisa married James Glaisher, of whom more will be said in my 'Further Reading' section under Glaisher. It was no doubt the trouble he had with the staff he inherited from John Pond, and upon whom he reported in detail to the Admiralty, that led Airy to devise his new system of always having a 'High Wrangler' in mathematics from Cambridge as his Chief Assistant and an apprentice-style promotion system from the Computers for the rest. For the world of 1840 was a very different one from that of 1811, the year in which Pond had been appointed Astronomer Royal. Perceptions of social discipline, and standards of public probity, accountability, and professional behaviour had changed conspicuously. 'Reform' was the social and political watchword, as one ancient practice after another came to be overhauled and improved, from how MPs were elected to Parliament to the higher standards laid down by the Church Commissioners regarding expected clerical duty and fairer income distribution within the Church of England. And George Biddell Airy was wholly in spirit with this new public mood: his aim was greater efficiency and fairness, with less cronyism, but rather what we now call 'transparency' in public institutions. In fact, he was a thoroughgoing *Victorian*, in the highest and noblest sense of the word.

Without doubt the best single guide we have to the life of a Greenwich Assistant is in the manuscript ‘Autobiography’ of Edwin Dunkin (1821-1898), which came to light in 1970, and was acquired by the RAS Library. In 1999 it was published, and I had the honour to write the historical ‘Foreword’. Dunkin was a Cornishman from near Truro. His father worked as an ‘Out-Computer’ for the Nautical Almanac Office: he received bundles of manuscript calculations sent from London to check and re-check before the *Almanac* was published. In fact, ‘out-computing’ went back to the late seventeenth century, when John Flamsteed, the first Astronomer Royal, employed men in the Midlands to check his own pre-publication figures computed in Greenwich.

Young Edwin received a remarkably good education, including a year at school at Guines, near Calais, to give him a fluent mastery of the French language. Initially he had considered training as a doctor, and as a pharmacist, but the costs involved were too high. He then considered securing a City clerkship. Eventually, in 1838, he came up to Greenwich to work as one of Airy’s Computers, being then slightly older than the average. At first, his working day as a Computer ran from 8 am to 8 pm, though Airy would soon reduce this to 8 am to 4 pm. Then in 1845 Dunkin became a Warrant Assistant on £130 p.a., and rose up to have charge of the Meridian Department, and helped to ‘break in’, and then used, the great Meridian Transit Circle that Airy designed and installed at Greenwich in 1851: the instrument that would thereafter define the Prime Meridian of the world.

Edwin Dunkin was in many ways a man after Airy’s own heart, and it is not surprising that the two men got on well, and Dunkin was to be promoted, spending the last four years of his working life (1881-4) as Chief Assistant when Airy retired in 1881, and William M. Christie succeeded Airy as Astronomer Royal. Like Airy, Dunkin prized public honesty, efficiency, and regular working methods. But also, like Airy, he believed that all work made Jack a dull boy, and greatly valued and enjoyed his six weeks leave per year, which he usually spent back in Cornwall. (Airy had his own holiday home at Playford in his beloved native Suffolk). Dunkin’s ‘Autobiography’, moreover, is full of fascinating asides, such as the transformation which the Great Western Railway made to travelling to the far west: eight hours on an express train, ‘The Flying Dutchman’, by 1890, whereas as a young man he had made the journey to London from Falmouth in a sailing packet boat and then a steamer. He was also aware how the GWR had transformed Cornwall from

a mysterious place in the far west to an increasingly popular holiday destination for the metropolitan middle classes.

Indeed, his Greenwich Assistantship was the making of Edwin Dunkin, carrying him up from a young man needing a job to being a Fellow of the RAS, then a full Fellow of the Royal Society, then finally, President of both the RAS and of its Dining



Fig.3 Photograph of Edwin Dunkin, c.1860.

By courtesy of the Royal Astronomical & SPL

Club. He became, moreover, an eminent public Cornishman, and President of the Royal Institution of Cornwall, in Truro. In London, he lived with his wife Maria and family in a large (three storeys plus basement) semi-detached house, named ‘Kenwyn’, in upmarket Blackheath, within an easy walk of the Observatory, and above the smoke and maritime squalor of Greenwich town and, judging from a photograph of the house, he must have employed servants. His salary on retirement at 63 was £600 p.a. Indeed, through his job at the Royal Observatory, Dunkin had become a true Victorian gentleman, and a pillar of the scientific establishment.

Other Assistants also rose to eminence. William Ellis, whose entire working life was spent at Greenwich, became a Fellow of the Royal Society and highly respected public scientist. Perhaps most remarkably, Charles Todd ended his days as both a Fellow of the Royal Society and a knight, albeit having spent most of his life in Australia. In 1841, at the age of fifteen, Todd, like so many, had begun

scientific life as a Computer at the Royal Observatory. In 1847 he became Assistant Observer at the Cambridge Observatory, moving back to Greenwich in

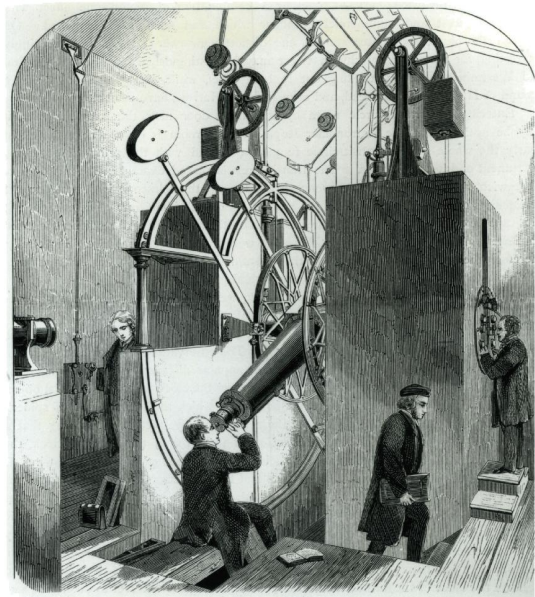


Fig.4 Airy's great Transit Circle of 1851.

Dunkin, Edwin, *The Midnight Sky* (Religious Tract Society, London, 1891 - Revised Ed.)

By courtesy of the Royal Astronomical & SPL

1854 to operate the new G.M.T. telegraphic transmission apparatus, which was beginning to transform the world by the late 1840s. And just as young people in our own time take like ducks to water to the modern technology of the computer, so around 1850 many young men (alas no women) founded their careers on telegraphy and its applications. By 1848 Airy was experimenting with electric signals inside the Observatory, for he realised the value that an instantaneous electric G.M.T. signal could have to the burgeoning worlds of empire, commerce, shipping and railway safety. So it was that young Charles Todd came to be the Observatory 'whiz-kid' when it came to batteries, wires, relays, bells, and automatic recorders. And so well did he do that when an official search was made for someone to become Supervisor of the projected telegraph system of New South Wales, Todd, with Airy's backing, got the job. Charles Todd's impact upon the subsequent development of Australia was considerable. He did much of the work that led to the opening of the transcontinental Anglo-Australian telegraph, which became operational in 1872; and during one of his exploratory journeys into the outback he named a spring of water after the Cambridge shopkeeper's daughter who would become Lady Todd – Alice. Indeed, the training and opportunities which a Greenwich Assistantship under Airy

had given Charles Todd were to turn him into a patriarch of Australian science.

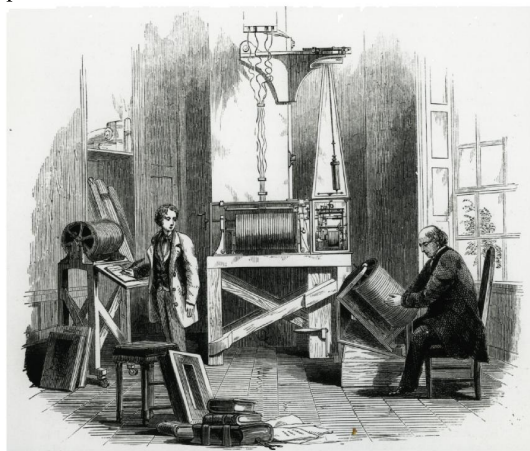


Fig.5 Electric chronograph room at the Royal Observatory, Greenwich, c.1865. The large cylindrical drums being examined were wrapped with stable drawing paper, and electric signals of stars observed crossing the wires of the great Transit Circle were noted and transmitted by the observer via an electric button. The electric signal activated a stylus that marked the slowly-rotating chronograph, leaving a visible trace of each star as it crossed the telescope wires. These traces were then used to monitor the accuracy of the Observatory clocks, and from them, the public time signals would be sent to the Time Ball, Gate Clock, and on to the national telegraph network, to spread GMT across the British Isles.

Dunkin, Edwin, *The Midnight Sky* (Religious Tract Society, London, 1891 - Revised Ed.)

By courtesy of the Royal Astronomical & SPL

It is clear when examining staff records that many families had members working in various positions at Greenwich, and not uncommonly Warrant Assistants would secure Computerships for younger brothers or relatives. One such family, which had two or perhaps three generations of its members on the Greenwich staff over at least four decades, were the Breens. They were an Irish Roman Catholic family, clearly very highly educated and mathematical, but who would not, before the reforms of 1871, have been eligible for many university scholarships. One of the most successful members of the family was Hugh Breen, who became an established Warrant Assistant and therefore secure for life, yet who in 1858 made a dangerous, and subsequently damaging, career gamble. For in that year, Hugh Breen resigned his Royal Observatory post to establish a private school for 'young [Roman] Catholic gentlemen' at Enniskillen in Ireland.

Indeed, he was catering for what we might now call a ‘niche market’, for the Protestant Church of Ireland controlled much of Irish education, and many middle-class Irish Catholics – landowners, business people, and professionals – had difficulty in finding good Catholic schools for their sons without having to send them abroad. Whether it was because Hugh Breen was a poor teacher – though he was accomplished in astronomy, mathematics, and classics – or had poor business skills we do not know, but his school quickly failed. Only a few weeks later, in January 1859, a Miss Catherine Wicks was writing to Airy to see if he could be re-engaged at the Observatory, although by that date his Warrant post had gone to another man. Even so, Hugh’s brother James still worked at the Observatory, and was, like Hugh, the author of astronomical books and academic papers.

The first of the ‘lower’, or non-Cambridge, Assistants to have a degree was Mr William Thynne Lynn, who in the 1860s was putting ‘B.A.’ after his name. Though working full-time at the Royal Observatory, Mr Lynn, the son of a country surgeon, had taken an external degree from the new London University, no doubt in his spare time. He was a devout man, as we know from the correspondence exchanged between Airy and the Revd D. Millar, Vicar of Greenwich, in 1868, when Lynn was making enquiries into the possibility of ordination into the Anglican priesthood. Lynn’s paper qualifications were clearly excellent, for as Airy said, he was a ‘fair modern linguist’, with good German, as well as being an astronomer, and regularly undertook charitable work amongst the ‘poor and distressed’ people in Greenwich. On the other hand, Airy doubted his suitability for Anglican Holy Orders, because ‘the social education of the old Universities is wanting’. For in 1868 the Church of England ministry was almost entirely dominated by Oxford and Cambridge graduates (Airy’s younger brother William had been ordained after leaving Cambridge), and many felt that one of the problems faced by the Church was that of relating to ‘ordinary’ working-class people, owing to the upper-middle-class and Oxbridge backgrounds of its clergy – and it is not entirely untrue to say that the problem is still with us in 2011.

Whatever was said by whom to whom, Mr Lynn stayed at the Observatory, and did not become a vicar. Another deciding factor, of course, could have been prudence: why give up a steady, well-paid job when, after ordination, he had no guarantee of obtaining a living and might end up – like many Oxbridge MAs without patrons – as an elderly curate surviving on £60 per annum?

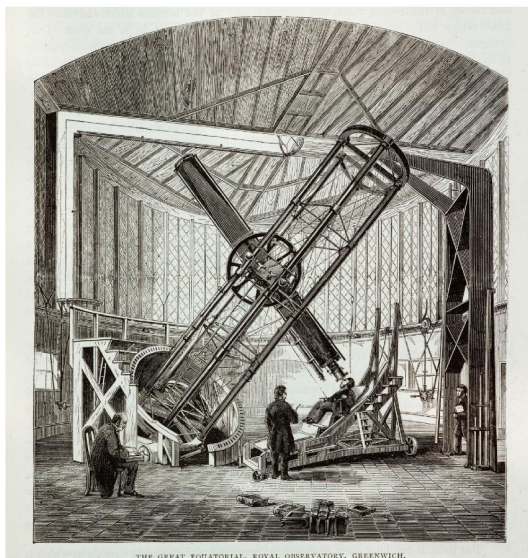


Fig. 6 The Great Equatorial Refractor, 12.8-inch object glass, on a large ‘English Mount’, 1859. This instrument would be used for asteroid, comet, and other studies
Dunkin, Edwin, *The Midnight Sky* (Religious Tract Society, London, 1879 - Revised Ed.)
By courtesy of the Science Museum, London & SSPL

On the other hand, Airy warmly backed Lynn’s application for the post of Assistant Registrar of London University, saying that he was a man who had successfully ‘discharged important duties’ at Greenwich and would ‘prove himself a valuable Administrative Officer of the University of London’. Unfortunately for Lynn, however, the job went to one Professor Hearst.

But undoubtedly the saddest case amongst Airy’s Assistants was that of Mr Gabriel Goldney. He was a gentleman born and bred, from a landowning West Country family. Coming up to Lincoln College, Oxford, in 1868, aged 19, he seems to have converted to Roman Catholicism, which would have legally obliged him to leave the University, though such a sincere conversion would not have done so after a change in the law in 1871. Without a degree, and perhaps ostracised by his family, he began to work as an ‘untenued’ Computer at Greenwich, living at No. 3 Royal Hill Terrace. Airy liked him, and one suspects that he possessed considerable charm and social know-how. Then in 1874, on Airy’s recommendation, he began to work as a properly salaried Assistant at the relatively new Durham University Observatory under the directorship of Professor Pearce.

But things began to go wrong, and the Durham University archives indicate that the bottle was probably the cause (his shaky handwriting too is evidence of this), as Mr Goldney was variously

reported to be incapable of discharging his Observatory duties. Professor Pearce seems to have done his best to help him, but things went from bad to worse, and in 1885 poor Goldney was sacked. Yet he clearly continued to live in the Durham area, for though he vanished from the record for the next 20 years, he received a fulsome obituary in the *Durham County Advertiser* of 3 November 1905, after he had died in the Durham workhouse, apparently as a long-term resident, and where he had held the office of porter, on £30 p.a. His cultured charm had clearly turned him into something of a minor Durham celebrity, for 'his polished manners, ripe scholarship, and brilliant conversational powers' earned him the admiration of all who knew him. Yet what a tragic life: from Gloucestershire broad acres and Oxford to the indigence of the Durham workhouse, via Greenwich and Durham University Observatories! Yet nothing in his obituary suggests that Goldney was in any way angry or embittered by his lot, and he seems to have cruised along as a learned, charming and amiable upper-class drunkard.

A very different sort of character was James Glaisher, whom we first encountered above. James (and his astronomical tragically short-lived brother John) had received a good schooling. His parents were friends of William Richardson, who was on the staff of the Royal Observatory, and the teenage Glaisher boys were allowed to visit the Observatory in the days of John Pond's reign as Astronomer Royal. A combination of the precision implicit in his father's watchmaking interests and the gleaming instruments in the Royal Observatory had set James on an astronomical career. But his real scientific apprenticeship began in Ireland, where, as was mentioned above, he was appointed to the Irish Ordnance Survey. Here he learned how to use transit instruments, theodolites, micrometers, and chronometers, and how to make precision measurements, and he was very good at it.

But it was also in Ireland that Glaisher discovered that scientific passion which was to make him something of a household name in the decades ahead: meteorology. For the curious weather systems, cloud patterns, sunlight, rainbows, and humidity of the Emerald Isle fascinated him, especially when making barometric measurements on the Galway and Limerick Mountains. So assiduous was he, however, that in spite of a powerful physique that would carry him through 94 years, Glaisher contracted a bad dose of pneumonia, which led to his being invalided back to England. His existing reputation and letters of recommendation from Ireland, however, resulted in his appointment as an Observing Assistant at Cambridge University Observatory, then under the direction of



Fig.7 James Glaisher. A formidable gentleman. Superintendent of the Greenwich Meteorological Observatory after 1841 and pioneer of scientific meteorology. The photograph shows him in his 60s.
By courtesy of the Science Museum, London & SSPL

George Biddell Airy, who held the Plumian Chair of Astronomy. And when Airy left Cambridge to become Astronomer Royal, he invited Glaisher to come with him to Greenwich, for he knew that a man of his calibre would be vital.

Yet James Glaisher was no 'yes man', not to Airy, nor to anyone else. Indeed, the briefest glance at his portraits makes this fact very clear, for while the portraits of Dunkin, Main, and other Assistants suggest men of patient, obedient industry, Glaisher's face is that of a highly-intelligent 'tough customer'.

After 1839 Airy began to expand and develop the systematic monitoring of geomagnetic and meteorological phenomena at the Royal Observatory. This was seen as falling precisely within the Observatory's remit of recording all physical phenomena which could be of use to the Royal Navy, Merchant Marine, and the nation in general. James Glaisher was made Superintendent of this new 'Mag. and Met.' Department, and this would, over the next 39 years, turn him into something of a household name, as well as establishing him as a scientist of international reputation. Amongst other things Glaisher was to become a pioneer in the development and use of self-

recording instruments to continuously register barometric pressure, humidity, temperature, and wind speed and direction, as well as long- and short-term changes to the earth's magnetic field.

Like Robert Hooke 200 years before, Glaisher hoped that if sufficient data could be built up about the weather, then we would be able to predict it. At first Airy shared this view, hoping that, as with gravitational physics, the vast, growing body of meteorological data being assembled at Greenwich and other Imperial, European and USA observatories might make the climate as predictable as the movements of the planets. By the mid-1860s, however, Airy was becoming sceptical about the weather ever being expressed in elegant mathematical equations as exact as those of the lunar orbit. For it seemed that there were simply too many global variables and too few global recording stations.

While Glaisher fully understood the Herculean nature of the task, he nonetheless believed that positive results were emerging, even as early as 1850, when he gave an interview—probably to the young journalist Dr Frederick Knight Hunt – for Charles Dickens's popular magazine *Household Words*. In it Glaisher argued, for example, that a statistical analysis of existing climate records showed that between 1771 and 1849 the climate of southern England had become 1° Fahrenheit warmer (a good thing, he argued, for such a temperature increase facilitated more abundant agricultural yields). Unlike most of the Greenwich Assistants, Glaisher appeared to move effortlessly in the world of the 'Grand Amateurs'. Already a Gold-Medal-winning Fellow of the RAS, he was elected Fellow of the Royal Society in 1849 while still only 40, corresponded in his own right with the leading scientists of Great Britain and Europe, and was invited to Grand Amateur scientific country house weekends. Quite clearly he was by then an established Victorian 'Gentleman of Science'. And very importantly, he was to use these Grand Amateur contacts to set up a network of well-equipped private meteorological stations across Great Britain. He was the founder of the (soon to be Royal) Meteorological Society, and encouraged his amateur astronomer friends, country clergy, gentry, and scientifically-minded ladies to purchase the appropriate instruments, to monitor them carefully, and use the Penny Post to send their weekly results, entered on to standard forms that were compatible with those employed at Greenwich, to the Royal Observatory. This created a much richer database than would ever have been possible if the weather had only been monitored in the Greenwich, Oxford, Cambridge, Armagh, Durham and Edinburgh Observatories. And

in particular, it gave a better understanding of how storm systems moved, which was a thing of the highest importance to the Royal Navy.



Fig.8 Glaisher's and Coxwell's balloon breaking through the cloud and rising in brilliant sunlight, on its way towards its 7-mile ascent. 1862.

By courtesy of the Science Museum, London & SSPL

Yet what propelled Glaisher – both literally and figuratively – into full celebrity status were the daring high-altitude coal gas inflated balloon ascents which he made with the aeronaut Henry Coxwell in the early 1860s. The truly sensational ascent was the one in which he and Coxwell rose to an estimated height of seven miles above Wolverhampton in 1862, with no breathing apparatus! For Glaisher had come increasingly to realise that scientific meteorology really required a study of the atmosphere to its highest accessible domains if it were ever to be properly understood. And in some of these ascents, he also incorporated astronomical studies by carrying the newly-developed spectrosopes (amongst more conventional meteorological instruments) aloft, to examine the solar spectrum at great altitude.

The bust-up between Airy and Glaisher was triggered by the minor incident of Glaisher's going home from work slightly early one day in 1874. Furious at Airy's admonitory note, Glaisher peremptorily resigned, and even Airy's emollient apologies, almost begging Glaisher not to leave, failed to get him to withdraw his resignation letter. But as Glaisher made clear to Airy, he needed more space and freedom in which to operate than his Greenwich Assistantship allowed, besides which he could make three times more money ('£100 per month') as a well-respected science consultant than his £445 p.a. salary from the Observatory. Before Glaisher actually left, though, I gather the two men had made it up, for Glaisher secured a £289-5-0 p.a. pension, irrespective of his private earnings. His fame continued to ascend after his early retirement, as did his earnings, down to his death in 1903.

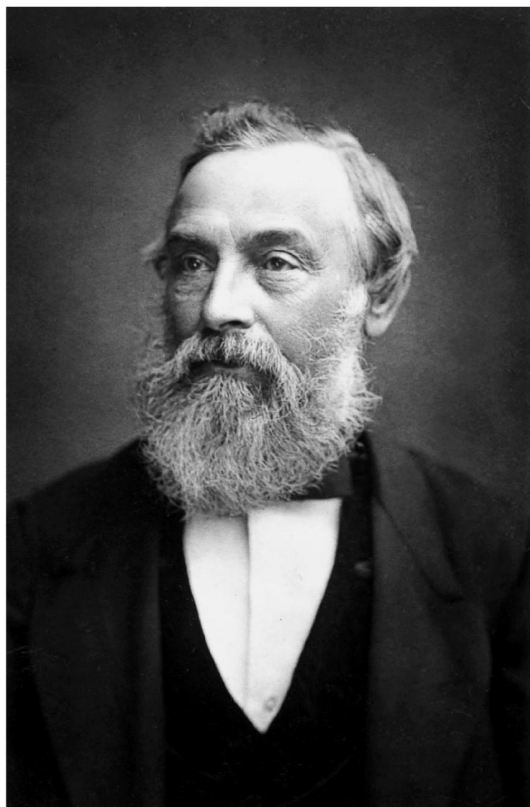


Fig.9 Henry Coxwell, celebrity aeronaut, who piloted the balloons for several of Glaisher's high-altitude ascents.

By courtesy of the Science Museum, London & SSPL

One can understand how the private career and independence of mind of James Glaisher could well have annoyed Airy at times, but it is clear that there must have been deep mutual respect, if not quite friendship, between them. For one thing, it is unlikely that Glaisher would have been elected FRS had Airy in any way blocked the election. Secondly, it is hard to imagine that Glaisher's brilliant son, James Whitbread Lee Glaisher (named after Glaisher's close Grand Amateur astronomer friends Samuel Whitbread, the rich Bedford brewer and John Lee, the eminent barrister and midlands counties landowner), would, after attending St Paul's School, have followed Airy's sons Wilfred and Hubert up to Trinity College Cambridge, had Airy not been helpful.

For as a scholarship boy from a modest Suffolk background himself, Airy was a firm believer in the power of education, and of the importance of encouraging young men of ability to advance into useful careers. Despot though he may have been, Airy was nonetheless benevolent, and certainly no snob, and was the last man to 'pull the ladder up' after him. After all, such exclusiveness would have run entirely against the grain of Airy's belief in openness,

talent, and reform. (It is interesting to note that when Airy retired in 1881 the 33-year-old James Whitbread Lee Glaisher was offered the post of Astronomer Royal, but turned it down. He preferred the peaceful life of a Cambridge bachelor mathematics don, and would continue thus to his own death in old age, in 1928. Quite the reverse, in fact from his dynamo of a father).

During the 46 years that Airy was Astronomer Royal, he was aware that the work to be done by the Warrant Assistants had increased considerably, and that this necessarily affected the calibre of men to be recruited and the salaries that it was appropriate for them to be paid. In 1835, for instance, Airy, upon becoming Astronomer Royal, had secured a 25% salary increase for himself (up to £800 p.a.), beyond what he had been receiving as a Cambridge Professor and Observatory Director, and £200 more than his Greenwich predecessor John Pond had been paid. Airy's wife Richarda, moreover, had a £300 p.a. Civil List Pension bestowed upon her in 1834, thereby bringing the Airy family income to the handsome sum of £1,100 p.a., plus an official residence in the Royal Observatory. But as Airy had made clear to his Civil Service employers, he – unlike Pond and many other astronomers – had no income other than his salary. Lady Richarda (as she would become), a Derbyshire clergyman's daughter, had no significant private means, while George Biddell himself, as a married layman, was in receipt of no independent income, academic (when Oxbridge College Fellows were still required to be bachelors) or ecclesiastical, thus making him a full-time working astronomer. And as he, a conscientious recipient of British taxpayers' money, was willing to give the whole of his working time to his job, he expected his Assistants to do likewise.

In 1835, the egregious Thomas Taylor received £300 p.a. plus, as he did not have an official residence, a generous housing allowance of £70. Indeed, in 1835 one could, in Greenwich or Blackheath, rent quite a handsome house for £70 a year, bearing in mind that many an office clerk did not receive £70 for an entire year's salary. But such would have only been fitting for an ex-naval-officer and a gentleman, even if Taylor were probably doubling his salary in unofficial 'fiddles'. The next Assistant, the 40-year-old John Henry Belville – 'Mr Henry' – was receiving a combined official income of £252, and the next Assistant down, Thomas Ellis (William's father), £120.

By 1856, however, Airy had an official salary of £1,000 p.a. (£1,300 with his wife's Civil List Pension); the Revd Robert Main, as Chief Assistant,

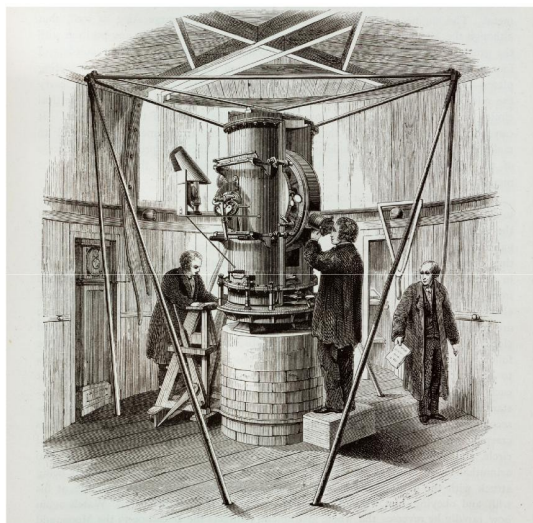


Fig.10 The Altazimuth Instrument at the Royal Observatory, Greenwich, after 1847. Designed by Airy to observe the exact position of the moon when out of the meridian. A crucial innovation for the Greenwich ‘regime’.

Dunkin, Edwin, *The Midnight Sky* (Religious Tract Society, London, 1891 - Revised Ed.)

By courtesy of the Science Museum, London & SSPL

£400 plus £70 for rent; James Glaisher, as number two, £390 (£250 plus £40 rent, with £100 p.a. supplement as Mag. and Met. Superintendent); Edwin Dunkin, £240; and the seventh Assistant, £130. On 10 September 1856, however, the *Morning Chronicle* newspaper attacked Airy for the small official wages paid to his staff. Yet as indicated above, perceived income and status depended upon what you were supposed to be, and £390 a year (for Glaisher) was by no means bad within the wider Victorian scheme of things. Yes, Glaisher was an eminent FRS, but his £390 salary enabled him to rent a fine residence first at No.1 Dartmouth Terrace, then an even better one at 13, Dartmouth Place, Blackheath (still standing), do the rounds of the Metropolitan learned societies, secure scholarships for a first-class public school and Cambridge education for his son, and bring up his daughter as a lady with good marriage prospects. And one only needs to cast an eye over the post-1863 *Crockford's Clerical Directory* – where Church stipends were listed – to realise that many a beneficed vicar or rector of the Church of England would have given his eye teeth for the £470 p.a. paid to the Revd Robert Main, M.A., as Chief Assistant. The Revd Patrick Brontë, father of the Brontë sister novelists, for example, received a modest £170 p.a., plus Haworth Vicarage, Yorkshire, in 1838 (Lewis, *Topographical Dictionary*: see below); while the famous amateur astronomer, the Revd Prebend

Thomas W. Webb, incumbent of Hardwicke, Herefordshire, received only £150 in 1868, augmented to £233 in 1883 (*Crockford's*), though Mr Webb was fortunate to possess very considerable private wealth in addition to his ecclesiastical income.

Another reason why a Greenwich Assistantship was seen as a very desirable piece of property derives from the much more modest salaries paid to assistants in the university and Grand Amateur observatories. These men, in the ‘private sector’ of astronomy, moreover, also laboured under much more insecure terms of employment, with sometimes a lack of paid holidays, and frequently no pension prospects. When, for instance, the Grand Amateur employer Colonel Tomline, owner of the Orwell Park Observatory, Suffolk, died in 1889, his astronomer Isaac Plummer, who had a Durham University M.A. degree, serious publications, and many years of service to his credit, was given one year's notice to quit his £300 p.a. job *and home* (with no pension or compensation) by Captain Prettyman, Tomline's successor, who had no interest in astronomy. Such a dismissal, however, would not have been possible for a ‘public sector’ Greenwich Assistant protected by his Royal Warrant. Yet let us not forget that *all* of these Assistants, Greenwich and otherwise, would have belonged to the servant-*employing* classes. For Lady Airy, Mrs Main, Mrs Glaisher, Mrs Dunkin, and even Mrs Plummer would have been *ladies*, who did not scrub and cook with their own hands. For after all, a teenage ‘maid of all work’, or skivvy, could be taken on for £7-£8 p.a. in 1861, an adult female cook for £12 upwards, and even a male factotum ‘boots’/footman/butler for £20-£40. For the difference between a wage of nine shillings and sixpence a week (£25 p.a.) and a salary of £300 a year was the very epitome of that gulf which separated the working from the middle classes.

Airy remained in office as Astronomer Royal until 1881, when he was eighty, his energy apparently unabated. As he grew older, however, his obsession with office tidiness and filing claimed an increasingly large part of his time. This led to the young Edward Walter Maunder – the future discoverer of the sunspot cycle ‘Maunder Minimum’ – recording an incident from the late 1870s which was, quite unintentionally, to do Airy's posthumous reputation some damage. For it seems that Airy once spent a whole afternoon labelling empty crates ‘Empty’. This small incident has often led people to forget that in his 1900 History of Greenwich Observatory Maunder spoke of Airy's reign as Astronomer Royal as one of the high points in that Institution's scientific history.

It is quite clear, however, that the 22-year-old Maunder, who joined the Royal Observatory staff in

1873 to run the ‘new technology’ solar photographic department, and the elderly Airy did not exactly ‘hit it off’. And there was at least one very good reason: Maunder was the first Assistant to be appointed under the new Cardwell Reforms of the Civil Service and Armed Forces, which replaced the old ‘personal contacts’ system of appointment with the introduction of the new Civil Service Examinations. For Maunder had *not* worked his way up through the time-honoured junior Computer to Warrant Assistant ‘apprenticeship’ scheme devised and absolutely controlled by Airy, but had passed an examination and been effectively *imposed* by the Civil Service Commissioners. Quite simply, this signified that the Astronomer Royal had lost the power to appoint and direct his own staff. For while, as we have seen, Airy was all in favour of reform and efficiency, he resented outsiders interfering with the well-oiled and economical running of the Greenwich Machine.

And then, in 1890, Airy’s successor, Christie, made one of the most far-reaching innovations in the history of the Observatory: he set up a pilot scheme for the appointment of women Computers. Yet while there were a few women doing salaried work in other Observatories by that date, the Greenwich scheme got off on the wrong foot. For one thing, the salaries being offered were absurdly low, and the scientific duties relatively menial, but the pilot scheme set out to ‘head-hunt’ high-powered female mathematics graduates from Girton College, Cambridge, and elsewhere. Even the eminent middle-aged Irish astronomical author, Miss Agnes Clerke, was offered, and politely turned down, a Computership. Some young women did take up the Greenwich posts, but they soon moved on to better things, either in Europe or America.

But in addition to the gentlemanly world of the scientific Warrant Assistants, there was, let us remember, another corps of assistants that worked for the Observatory, with whom I do not have the space to deal here, but upon whom I have published elsewhere: the watchmen, gate-keepers, handymen, labourers, and servants of the establishment. A body of men whose ways and values Airy often lamented, and who, ex-Navy ratings as most of them were, received some kind of pension from the Greenwich Royal Naval Hospital. Of course, not all of these men were old, but could – when Great Britain operated the largest Navy in maritime history – have been invalided out of active service following injury or illness, and having no homes of their own, could claim a right to a hospital (or rather hostel) bed and food at Greenwich, and a few shillings each week for beer and baccy. A body of men, in fact, as hard-

drinking, swearing, fighting, and fornicating as ever graced the lower gun deck of *HMS Victory*, and who were no doubt closer in spirit and in values – the officer and men division notwithstanding – to Mr Thomas Taylor than to the academic and clerical world of Sir George Airy. For Airy’s correspondence with the shore-based Commanding Officer of the Hospital about its beached tars reveals a whole layer of early Victorian society that was the polar opposite of respectability: tales of Observatory ‘employees’ who accommodated prostitutes in their grace and favour cottages, such as Edward Green, who was sacked for this practice in 1850; and of fights, violent womenfolk, swindles, scrounging, and monkey-tricks that would have made the polite reverend gentlemen of a Cambridge Senior Combination Room swoon! And also of some who were decent working men, such as James Stride, who retired in 1863 and appears to have gone to live with relatives at Great Woodford, near Salisbury, Wiltshire. And while Airy could be severe when dealing with scroungers, he had no scruples about bombarding the top brass of the Navy when it came to securing pensions for honest old Observatory servants who had discharged their duties well. For Stride had worked as a ‘labourer’ and gardener at the Royal Observatory for 21 years. His working salary had been £47 a year, and Airy secured for him a handsome Admiralty pension of £16-9s.-8d. a year.

The archives of the Royal Observatory are a mine of information not just about astronomical, scientific, and technological history, but also about a Victorian community. And the history of that community has become a source of enormous fascination to me, encompassing as it does driven careerists, devout clergymen (Robert Main), and brawling drunkards, and a spectrum of achievements and doings extending from painstaking science and devoted ‘leisure time’ service to the Greenwich poor on the one hand, to a callous child murder on the other. In this article I have scarcely been able to scratch the surface, but I look forward to exploring it in more detail in my forthcoming biography of Sir George Biddell Airy and that institution which he presided over and transformed across nearly half a century. For as one might say, ‘all human life is here’.

Further Reading

I have not provided detailed endnotes because most of the material contained in this article is taken from manuscripts in the official papers of Sir George Biddell Airy, Astronomer Royal 1835-1881, now in the Royal Greenwich Observatory files, curated by Cambridge University Library. Most of the Airy files

have the Library prefix RGO6. This is a very large archive, with many divisions and sub-categories. There are no single files dealing with the Observatory staff, their salaries, and working conditions, but RGO6: 1, 3, 4, 6, 7, 43, and 72 are particularly rich in letters about staff members. Short of providing detailed bibliographical references for each item cited, it is impossible to guide a researcher to a single file for staff matters, as the pieces are scattered across a 46-year body of records. Hence in lieu of source notes I append some specific suggestions as to further reading.

One good primary source for the Royal Observatory is: *Autobiography of Sir George Biddell Airy, K.C.B.*, ed. Wilfred Airy (CUP, 1896).

For good modern sources, see A.J. Meadows, *Greenwich Observatory 2. Recent History (1836-1975)* (Taylor and Francis, London, 1975).

The new *Oxford Dictionary of National Biography* (2004; also online) contains definitive scholarly biographies of Airy and many of the leading members of Airy's staff. See under individual names.

Several articles on the Royal Observatory in Airy's time can be seen in Joseph Ashbrook, *The Astronomical Scrapbook: Skywatchers, Pioneers, and Seekers in Astronomy* (CUP, Sky Publishing Corporation, 1984).

For the work of Greenwich and other Victorian observatories, see the following:

J.M. Appleton, *Stars and Storms. The Life and Work of John Isaac Plummer, Victorian Astronomer & Meteorologist* (Private publication, Ipswich [?], 2009-10).

J.A. Bennett, *Church & State in Ireland. 200 Years of the Armagh Observatory* (Armagh Observatory and Institute of Irish Studies, Queen's University, Belfast, 1990).

Mary T. Brück & S. Grew, 'A Family of Astronomer: The Breens of Armagh' (*Irish Astronomical Journal* 26 (2) (1999), 121-8).

A. Chapman, 'Science and the Public Good: George Biddell Airy (1801-92) and the concept of a scientific 'Civil Servant'', in *Science, Politics, and the Public Good. Essays in Honour of Margaret Gowing*, ed. Nicholaas Rupke (Macmillan, London, 1988), 36-62.

A. Chapman, *The Victorian Amateur Astronomer. Independent Astronomical Research in Britain 1820-1920* (Wiley-Praxis, Chichester, 1998).

A. Chapman, 'The Observers Observed: Charles Dickens at the Royal Observatory, Greenwich, in 1850', *The Antiquarian Astronomer* 2 (Dec. 2005), 9-20.

Edwin Dunkin, *The Midnight Sky* (London, 1891).

Edwin Dunkin, 'Autobiography', RAS Add. MS. 55. Published as *A Far-off Vision: a Cornishman at Greenwich Observatory*. Edwin Dunkin, *F.R.S.*,

F.R.A.S. (1821-1898), ed. Peter D. Hingley and Tamsin Daniel (Royal Institution of Cornwall, Truro, 1999).

Roger Hutchins, *British University Observatories 1772-1939* (Ashgate, Aldershot, 2008).

E. Walter Maunder, *The Royal Observatory, Greenwich. A glance at its history and work* (Religious Tract Society, London, 1900).

David Rooney, *Ruth Belville, the Greenwich Time Lady* (National Maritime Museum, London, 2008).

Simon Schaffer, 'Astronomers Mark Time: Discipline and the Personal Equation', *Science in Context* 2 (1988), 115-45.

For the life and career of Charles Grover, 'professional assistant' to a generous 'Grand Amateur' astronomer, see:

Barbara Slater, *The Astronomer of Rousdon. Charles Grover, 1842-1921* (Steam Mill Publishing, Norwich, 2005).

For Thomas Taylor, see:

RGO6, 1/157-8, 1/176-9, 1/183, 1/235, 72/223.

For staff employed on the Harton Pit gravity experiments, 1854, see:

A. Chapman, 'The Pit and the Pendulum: G.B. Airy and the Determination of Gravity', *Antiquarian Horology*, Autumn 1993, 70-8, reprinted in Chapman, *Astronomical Instruments and their Users. Tycho Brahe to William Lassell* (Variorum, Aldershot, 1996).

David W. Dewhirst, 'The Greenwich-Cambridge Axis', *Vistas in Astronomy* 20 (1976), 109-11.

For incomes and money, see:

John Burnett, *A History of the Cost of Living* (Penguin original, 1969) and *Useful Toil: Autobiographies of working people from the 1820s to the 1920s* (Allen Lane, 1974; Pelican, 1977): excellent on servant's wages, much based on suggested wages in Mrs Isabella Beeton's *Household Management* (1861).

A. Chapman, 'Clerical Astronomers', in *The astronomer of Hardwicke. The Life and Work of Thomas William Webb* (Gracewing, Leominster, 2006).

Dunkin, 'Autobiography' (above); Airy, *Astronomer Royal's Report*, 1844, p. 18, 1847, p. 9, for Computers' wages.

Samuel Lewis, *A Topographical Dictionary of England* (London, 1838): a valuable source for the values of Church properties, livings, etc., for 1838.

For James Glaisher, perhaps the most interesting of Airy's Assistants, there is abundant documentation in the RGO6 files, with detailed obituaries, 1903, in *Monthly Notices* of the RAS and the *Proceedings* of the Royal Society and of the Royal Meteorological Society, as well as in the old and new *Dictionary of National Biography*. His own publications were

extensive, especially in meteorology and meteor studies. His marriage in 1843 to Cecilia Louisa Belville – the daughter of the senior Greenwich Assistant John ‘Mr Henry’ Belville – seems to have been something of an elopement, and presumably against her parents’ wishes, as neither attended their daughter’s wedding. He was 34, and while her age was registered as 16, she appears only to have been 14! After having three children, she eventually left him. One suspects that Glaisher was a rather formidable, ambitious, and controlling husband; it seems, for instance, that he was angling to secure a Continental aristocratic marriage, to the Greek Ambassador in London, for their reluctant daughter Cecilia Appelina, who appears to have been in love with a young local doctor; and this precipitated a major family split in the late 1860s when she married the doctor rather than the Ambassador. Cecilia Louisa Glaisher, however, was a highly-intelligent and gifted woman. Like her father, ‘Mr Henry’ Belville, she was bilingual in French and English, and during the earlier, happier, years of their marriage, was such a skilled microscopic draughtswoman that her definitive drawings of snowflake crystals were used in Royal Microscopical Society publications: a Society of which her husband became President. (One of her snowflake drawings is still used as the logo of the R.M.S.) James Glaisher became estranged not only from his daughter but also from his wife, and when Mrs Cecilia Louisa Glaisher died in 1891, James adamantly refused to have ‘In Loving Memory’ carved upon her tombstone! And this was respectable, upper-middle-class Victorian England! James left the very handsome sum of £35,814 when he died in 1903.

See also the following:

A. Chapman, ‘The Observers Observed’ (Ibid), 13-17.
A. Chapman, ‘James Glaisher: Astronomer, Meteorologist, and Aeronaut’, in *Patrick Moore’s 2010 Year-book of Astronomy*, ed. Patrick Moore and John Mason (Macmillan, London, 2009), 312-29.

Frederick Knight Hunt, ‘Greenwich Weather Wisdom’, in *Household Words* (ed. Charles Dickens) 1, 9 (May 1850), 200-4.

John L. Hunt, O.B.E., ‘James Glaisher, F.R.S. (1809-1903)’, *Quarterly Journal of the RAS* 37 (1996), 315-47; ‘J.[ames] W.[hitbread] L.[ee] Glaisher, F.R.S., Sc.D. (1848-1928), *ibid.*, 743-57.

L. T. C. Rolt, *The Aeronauts: A History of Ballooning 1783-1903* (Longmans, London, 1966), 192-9: for Glaisher’s balloon flights.

For the William Richardson murder scandal, see RGO6 1/448; *The Times*, 1846, January 27, 31, February 6, 8, 24, April 2, May 16; also Judith Flanders, *The Invention of Murder. How the Victorians revelled in death and detection and created modern crime* (Harper Press, London, 2011), 277.

For corruption in the Georgian navy, see the works of the foremost contemporary historian of the Royal Navy, and especially of its administration: N. A. M. Rodger, *The Wooden World. An Anatomy of the Georgian Navy* (Collins, London, 1986); *The Command of the Ocean. A Naval History of Britain, 1649-1815* (Allen Lane, Penguin, National Maritime Museum, London, 2004).

For Greenwich porters and labourers, see A. Chapman, ‘Porters, Watchmen, and the Crime of William Sayers: the non-scientific staff of the Royal Observatory, Greenwich, in Victorian times’, *Journal of Astronomical History and Heritage* 6 (2003), 27-36: esp. 31, 35 for James Stride.

