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***John Stewart Bell
and Twentieth-
Century Physics***

Vision and Integrity

ANDREW WHITAKER

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to
Mary Bell

Preface

A quarter of a century after his death, and half a century after his most important work, it is becoming clear to most commentators, although still perhaps not to all, that John Stewart Bell was one of the very most important physicists of the twentieth century.

While he performed extremely valuable work on particle accelerators and in nuclear and elementary particle physics, it is clear that his special claim to fame rests with his work on the foundations of quantum theory, and there are two distinct aspects to this.

The first is the important Bell's theorem, or Bell's inequality, a result that startled the scientific community not only by demonstrating a clear distinction between the predictions of quantum theory and the demands of local causality, but also by showing that experimental tests could be performed to decide between the two.

Such experiments have indeed been carried out over the last 45 years with ever-increasing scientific sophistication or, in other words, with a reduction in the number and significance of loopholes, and it is confidently expected that an entirely loophole-free test will be possible in the next year or so. It is all but definite that the verdict will be in favour of quantum theory.

The second aspect, though, is perhaps even more significant. It is that, through his example and his achievements, discussion of fundamental aspects of quantum theory, which had been considered practically the mark of a crank in the years when Niels Bohr and his Copenhagen philosophy held physicists in a pincer-like grip, is now a respected and highly valued field of study, opening up for investigation novel and wide-ranging conjectures about the physical universe.

Study of fundamental concepts has opened up the highly practical topic of quantum information theory, which has already made considerable progress, but is certain to develop in future decades so as to revolutionize information technology.

By the 1960s, quantum mechanics was already the most successful physical theory ever in terms of explaining the behaviour of atoms, molecules, nuclei, solids, and so on, as well as being hugely significant commercially in, for example, the invention of the transistor and the laser. If the achievement of taking such an important field of study and developing it in completely unforeseen directions, adding enormous depth and breadth of understanding and unveiling entire new and fascinating areas of investigation, is to be considered 'great' science, then there are quite reasonable grounds for declaring Bell to be a 'great' scientist.

This book provides a full account of the development of Bell's life and career from its rather humble (if not necessarily 'poor') origins, through the difficulties in obtaining finance for his secondary school and university studies, and onto his enormous achievements at Harwell and then at CERN. However, its main emphasis is on his work, not only on quantum theory but also on what he was actually paid for—the study of accelerators, nuclear physics, and the physics of elementary particles; Bell himself felt that these components of his work were rather neglected. The presentation is non-mathematical, and every effort has been made to provide a thorough but comprehensible account of all areas of his work.

The story is presented decade by decade, so the reader meets quantum theory and its difficulties as Bell himself met them, first at Queen's University Belfast in the 1940s, and then at Harwell in the 1950s. The quantum background is presented quite fully, although in a broadly non-technical fashion and, as successive chapters study the work and ideas of a particular decade, one may appreciate the development of Bell's ideas.

With ideas of such depth, it is not surprising that argument about the precise logical requirements and meaning of the all-important Bell's theorem continues. Indeed, as explained in Chapter 4, differences of opinion appear to have surfaced more obviously in connection with 50th anniversary celebrations. It is not felt that this book is the place for detailed conceptual analysis. Rather, some aspects of the discussion are mentioned, and relevant references given for those wishing to follow them further, but the central approach has been to present the ideas of Bell himself and others, in some cases with rather different views, broadly in their own words. Of course, it might be suggested that Bell's words should be given particular weight!

When Bell entered the accelerator field at the end of the 1940s, the field was new enough that it has been possible here to present a fairly full account of the developments up to that time, and so to set the discovery of strong focussing, in which Bell played a substantial role, in context. Of course, there had been a major widening of the field by the time he returned to the area in the 1980s, but a substantial account of his later work has also been given.

Elementary particle physics is, of course, a much wider subject. A general account of progress in the 1960s and 1970s has been included in order to enable the discussion of some of Bell's most important work in the area, on CPT and gauge theory, to be understood. The equally important discovery of the Adler–Bell–Jackiw (or ABJ) anomaly is also described, although it must be admitted that this is a challenging topic for anybody, however knowledgeable, to appreciate fully!

Bell and his collaborators also dealt with many other problems in nuclear and elementary particle physics. While each topic and the advances made are sketched, perhaps the most interesting point here is that Bell usually chose

to work in widely spread areas where novel opportunities and difficulties abounded. Having made, often, a crucial advance, he usually preferred to leave further work in the area, of a broadly clearing-up nature, to others.

As well as describing Bell's work, this book presents fairly substantial accounts of the three institutions connected with his study and work—Queen's University Belfast, Harwell, and CERN. Each had its own special features which helped to form Bell's scientific attitudes and his interests, and it seems appropriate to explain something of their genesis and nature.

As well as of his work, something has been said here of Bell's character, both of possible defects (few enough—perhaps a failure to suffer what he saw as foolishness gladly when really provoked!), but also his manifold strengths—kindness, humour, honesty—both personal and scientific—and courage.

Acknowledgements

There are many people to whom I would offer sincere thanks for help in the writing of this book.

First, I would like to thank Mary Bell for support and interest over a number of years, for her hospitality in Geneva, and for helpful and useful discussions.

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I would like to thank David Bell, John's brother in Canada, for permission to make use of an interesting memoir of John's earlier years.

I would particularly like to thank Reinhold Bertlmann, as well as his wife Renate, for much help and support over a very long period—nearly 20 years! It was a very considerable encouragement, once I had decided I would like to write an account of John Bell's life and work, to discover that Reinhold had also felt, based on my previous writings, that I could be the best person to take on this role. I am grateful for him supporting my travel to Vienna for extensive interviews with him, which provided crucial information and insights on John and Mary Bell's lives and work, and for his hospitality at that time.

I would also like to thank Reinhold Bertlmann and Anton Zeilinger for the opportunity to attend and contribute to the two 'Quantum [Un]Speakables' meetings in Vienna, which were exceptionally useful for me, not only for hearing many authoritative accounts of Bell's work, but also for meeting many of those most important in his career and thus coming to understand many aspects of his ideas and personality.

Renate Bertlmann has also been of tremendous assistance, both in person in Vienna, and for being exceptionally helpful with the provision of illustrations, both those from the first Quantum [Un]Speakables meeting, but also for her pictures of the meetings between the Bells and the Bertlmanns. Gerlinde Fritz of the Austrian Central Library for Physics and Chemistry has also helped with pictures from the meeting.

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During the writing of this book, a very successful exhibition on the life and work of John Bell was organized at Queen's University Belfast by the curator of the Naughton Gallery, Shan McAnena. In connection with this, a number of experts on Bell's work were kind enough to present brief remarks on their interactions with John Bell, which were later edited for a video presentation. They did so at the 2014 Quantum [Un]Speakables meeting, and those participating were John Clauser, Reinhold Bertlmann, Anton Zeilinger, Daniel Greenberger, Alain Aspect, David Mermin, Michael Horne, and Helmut Rauch. Their remarks were helpful for the writing of this book, and I would like to thank them all for their time and effort. I would also thank Shan and Elisa Nocente from the Naughton Gallery for permission to use the gallery's pictures of Karl Emeléus and William McCrea in this book.

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1

A Tough Start but a Good One

Belfast and politics

Perhaps surprisingly, Belfast in 1928 was relatively peaceful, which was in marked contrast to earlier in the decade when, between June 1920 and June 1922, more than 450 people had lost their lives in violence in the city [1].

The Government of Ireland Act, which was introduced in Parliament in February 1920, had partitioned the country into Northern Ireland, which consisted of six counties in the north-east, and Southern Ireland, the remaining 26 'southern' counties, actually including the most northerly county of all, Donegal. Each part would have broad control over its internal affairs and its own parliament, although each would also be represented in the national parliament; their relationship to the Crown would be unchanged, and they would have no powers over such matters as war and peace, or external trade [2].

In the north, where two-thirds of the population were Protestant and keen to maintain the union with Britain, the proposition was accepted with some degree of alacrity, but Catholics, in the north as well as in the south, where they were in a great majority, were determined to obtain full independence and a republic for the entire island, and the guerrilla war run by the Irish Republican Army (IRA), which had been in operation since the beginning of 1919, continued, being particularly intense in the north, where it was largely against the Unionists rather than against the British as in the south [1].

Eventually, there was a truce between the British and the IRA in July 1921, leading in December to the Anglo-Irish Treaty, which was signed extremely reluctantly by the Irish side because it confirmed partition and, although it provided for an Irish Free State, gave it only dominion status within the empire. Also, members of the southern parliament would have to take an oath to the Crown [2].

A government in the south was set up under Michael Collins, but strong opposition came from those determined to accept nothing less than a republic. Collins was playing a double game with the British, working with them to establish change and face out the republicans in the south while hoping to keep the two sides in the south together by organizing unrest in the north. But it proved impossible to avert a civil war in the south, and this began in June 1922 [1].

The war made it impossible for southerners to provide any support to the IRA in the north, while in the north itself in April the new Unionist

government had introduced the draconian Special Powers Act, under which internment without trial was now taking place. The combined effect of these two factors was to cripple the northern IRA [1].

In the south, the pro-Treaty side had won the civil war by May 1923 and, while regretting partition, they were certainly not prepared to oppose it physically. Rather, nationalists and republicans, north and south, put their trust in a promised Boundary Commission, which they hoped, and Unionists feared, might transfer substantial areas from north to south and thus render Northern Ireland ungovernable; however, by 1925 it became apparent that the Boundary Commission was a damp squib. Ireland was frozen into a pattern none had particularly wanted but which would remain, challenged in word but hardly in deed, until the violence of the late 1960s and early 1970s. (A bombing campaign in England just before the Second World War and an IRA border campaign in the 1950s were largely ineffective) [3].

In Northern Ireland, the Unionist government enhanced its power by abolishing proportional representation for local elections, by some gerrymandering of constituency boundaries, and through some discrimination in jobs and housing, the extent of which may still be debated. The Catholic response was little more than sullen non-cooperation. There were certainly frequent individual sectarian scuffles, and indeed large-scale sectarian riots in 1935, although the riots of 1932 were of Catholics and Protestants protesting side by side against the cutting of employment relief; but, overall, Belfast and the rest of Northern Ireland were probably less troubled than many other countries in the 1930s and 1940s [3]. There was not a single sectarian murder in Belfast between 1923 and 1933, while the ordinary crime rate in Northern Ireland in these years was perhaps the lowest in Europe [4].

All this is to explain why, during the first 22 years of his life, which was spent in Belfast from 1928 to 1950, John Stewart Bell was in more danger from wartime German bombs than from communal disturbance.

Family background

John Stewart Bell (Figure 1.1) was born on Tate's Avenue, Belfast, on 28 July 1928 [5, 6]. He was the first son of Elizabeth Mary Ann, known as Annie, and John, known as Jackie after his mother's pet name for him; to avoid obvious confusion, John Stewart Bell was always known as Stewart at home. Annie and Jackie had been married in 1925 in St Anne's Church of Ireland Cathedral in Belfast. They were quite young at the time—Jackie was 21 and Annie just 18. Their first child, Ruby Jane, was born in December 1925, and after John came two more boys—David Andrew, born in February 1930, and Robert, born in December 1932 (Figures 1.2 and 1.3).



Figure 1.1 A young John Stewart Bell. Courtesy Ruby McConkey.

Both Annie and Jackie were members of large families—eight or nine, and the families had lived in the north of Ireland for many generations. Annie's father came from Enniskillen in County Fermanagh, where his family, the Brownlees, had been well known since the sixteenth century, and her mother from County Tyrone; these were two of the counties that were to become part of Northern Ireland. Before that, at least part of Annie's family had come from Scotland, and the name Stewart was a reminder of that—her mother's family had been called Stewart long ago.

In fact, Annie's family had suffered a drastic fall in status at the beginning of the twentieth century. Her father had owned a prosperous grocery and baker's shop in Enniskillen, and the family was well off at that time. Annie's oldest brother went to Royal Portora School, one of the most famous schools in Ireland, and the family had employed a nursemaid and a housekeeper. But around 1904, disaster struck; the shop was burnt down, there was no insurance, and the family were reduced to penury. Annie's father refused to stay as a 'working man' in a town where he had been a 'gentleman', and that was when the family moved to Belfast to pick up the pieces of their lives. Annie was the first of the children to be born in Belfast.



Figure 1.2 A family outing: Mrs Brownlee (Bell's grandmother), Ruby Bell, and Annie Bell, behind; David, John, and Robert in front. Courtesy Ruby McConkey.

Annie's mother worked as a dressmaker, and somewhat later for a time ran a corner grocery shop on Tate's Avenue. Her father undertook whatever jobs came up. For example, when the Tate's Avenue Bridge was being built in the 1920s, he was in charge of security, and even into his 80s, he undertook security at a local school. Ruby, his granddaughter, remembers that in those days he was still always the gentleman, but he carried a silver-headed walking stick and could deal with anybody! When he died in 1940, he was buried in County Fermanagh, and the town of Enniskillen came to a standstill for the funeral.

Jackie's family came from a rather less privileged part of society. For generations, their main activity had been dealing in horses, which would be bought at various fairs—Comber, Moy, and Lisburn, and sold primarily by word of

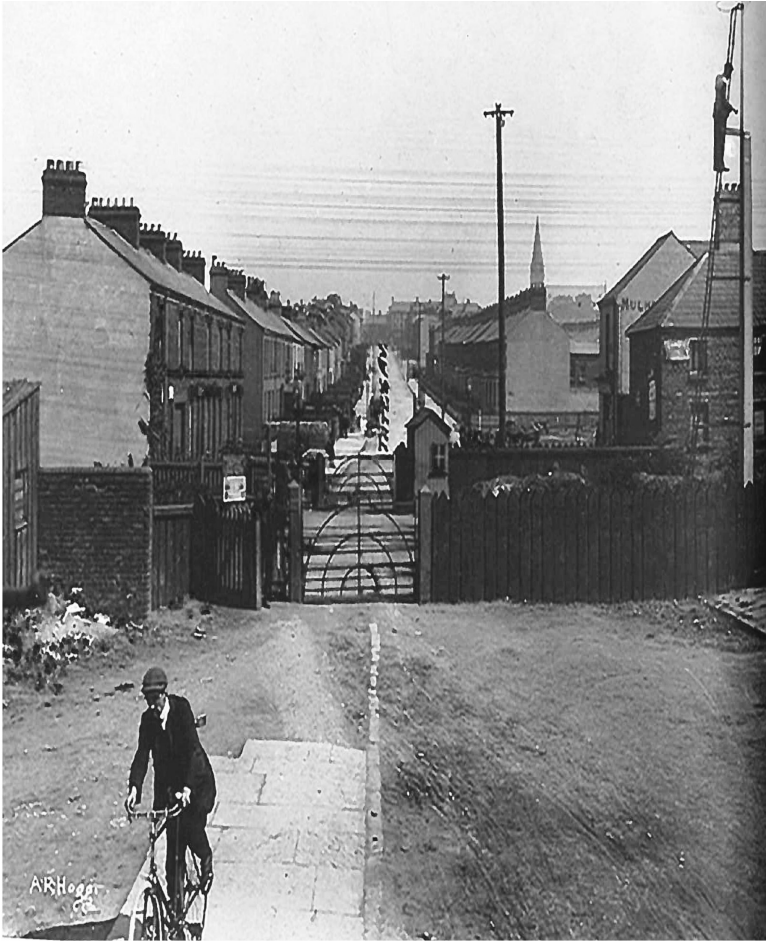


Figure 1.3 Tate's Avenue, from the far side of the railway in 1915, before the building of the bridge. The original family home, in which all the children were born, was on the left-hand side, quite close to the railway. Courtesy Public Record Office of Northern Ireland.

mouth in Belfast. Before being sold, the horses would be kept in fields behind the houses in the various roads where the family lived.

Many years later, when Jeremy Bernstein [5] asked John about what occupations members of the previous generations of the Bell family had had, as well as horse dealing, John mentioned carpentry, blacksmithing, manual labour, and farm work. When he was asked whether there were any scientific or academic traditions on either side of his family, he replied that, as far as he knew, there

weren't, except that a half-brother of his mother had been a blacksmith and had taught himself something about electricity. However, Ruby remembers Annie's pride that in a previous generation there had been a 'Reverend Brownlee'.

By the early twentieth century, both Annie and Jackie's families were in Belfast, and in fact both Annie and Jackie were born within a few hundred yards of where John himself was to be born 20 years later. They were actually briefly at the same school, St Nicholas' Church School just off the Lisburn Road, but they did not talk to each other, because girls and boys had separate classes and in any case did not bother with each other.

This only lasted until Jackie was 6, when he left school to help with the family finances by buying and selling horses. However, working at this age was against the law and, when he was 8, the school attendance officers caught up with him, and he was returned to school until he was 11 years and 10 months old, in July 1918. His attendance may not have been exemplary, but the law seems to have been enforced rather half-heartedly, and only occasionally did his parents have to pay fines for his non-attendance.

Then, Annie and Jackie fortuitously met again at an Orange bonfire—an event held on the evening before 12 July, when Protestants like to celebrate the Battle of the Boyne and the triumph of William III ('King Billy') at the end of the seventeenth century. Happily, their marriage soon followed.

Up until the Second World War, though, employment opportunities in the less well-off areas of Belfast were modest—in this respect, the inhabitants of Belfast were no different from most working people in the large cities of the United Kingdom. In Annie's word, the depression of these years was 'dreadful'. Belfast was very badly hit. Around the turn of the century, it had been a great industrial city, perhaps leading the world in linen and shipbuilding, but by the 1930s these industries were in desperate trouble [4]. Most ordinary people worked at whatever jobs they could get—labouring, factory work, small-scale trading, and so on.

The Bells were certainly not immune from these pressures, but, as Ruby has said, while Jackie did not much like heavy work, he was prepared to turn his hand to anything. He retained his family task of horse dealing, to which he added dealing in horse-drawn vehicles. Robert has said that, between 1924, when he bought his first horse-drawn vehicle, and when he joined the army in January 1940, he had bought and sold over 350 horses and over 200 vehicles.

In addition, he developed a business as a fruiterer, which was sufficiently prosperous that he was able to employ two of his own brothers. For this purpose, he operated a series of horse-drawn vehicles, including a flat-back lorry, then a butcher's van, and finally a trap. These vehicles were also available for family use, such as for picnics at the Black Mountain on a Sunday after Sunday school. For example, Ruby remembers one 12 July when he took the family out to the country, then returned to Belfast and spent the remainder of the day ferrying people between the furthest tram stop and the 'field' where the Twelfth celebrations took place.

Jackie is stated to be a fruiterer in the records of his own wedding and the birth of David, the couple's second son but, at the births of his children in between and after those dates, he is stated to be a labourer. It seems that, on the latter occasions, the births were registered by an aunt.

Incidentally, at one time Robert was amazed at the large number of neckties that Jackie owned; Jackie explained that a necktie was the standard present from customers to purveyors of fruit and vegetables.

After his death, Annie's view of her husband was that he had 'never had a chance', but that if he *had* had a chance, he could have done well.

Annie herself certainly had far more ambition than Jackie did, perhaps not surprisingly, considering her family's fall from prosperity. John commented that while her family was not actually richer than that of her husband, and indeed not even better educated, they did have more respect for knowledge and getting on in life.

It had originally been intended, following the suggestion of her teacher, that Annie might herself become a teacher. However, this plan was abandoned when her father applied for a job in a local shop. There was no job for him but he was told that 'if he had a wee girl', she could be taken on, and that was the end of any ambitions for Annie to be a teacher.

She worked in several shops, including Woolworth's, but also, following her mother's example, was self-taught as a dressmaker, and at the time of her wedding was listed as a 'stitcher'. In fact, she was a 'sample embroidery stitcher' and, even after her marriage, she maintained very close links with one particular linen manufacturer. When they received a special order from a 'Big House', Annie would be sent for to take charge of the order, much to the annoyance of the full-time workers who did not possess her skills.

Indeed, as a private dressmaker, she was 'stitching night and day' for her customers, and also for her own family, making use of any leftover piece or scrap of material that happened to be available; for example, she was to make John's academic gown out of an old blackout curtain.

Annie was determined to maintain family life as pleasantly as possible within the limited finance. She was undoubtedly intelligent—when her mother ran the corner shop, it was taken for granted that Annie was 'the bright one' who would do the books. She was articulate and resourceful [7]; and she was particularly keen that her children should advance beyond the constraints of Tate's Avenue and the like. In later years, she would happily travel to visit John in Harwell and Geneva, and David in Canada, while her husband preferred to stay at home in Belfast.

Yet, while Annie was certainly the power behind the family, and the success of John and her other children was undoubtedly a result of her hard work, drive, and ambition, John's cousin, David Bell (Figure 1.4), stressed that the ability in the family ran far wider than that. (David Bell's father was one of Jackie's brothers and was around 20 years younger than Jackie.) David believes that both Annie and Jackie were highly able and, indeed, that the same was true, at least



Figure 1.4 Jackie Bell, John Bell's father, assisting his nephew, David Bell, to see over a Tate's Avenue wall, around 1947. Courtesy David Bell.

in broad terms, of their substantial numbers of siblings; and the sad thing is that most of them, as well as the children of the elder ones, were held back by lack of educational opportunities. Once education at secondary and even tertiary levels became available, they flourished and, in fact, while John was at university, three of his cousins were at the prestigious Methodist College.

Just as a typical example, David himself became a Professor of Computer Science at Queen's University Belfast, and his brothers, Jonathan and Paul, became respectively Head Curator at the Ulster Folk and Transport Museum, and a consultant psychiatrist and Medical Director to the South and East Belfast Health and Social Services Trust.

As another example of the success of the Bell dynasty, another of John's cousins, William Bradshaw Bell, always known as Billy Bell [8], son of an elder brother of Jackie, who was born in 1935, became a well-known local politician. According to *Wikipedia*, he is the only person to have been mayor of two different cities in the United Kingdom: Belfast, from 1979 to 1980, and Lisburn, in 2003.

Family life

Tate's Avenue is in South Belfast, which contains most of the more prosperous parts of the city. The road south from the city centre splits into two roads

diverging somewhat but both running broadly in the direction of Dublin. To the east, University Road, which becomes Malone Road, is the home of the Ulster Museum, the Botanic Gardens, Queen's University, and much middle-class housing; some of the upmarket streets in this area run down to the more westerly of the two roads, the Lisburn Road, which itself contains housing and a wide variety of commercial activity.

The railway line to Dublin is to the west of the Lisburn Road, and most of the streets that lie to the west of that road, on both sides of the railway, are rather less prosperous than those on the east side. The most substantial road travelling west from the Lisburn Road is Tate's Avenue, which provides one of the few crossing points of the railway. In the 1920s, the area around this road would have been, as indeed it largely remains today, staunchly Protestant and working class. Houses were mostly fairly small, with the provision of facilities in some cases rather moderate.

Yet, living in the area would have been very far from unpleasant, partly because, perhaps as it was a little way from the city centre, the density of housing there was relatively generous, compared to that nearer the city centre. It was also pleasant to be near the amenities of South Belfast, such as Queen's University, whose proximity was handy for John during his time there, and the Lisburn Road shops.

Mostly, though, it was because, as you walk up Tate's Avenue, you are walking towards the delightful vista of the Black Mountain, which is part of the Belfast Hills (Figure 1.5). Whatever the season or the weather, just to have the mountains in view must be uplifting. In his poem 'Spring in Belfast',



Figure 1.5 Tate's Avenue: 'The hill at the top of every street' (Derek Mahon). Courtesy Joan Whitaker.

Derek Mahon [9] wrote: 'We could all be saved by keeping an eye on the hill at the top of every street', and he may well have been thinking of Tate's Avenue!

Annie anyway thought that it was lovely. At this time, there were fields at the end of Tate's Avenue and it had practically no traffic. Nearly a century later, it leads to the ring road linking motorways to north and south, and a road of out-of-town shopping, warehouses, and car showrooms, and Tate's Avenue itself is extremely busy; but, at that time, in Annie's words, it was like 'a wee country village', and the children could roam to their hearts' content.

All the children were born at No. 129, on the east of the railway line (Figure 1.3); however, this situation was not ideal as, in the mid-1920s, a bridge had been built over the railway and, as this bridge increased in height towards the railway, the houses near the railway ended up very much in its shadow. Also, there had once been a field beside the house where the children could play; at about this time it was fenced in for a builders' yard, and Annie was not prepared to accept this.

So, for the benefit of the children, in 1936 the Bell family moved along the road to a new house at No. 240 (Figure 1.6), almost at the end of the road, on the far side of the bridge, and well away from it and close to the fields. Robert has written the following about No. 240:

The house was a new one in a new development. The streets were new and the pavements were new. The block of shops had been recently built. Tate's Avenue Bridge was an impressive modern construction. The whole area was bright, clean, and modern. The green fields started at the end of the block of houses in which we lived, and stretched off into the distance. Those fields were the floodplains of the Blackstaff River. After heavy rain the ponds filled up, and the swans and wild duck arrived with even more than the usual number of seagulls. In the early mornings we heard the call of the corncrake, and in the late evening a curlew. The place at that time was semi-rural and not a bad place to live.

And Annie was delighted that the rent of the new house was three shillings a week less than that for the old one!

The houses in the vicinity of their first home, incidentally, have been knocked down comparatively recently to build a complex of flats.

In later life, Annie would become irritated with commentators who, with the best will in the world and in order to show how far John had risen, emphasized the low financial status—perhaps 'poverty'—of the family. She insisted that they—in particular the children—had everything that was necessary for a good life. She was a great budgeter; Ruby was to say that she made two and sixpence do the work of five shillings, and every Saturday morning she would put out on a window ledge the money for milk, coal, groceries, and so on.



Figure 1.6 The house in which the Bell children were brought up from 1936: 240 Tate's Avenue. Courtesy Joan Whitaker.

She was able to buy the children bicycles—second hand but, as she said, they had just as much fun on them as if they had been new and, in any case, as Robert has pointed out, in wartime there were no new bicycles to be had.

She also tells the story of how, once John had become a vegetarian, at Christmas time when he smelled the turkey cooking he would remark

'I smell a corpse burning.' This story makes the point of his sincerity as a vegetarian, and perhaps also the intolerance of a vegetarian to those who have not yet taken that leap of conscience, but it does also speak of at least a modest affluence—even at Christmas, in those days before battery farming, a turkey was a very good meal.

Indeed, despite financial strictures, life must have been pleasant enough. Annie, feeling that her own parents might have been too keen on keeping the children in and not letting them mix, made sure that all the children got out of the house; they went for cycle rides and took long walks up in the nearby hills, to the Cavehill further north, or in other directions. Later, when John was married, his wife Mary also enjoyed these walks. He himself hated actual sports at the time and, as he said, grew up to be 'a seven-stone weakling', although he later regretted this, and in Geneva he was to become an enthusiastic skier. Neither was he interested in scouting when he was in Belfast; in this he was different from his brothers, who were keen scouts—David was to become a scoutmaster.

All the family had many friends and in those days it was natural for many of these friendships to be 'cross community', which is to say, between Protestant and Catholic. As part of her dressmaking business, Annie indeed used to make First Communion frocks for many of these Catholic friends. Living in such a staunchly Protestant area, there was obviously scope for getting involved in political activities, such as the Orange Order, and Annie in particular was a strong supporter, but John was probably much too interested in books and ideas to have any concern with what, to him, would have seemed a waste of time.

The family, though, were brought up soundly in the Protestant faith. They were Church of Ireland, which is, like the Church of England, part of the Anglican Communion. John was baptized in St Aidan's Church, which is a few hundred yards towards the city centre from his home. The choice of church was to please Annie's mother, as it was near her home, where Annie herself had been born. However, the Bells' home was in the parish of St Nicholas on the Lisburn Road, and it was here that the family worshipped, with Sunday school for the children and then church in later years. John, dutiful as ever, was awarded a number of prizes for attendance. All the children were confirmed in this church, and indeed Annie herself had been confirmed there much earlier. However, John was not to remain in the fold for much longer.

Early education

Jackie thought it was natural that the children should leave school at the age of 14 and get a job. In contrast, Annie was extremely keen on her children

being well educated, so that they might move beyond the type of work of work their parents were limited to. She pointed out the workmen on a wet day and told them that she didn't want her sons to be digging drains for the rest of their lives. She advised them to use their brains and get educated because it's more comfortable—then they could wear their Sunday suits every day! (Years later they were able to tell her that they were always wearing their Sunday suits now, although John, in particular, was usually more casually dressed.)

John needed no encouragement to become absorbed in books and learning. From an early age, he was much in the local Donegal Road public library, absorbing all the information that he could, information that he then proceeded to analyse in depth. He was very generous with the fruits of this analysis, forever dispensing knowledge to all the members of his family, to the extent that they called him 'The Prof'. Even at such a young age, they recognized his brilliance, and by the age of 11 he had read enough to tell his family that he wanted to be a scientist. Annie's natural response was 'What's a scientist?', and he did his best to explain the idea to her.

His interests were not confined to books; in fact, just like his father, he was extremely practical, although he took no interest in his father's actual work, unlike Robert, who enjoyed feeding the horses. John was concerned with experiencing every aspect of life; indeed, when he was knocked over by a car, which was fortunately not travelling too fast, his first action when he was back to his feet was to get paper and pencil and draw the underside of the car.

At school, he was equally outstanding. His first school was Ulsterville Junior School, near Tate's Avenue and the Lisburn Road, and right away he was exceptional. He was always at or near the top of the class—good in all subjects, no better or worse in mathematics than in any other subject.

However, tragedy was quite close to striking. Over the summer holidays, when he was 7, he became exceptionally ill with whooping cough, to the extent that his parents were warned that he might not live. Thankfully, he made a good recovery; but, when school recommenced in September, Annie did not immediately take him back, rather waiting until she thought he was ready.

When she did so, she suggested to the teacher, Miss Nora Rankin, that he should be kept down a class until he was recovered. Miss Rankin replied: 'Oh, but he's one of my best.' For all Annie's confidence in his ability, she was pleased to hear this confirmed by someone she would consider to be more of an authority than herself. John was briefly kept down but moved up at Christmas without a problem and so never got behind.

Ulsterville Junior School was a feeder for Fane Street Elementary School (Figure 1.7), to which John moved at the age of 8. In many ways, Fane Street was and still is an exceptional school. Situated on the less prosperous side of the Lisburn Road, the great majority of its pupils at the time, however positive



Figure 1.7 Fane Street School. Courtesy Joan Whitaker.

their parents may have been, came from backgrounds with little social or educational advantage. Through the years, it has struggled with population movement and with constant changes in educational policy, being successively elementary, secondary, and then primary in educational level.

Despite this, it has maintained an excellent reputation with employers and produced quite a number of very successful men and women. Indeed, in recent years, one of its former pupils has achieved the feat of becoming Head of the far more upmarket Methodist College, which is definitely on the prosperous side of the Lisburn Road!

Clearly, it was exactly the right school for John, and he thrived. The headmaster, Mr Thompson, called in Annie to say just how good her son was, and it seemed John had the ability to go on to great things. But here lay the rub! At 11, pupils could either keep going at Fane Street for a further three years and then leave to get a job, or they could move on to secondary education, grammar or technical. But secondary education was not free in Britain at the time. That was shortly to come to England in 1944, although because of wrangling between the various religious providers of education, it did not reach Northern Ireland until 1947 [4]. But in the 1930s and early 1940s, the only way

for children from backgrounds that were not particular well off to get to secondary school was via scholarships.

In fact, none of John's siblings (Figures 1.8 and 1.9) went to secondary school; all left school at 14. This was definitely not because of any lack of ability. Ruby, the eldest, actually obtained a City of Belfast Scholarship to go to Methodist College but could not take it up because her father in particular thought that it was 'not worth educating a girl'. Annie had thought that she might become a music teacher, and for many years Ruby hurried home once a week to get her music bag for her piano lesson, which cost a shilling. Ruby obtained four certificates for piano, but then, at the age of 14, she began playing with a band and formal study finished; Annie's dream was gone and she was certainly not amused!

Ruby left school to become a shop assistant, but her career developed and she became a fashion buyer and works study expert. After the factory where she was working was bombed in 1969–70, she took a job in telesales with the local Newsletter and stayed there 17 years, rising to become circulation, sales, and PR manager.

Both of John's brothers came to regret leaving school so early. Robert followed John in becoming a laboratory assistant in the physics department at Queen's University, and he enjoyed working with all the equipment. However, to get any qualification, he had to move to one of the largest engineering establishments in Belfast, which he came to detest. Perhaps his commercial nature, inherited from his father and grandfather, came out, as he later became the proprietor of a successful shop selling radios in Belfast; when the bombing made this difficult, he moved to Bangor, where he sold domestic electrical equipment.

David made rather a remarkable climb back to the academic world. He left school to work in a shop, but, when Annie discovered the lowly tasks he was undertaking, she took him away and asked Sam McConkey, who had married Ruby in 1947 and who was a qualified engineer, to take him on as an apprentice. David was happy and successful in this work, but, like Robert, he had to leave to become fully qualified. In his new position, he moved on to study at night school and then to day release, eventually obtaining a degree in electronic engineering by night study.

He spent the years between 1954 and 1956 in Canada with his company, and then in the early 1960s he returned to Canada and became a Lecturer in Lambton College. Discovering that there was a shortage of textbooks, he decided to write his own, and he has since become the author of a considerable number of successful texts. In Canada, David was a staunch trade unionist, and indeed he was chosen to be a candidate for the Social Democratic Party in a coming election but had to withdraw because of the illness of his wife.

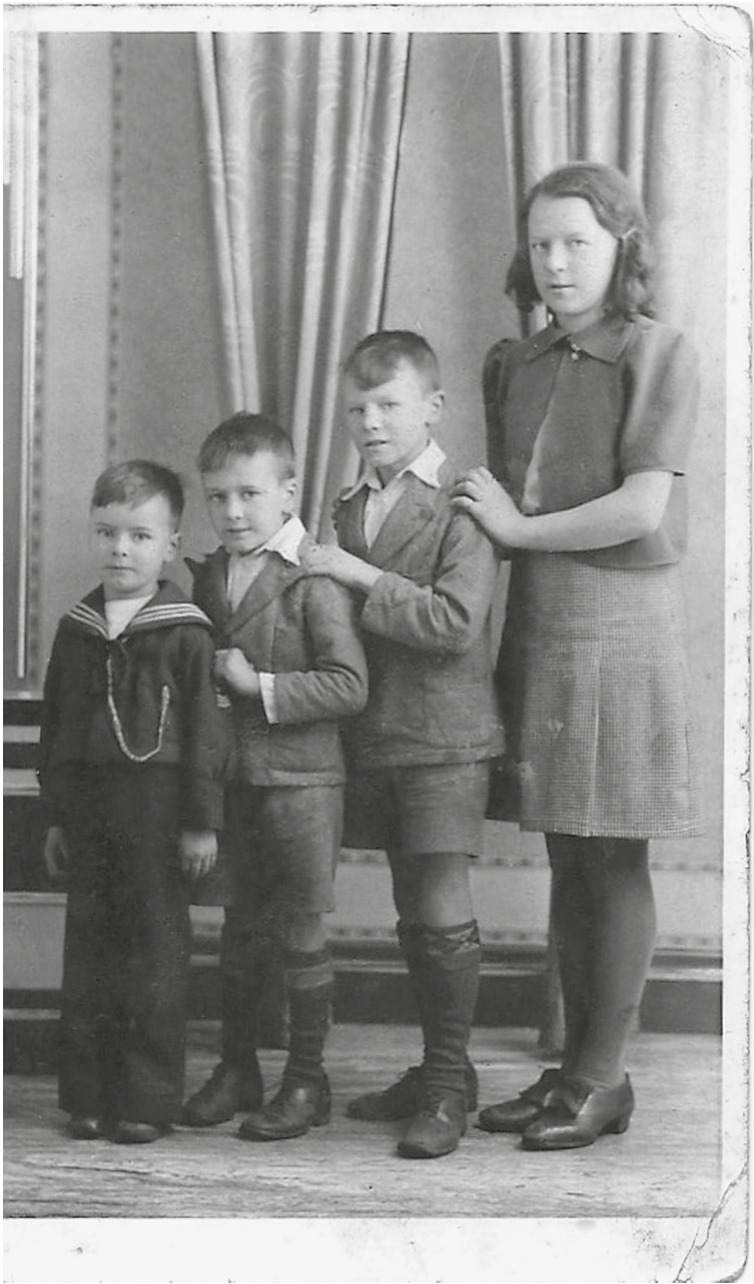


Figure 1.8 The Bell children—Robert, David, John, and Ruby—around 1936. Courtesy Ruby McConkey.



Figure 1.9 To the left, Annie Bell, behind, and David and John, in front; to the right, Mrs McGarry, behind, and Sis McGarry, in front (friends). Courtesy Ruby McConkey.

However, to come back to John, it was clear that 1939 would be a fateful year for him. Would he be able to enter a secondary school, preferably a grammar school, where he would be able to develop his obvious ability, or would he be forced out into a world that would be more hostile than that and where progress would be more precarious?

That might be described as rather a parochial view of the world! Clearly, it would also, indeed primarily, be a fateful year for the world, as it lurched into the Second World War. The war would also have specific consequences for the Bell family.

The war and the Tech

During the war, there was never to be conscription in Northern Ireland [10]. The Unionist community might have liked it, as it would have demonstrated and built up the links with Great Britain, but it was felt that the risks of alienating the nationalist community to perhaps open revolt were too great. Nevertheless, many from both communities, and indeed many from Southern Ireland, which remained neutral, did join up, and many others travelled to England to carry

out war work. For some, the spur was the desire to support Britain in her hour of need, or to defeat the National Socialist government in Germany. For others, it may have been the lure of a regular job and a steady income.

Jackie was among those who enlisted. He was to fight through the war in the Royal Ulster Rifles, becoming a corporal, although he was seriously wounded in the stomach. It seems that his joining up was something of an accident, since he went with two friends to the recruiting office, expecting to be turned down. In fact, although his friends were turned down, one for flat feet and the other for a twisted spine, Jackie was accepted. He had to sell his horses, but he promised Robert that he would recommence the horse dealing after the war. Unfortunately, his injury prevented this from happening.

Ironic as it may seem, after the terrible depression the war brought a measure of prosperity back to Northern Ireland, with a vast number of jobs in war work. During the war, the shipbuilding company Harland and Wolff built almost 170 Admiralty and merchant ships and repaired over 30,000 vessels; they also made more than 13 million aircraft parts, more than 500 tanks, and thousands of guns. The aircraft makers Short and Harland made well over a thousand Stirling bombers and a hundred Sunderland flying boats [4].

In addition, Northern Ireland profited from the presence of an enormous number of American soldiers, who proved to be well-off customers for businesses of all types. Over the full duration of the war, more than 300,000 American troops were stationed at different times in Northern Ireland.

For John, the sad fact was that, for his education to go forward, he was totally dependent on obtaining a source of finance. He passed the qualifying examination for secondary school, presumably with ease but, as already said, tuition at secondary school was not free; it was not even cheap. Within a decade, free secondary education would become available but, at that time, his parents were not able even to consider sending him to any secondary school without financial support, which would probably have to come from a scholarship.

Annie would certainly have loved him to go to the Royal Belfast Academical Institution, known to all as 'Inst' (Figure 1.10). This school occupied a prominent site near the centre of Belfast, and it had an important place in Belfast hearts. It had been founded in 1814 at rather an interesting time in the history of Belfast [11, 12].

In the eighteenth century, there were three main classes of people in Ireland. At the top were members of the Church of Ireland—Anglicans or Episcopalians, who had full right to own land. Decidedly at the bottom were Catholics, who were effectively deprived of rights by the Penal Laws. Rather awkwardly in the middle were Presbyterians, who were at least formally affected by the Penal Laws—for example, their children were illegitimate unless the parents had been married in a Church of Ireland church by a Church of Ireland clergyman—but they were allowed to own land as a

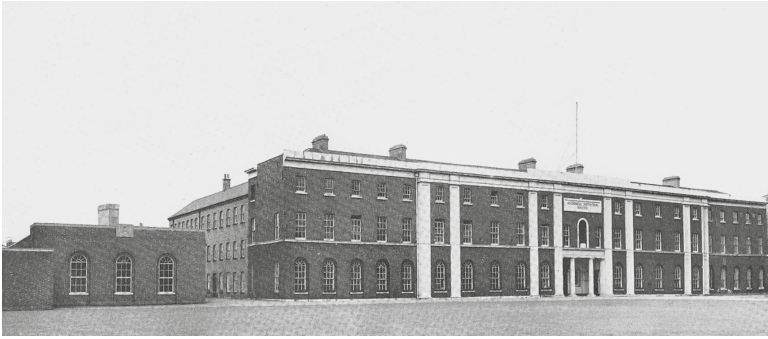


Figure 1.10 Royal Belfast Academical Institution, or ‘Inst’, c.1960, from John Jamieson, *History of the Royal Belfast Academical Institution 1810–1960* (Mullan, Belfast, 1959). Courtesy Royal Belfast Academical Institution.

privilege. While the other two groups lived in all parts of Ireland, Presbyterians were mainly in the north-east [4].

At the end of the nineteenth century, with revolution in the air in France and America, it was not surprising that there should be a rebellion, that of 1798, in Ireland, but what may be surprising is that the leaders of the so-called United Irishmen included Presbyterians as well as Catholics. Indeed, in the north, those taking part were virtually all Presbyterians. The rebellion was put down violently, the main result across the country being the Act of Union, under which the Irish Parliament was closed down and the governments and parliaments of Great Britain and Ireland were united. The Union was to last until 1922 [4].

In Belfast, the rebellion heralded a period of liberalism, and it is interesting that some of those who must have come quite close to being hanged in 1798 rapidly became pillars of the establishment. Several liberal institutions were founded which have lasted to the present day, including the well-known Linenhall Library.

The most important was Inst, then, and until 1831, without its royal title, as the powers that be were perhaps justifiably suspicious of the radical republican motives of its founders. As well as a school department (for boys only), it doubled as a college, on the model of a Scottish university, and at the time had medical and theological faculties. James Thomson, father of William Thomson, later Lord Kelvin, who taught at both levels and was Professor of Mathematics in the Collegiate Department, was the dominant personality until his move to the University of Glasgow in 1832 [11].

The school had been founded by public subscription among Belfast’s citizens, specifically to provide a liberal and non-sectarian education, and also a practical one, dedicated ‘to diffuse useful knowledge, particularly among the

midling orders of society, as one of the necessities rather than of the luxuries of life; not to have a good education only the portion of the rich and the noble, but as a patrimony of the whole people'. Its building is perhaps the finest example of late Georgian architecture in Ireland [12].

By 1939 the college and medical areas had long gone to Queen's College (later Queen's University) and the theological work to the Presbyterian Church's own college, but the school was strong academically and had a good interest in physical science—two of the houses were named after Kelvin and Larmor (Sir Joseph Larmor, a former Inst boy and Queen's student, later Lucasian Professor of Mathematics at Cambridge).

It will be clear that the school would, and probably should, have been ideal for the (comparatively) poor but brilliant John, who was certainly desirous of good middle-class employment. But it was not to be. He took the examination for the scholarship but was unsuccessful, and this was repeated when he took scholarship examinations at Methodist College and all the other grammar schools in Belfast. John was later to wonder whether this gruelling experience put his brothers off going through the same process.

One may wonder why such an obviously gifted boy was so uniformly unsuccessful in being awarded a scholarship. The disappointment certainly could not be explained by any feeling that he was admittedly very good at mathematics but perhaps not so good at the other subjects—as already stated, he was an all-rounder academically, good at everything.

The explanation must lie in the fact that the grammar schools had preparatory departments, which parents paid for their children under the age of eleven to attend. If children were reasonably bright, when they were 11 their parents would enter them for the scholarship examination, so as to avoid having to continue paying fees for secondary education; clearly, these children would have 'an inside track' for the process—useful hints and much-needed confidence. Also the private tutor system was well established; parents could and would pay out money for tuition directed solely at the exam, in the hope of their child being awarded a scholarship, thus saving money in the long run. The boy from Tate's Avenue and Fane Street School, however talented, would probably stand little chance. Again, one must think with sadness of the loss of talent.

Yet, at the last moment, money did turn up—not for any of Belfast's prestigious grammar schools, but for Belfast Technical High School. The source is not quite clear, but, from John's application to Queen's University in 1945, it seems that he had a scholarship of around seven guineas for at least three years, a guinea being one pound and one shilling. Today, the scholarship might be worth around £350. For Annie in particular, sending her son to 'the Tech' rather than, say, Inst, must have seemed a great let-down. As things turned out, though, it gave John all that he needed.

Strangely enough, the Technical High School [13] has had a symbiotic relationship with Inst. In 1899 the Belfast Corporation felt that it was essential that

the city should have a fine, up-to-date technical college (Figure 1.11), largely for part-time evening instruction of apprentices and workers in the shipbuilding, textile, and machinery industries. Unfortunately, though, there was no suitable site in or near the city centre.

At roughly the same time, the governors of Inst found that their debt, which had been large for many years, was spiralling upwards. They were told that the land in front of the school was worth between £100,000 and £200,000, perhaps between 8 million and 16 million pounds today, and they were eventually persuaded in 1902 by the Lord Mayor to lease in perpetuity a strip of the front lawn of size 240 ft by 205 ft for £1,350 a year to be used for the new technical college.

The college—originally the Belfast Municipal Technical Institute—was completed in 1907. It was built from Portland limestone and is in a fine baroque style, but its uncompromising massive frontage, blocking the view of the unassuming but stylish Inst building, has been described as ‘an act of extraordinary



Figure 1.11 A view of the College of Technology at the time of its foundation c.1907, from *Municipal Technical Institute Belfast: Description and Illustrations of the Buildings and its Equipment* (Belfast Municipal College of Technology, 1907). Courtesy Belfast Metropolitan College.

architectural vandalism' and 'the largest and most ornate cuckoo's egg ever laid in a songbird's nest'.

This would have been of little concern, of course, to John (Figure 1.12), who must have been far more concerned about the course of study he would follow, how he would get on with his teachers, and how well he himself would fare in an environment which might be rather more challenging than those he had been used to.

In fact, he was to follow a course leading to matriculation (Figure 1.13), which would allow him to enter Queen's University in the city, still with the same proviso—if he were able to generate the necessary money. Many of the subjects he would study would be the same and probably have much the same



Figure 1.12 A youthful John Bell. Courtesy Ruby McConkey.

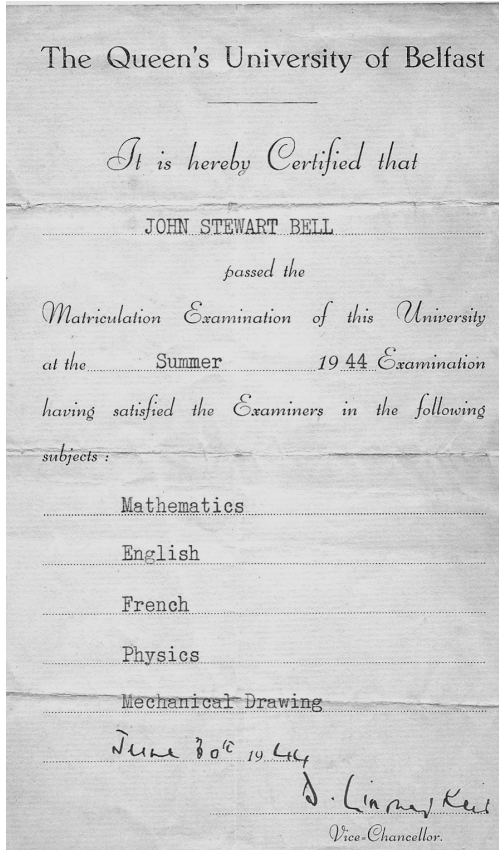


Figure 1.13 John Bell's matriculation certificate for Queen's University Belfast. Courtesy Ruby McConkey.

content as he would have had to follow at a grammar school—English, mathematics, French, physics, chemistry, and so on; but, whereas a grammar school boy would have studied Latin, and perhaps Greek, the curriculum at the Tech included instead bricklaying (though theoretical only), carpentry (which he enjoyed), and bookkeeping (which he didn't!).

As to his teachers, in fact he was able to assert to Bernstein that he had found all of them, not only those at the Technical School but also those at Ulsterville Avenue and Fane Street to have been not only excellent in imparting and explaining information but also helpful to the individual student. He felt that he had been very lucky throughout his education.

And, if he had been at all concerned about his ability to do well, he need not have been. Annie was to find this out when he brought home the first list of marks of the various students and she saw that his name was at the top. Initially, she thought that the list must have been alphabetical and that his name was at the top just because he was a 'B'. 'No, Mummy', he said; 'It can't be like that because there's a fellow called Adams and he's about seventh!' In fact, John was to be top of his classes right the way through the course.

Ruby and John travelled into Belfast together at this time, Ruby to her work and John to school. In fact, they walked the first tram stage to save a little money in order that John might have a few coppers in his pocket.

Being an unaggressive soul, it is unfortunate but perhaps not too surprising that John was bullied at some stage. Ruby found out about this and told him that, while she herself could not hit the boys responsible, she would come with him while *he* hit them. This is exactly what happened, and consequently there was no repetition of the trouble; in fact later on John and one of the boys became great friends.

John enjoyed having fun with his brothers but he was also very close to Ruby. He was conscious of how much he owed to her and sad that, in terms of education, she had not 'had her chance'. So he was delighted when she and Sam were able to send their children to good schools; both children were later to go on to university, with Isabel becoming a nurse and incidentally obtaining a pilot's licence, and Dorothy going on to work in building technology [14].

Meanwhile, the war was not going well for Belfast people. The shipyards presented an obvious target for German bombs but, for some reason, the government did not think the Germans would bother to come so far. They thought that it would be far more natural for their bombers to drop their loads on targets in England than to fly right over England and attack Northern Ireland. It was a fatal miscalculation [4, 10].

By February 1941, John Andrews, by then Prime Minister of Northern Ireland for only three months, realized that the situation was dire. He reported that he was extremely concerned about the lack of anti-aircraft defences, and also the state of mind of the public, who were both physically and psychologically totally unprepared for bombing.

In September 1940, Belfast had been provided with a light balloon barrage, and by the spring of the following year it was protected by 16 heavy and 6 light anti-aircraft guns. Even that scant effort, though, was better than other aspects of preparations of the defence of the city. On 20 July 1940, a Royal Air Force squadron equipped with Hurricane fighters was transferred from Edinburgh, Scotland, to Aldergrove, which is a few miles from Belfast. Unfortunately, though, they could operate fully only in daytime. It seems that official advice was that no major German raid would be at night. In addition, there were to

be no searchlights in the city until 10 April 1941 (too late for at least the first attacks), and no provision for a smoke screen.

On the ground, too, provision for bombing was derisory, even after Coventry and other British cities had been pulverized. (In Coventry alone, 50,000 houses had been destroyed and over 550 people killed, the worst attack being in November 1940.) People in Belfast were told that they could use the city's two underground toilets in case of attack but, in fact, shelters could protect only one-quarter of the population. There had been a plan to evacuate 70,000 children from the city in July 1940, but fewer than 9,000 had taken advantage of this opportunity and, of these, half had returned to Belfast before the bombing began in the spring of 1941. There were plans to deal with only 200 bodies and only 10,000 made homeless by bombing.

As early as November 1940, a single unobserved German plane had flown over the city, bringing back high-definition photographs of suitable targets and reporting back that the defences of the city were totally insufficient. The first bombing mission was on the night of 7 April 1941. A relatively small squadron of German bombers attacked industrial targets—the shipyard and the docks. Again, the report back of the airmen was that Belfast's defences were 'inferior in quality, scanty and insufficient'.

On the night of 15 April came Belfast's night of horror (Figure 1.14). One hundred and eighty German bombers flew from northern France, over Britain and then the Irish Sea, to Belfast. Over a period of 5 hours, wave after wave of bombers swept in, and overall more than 200 metric tons of bombs and 800 firebomb canisters were dropped on the city. The telephone exchange, which provided all communication with Britain, and the anti-aircraft operations room were destroyed, and in this raid, whether on purpose or by mischance, the bombs fell mainly on civilian housing, principally in the north of the city. Many of the smallest houses of the poorest people in the city were destroyed.

On that night, the death toll was more than 900, with around 600 seriously wounded. Up to that point in the war, no city apart from London had so high a death toll in a single night, and indeed through the rest of the war only Liverpool (possibly) was to do so. The air raid warden system operated reasonably efficiently, but rescue service, hospitals, and mortuaries were overwhelmed.

So, unsurprisingly, was the population. All day on the 16th, thousands upon thousands of Belfast citizens 'trekked', leaving the city by car, train, or bus, sometimes the matter of the destination being a secondary consideration to getting out of Belfast for the coming night. Many were billeted in towns and villages in the country, and others crossed the border. By the end of the month, more than 200,000 people had left the city, and many of those who had to stay for their daytime work took to 'ditching' at night—walking out



Figure 1.14 The results of bombing in the High Street, on 16 April 1941. Courtesy Belfast Telegraph.

to suburbs, spending the night in fields, parks, or ditches, where they felt safe, and returning to Belfast in the morning.

Among those on the move were Annie and her children. The children had not taken part in the evacuation of 1940 but, from the beginning of the war, Annie had been keen that the children had friends in to play rather than them being out in the blackout. She hated the idea of them being away if there were to be an air raid and thought they were much safer inside than elsewhere; so, she let them bring any friends in, and most nights there would be two or three extra children in the house.

Then came the raids. For the first, on 7 April, Annie was on her own with the children. They had no shelter and so just sat together all night. They were able to look out of the window and see the planes dropping flares. Most of the bombs fell in the north of the city, but a stray bomb fell in Blythe Street, which was about half a mile from the Bells' house, killing ten members of the same family and demolishing a terrace of houses.

Jackie had been in London for the Blitz there, but he was at home on leave for the raid of 15 April. On the following day, it was like a holiday—nobody worked; nobody did anything; everybody was dazed. But Jackie took action; he

decided that the family should stay with friends in Enniskillen near the border with Southern Ireland for a while.

There were further air raids on Belfast on the nights of 4 and 5 May 1941. These raids were to be known collectively as the 'fire raid'. Two hundred aircraft dropped around 100,000 incendiary bombs followed by high explosives, the targets being chiefly industrial—the docks, the shipyards, and the aircraft factory—as well as the city centre. Because of the trekkers and ditchers, there were fewer fatalities than for the previous raid—under 200—but great damage was done to industry. Harland and Wolff suffered greater damage this night than any other British shipyard on a single night of the war.

By the end of the night, there was not a series of fires but one enormous fire. The fire brigade was completely unable to cope and appealed for help. Rather surprisingly, fire engines were sent up from Southern Ireland on the authority of Eamon de Valera, the prime minister at that time, who put neutrality at risk in obedience to his concept of a united Ireland. In fact, because of the fracture of water mains, there was little that could be done and many fires had to be left to burn themselves out.

After that, there were to be no more major raids on Belfast. The Germans felt that they had devastated the industry of Belfast to such an extent that there was no hope or risk of recovery, although in fact the regeneration of industry, as distinct from housing, was reasonably quick and thorough. Gradually, the ditchers regained the confidence to spend the nights in the city, and the trekkers, including the Bell family, came back to Belfast. Jackie had long since returned to his duties and, for the rest of the war, the family would neither see him nor have any idea of his whereabouts, which were kept strictly secret. John returned to his studies and his other intellectual interests.

As has already been said, he was always very keen to expound his knowledge to anyone who would listen. An amusing example was when the other members of the family were out at the cinema, and a man called to collect the money for the football pools, which, like most people in the United Kingdom, the family did every week. John gave the unfortunate man a lengthy lecture on statistics and probability, pointing out the extremely small possibility of winning.

For a number of years, John and his two brothers were something of a gang with, of course, John as the intellectual leader (and Ruby the unpaid nursemaid who would be in trouble if the boys themselves got into trouble!) This situation may have lasted until John was about 13, when the various interests gradually diverged.

David has said that John was better at card games than anyone else he knew and that he also taught the younger boys how to play chess. David was keen to beat his older brother, and studied numerous library books about chess, eventually working out an original routine which involved sacrificing his queen to

produce a checkmate position. John was almost fooled—but not quite, and David had to admit that he would never beat him! John also constructed an attractive chess set, with the pieces stained black and red.

The boys developed a great interest in photography. John first made a pin-hole camera, with the aid of a mustard tin painted black inside and with a pin-hole in the lid, a piece of photographic paper, and a bathroom/darkroom with a dim red light. Later, he introduced his brothers to the procedure for developing films and making prints. They progressed from Brownie box cameras to cameras with better lenses, and they learned how to tint and hand-colour photographs. John constructed an enlarger so they were able to produce conveniently sized prints, and he was always keen to learn more—he was a regular purchaser of the *Amateur Photography* magazine.

He also introduced his younger brothers to a variety of hobbies—stamp collecting (which entailed learning about the nations of the world), fretwork, constructing boats in bottles, and conjuring tricks. He also taught Robert to ride a bicycle, taking the opportunity to explain the principle of the gyroscope.

One of their great interests was radio, building radio sets from parts. The great place in Belfast for this activity was the Smithfield Market, a wonderful place of covered cobblestoned streets dating from Victorian times, where new and second-hand books, clothing, records, and so on, could be purchased. Sadly, it was burnt down in the 1970s, and the modern Smithfield is a pale imitation of past glories.

At one shop in Smithfield, old radios were taken apart and the parts were put up for sale. Here the boys purchased valves, chokes, transformers, condensers, resistors, wire, headphones, and Morse code keys and used them to construct receivers that could be listened to through headphones. John provided instruction on circuit diagrams, the use of the soldering iron, and how radios actually worked. With more valves, they moved on to sets that did not require headphones, and the coal hole under the stairs became the ‘radio room’, with coal being relegated to the backyard.

Finally, John purchased a microphone, but he used this to shock his family. Secretly, he connected it to the family radio; subsequently, the news reader ‘broadcast’ that Mrs Bell of Tate’s Avenue had won a million pounds in a magazine contest. It took the family a little time to realize that it was only John playing a joke.

There were occasionally other episodes when John may have tried the patience of his elders. When the other boys were young, he taught them not to ask for something; wait and then cry, he told them, and then you will be sure to get it!

Later, in his mid-teens, he must have been bored, because he decided to engrave his initials outside the front door. The carving remains to this day (Figure 1.15).

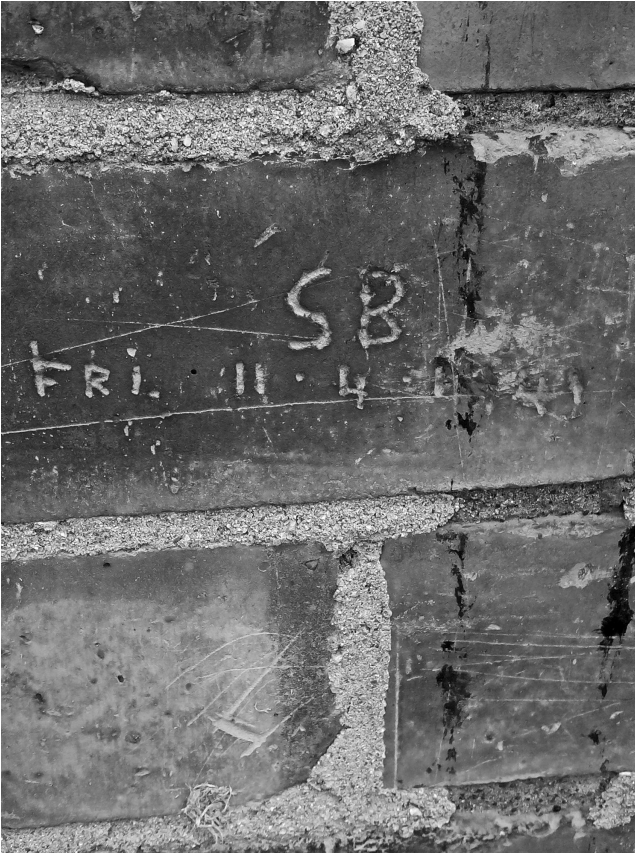


Figure 1.15 John Stewart Bell's mark ('SB', for Stewart Bell; as his father's name was also John, at home John was always called by his middle name, Stewart) at 240 Tate's Avenue, made Friday, 11 April 1941. Courtesy Joan Whitaker.

A roving mind was to lead him, although not by the straightest of routes, to an interest in physics. He had been brought up in the church but, perhaps inevitably, came to wonder whether what he was taught there was true. Annie was very religious, and he used to be sent to two Sunday schools: Plymouth Brethren, and Church of Ireland. Sadly, the two Sunday schools did not agree with each other, the Plymouth Brethren in particular saying that the Church of Ireland was quite wrong!

John was around 11 or 12 at this time and, to decide which was correct, he decided to read the Bible solidly for a week, at the end of which he announced,

much to Annie's consternation, that he did not believe in God! Annie called in the local minister, Reverend John Mercer, to 'sort him out'. He arrived fully confident that he could carry out his mission—and left some time later angry and deflated. He and Annie had to content themselves with the understanding that John would 'grow out of it'. Actually, he never returned to belief, but through the rest of his life he enjoyed conversations and friendships with religious people of many faiths. For example, while he was studying at Queen's University Belfast, he had discussions with a Catholic friend, Denis McConalogue, and he attended some meetings of the Student Christian Movement, although just for argument.

Loss of religious belief may have taken him to a study of philosophy. Probably the most well-known philosopher at the time was C. E. M. (Cyril) Joad [15], who appeared on the Brains Trust, a strangely very popular radio programme, in which a panel of worthies answered questions on a range of intellectual topics. Joad's response to any question inevitably began 'It all depends on what you mean by ...' He was something of a charlatan, but he wrote many readable books, and he did encourage ordinary people to take philosophy seriously.

John's study of philosophy began with Joad and the Brains Trust but, in an effort to find out 'what life is all about', he moved on to more professional accounts of the basic ideas, and eventually to taking out from the library thick books on Greek philosophy. But in the end he became disillusioned with philosophy, as it did not seem to lead anywhere. The task of 'good' philosophers seemed to be merely to refute 'bad' philosophers, and that, he thought, was all there was to the subject. There were no answers.

Physics seemed to be the next best thing. Admittedly, the questions were less interesting than those answered by the philosophers but, unlike philosophy, physics did ask what the world is like, and it did progress and come to conclusions. Each generation built on the work of the previous one.

Slowly, it seemed that physics, and in particular the ideas and theories of physics, were becoming his main intellectual interest. He read popular books on physics—Einstein on relativity [16], and books by such authors as Bertrand Russell, Lancelot Hogben, and J. G. (James) Crowther.

At the Tech, he enjoyed, and found reasonably easy, his physics courses, which contained basic mechanics—Newton's laws of motion; simple statics and dynamics; an introduction to electricity and magnetism; introductory atomic physics; and so on. His mathematics would have got as far as basic calculus—differentiation and integration.

Already, he was thinking deeply and making clear moral decisions about his life. He did not smoke or drink, and, as already mentioned, he became a vegetarian. He also did his very best to put his family off eggs by telling them about the behaviour of hens when their waste was put down. Annie, of course, was far from sure that a vegetarian diet would keep him healthy. Occasionally,

she would coax him to eat an egg and, whenever she was making vegetable soup, she would put a little meat in. It is difficult to be a vegetarian when you are living in someone else's house and they do the cooking!

In his decision to become a vegetarian, John was very much influenced by George Bernard Shaw (so it is rather amusing that Bernstein noted his long, neat, red hair and his pointed beard and characterized his appearance as somewhat Shavian). Shaw and Joad had a fair amount in common. In fact, at the beginning of the First World War, they and Bertrand Russell had formed an alliance totally rejecting the war.

To this trio might be added H. G. Wells, completing a group of people for whom John had great respect and whom he wished, at some level, to emulate. Of course, by no means were they a homogeneous group intellectually, Russell being far superior to any of the others, and Joad somewhat inferior. Yet, all were deep and earnest thinkers, and all expected the results of their thoughts to lead to moral conclusions and to definite action in their own lives and in politics. Russell and Wells were extremely concerned with science, although Joad and Shaw less so, and Wells in particular had a vision of science transforming life, particularly perhaps that of the humble, for the better. It is possible to trace many of these characteristics in John's life.

A year of transition

In 1945 Jackie returned from active service to Belfast with his stomach wound. He was awarded a small military pension and he was in and out of hospital for some time. Indeed, he never returned to full health. For a short period, he worked in the stores at the shipyard, where he earned rather better money than he had been used to but, after a couple of months, his health let him down and he had to leave that job.

Fortunately, being a returned soldier, he was able to gain employment with the British Legion, starting as a Park Ranger but swiftly being promoted to being in charge of the British Legion car parks throughout Belfast. Also, in the summer, he was responsible for sending squads of men to Portrush on the North Coast, to service the golf tournaments that took place there.

Even before then, John had to make hard decisions or, to put things more accurately, he had had to wait and see what possibilities the financial circumstances might allow for him. In summer 1944, he passed his matriculation, which was set and awarded by Queen's University, his subjects of choice being English, French, mathematics, mechanical drawing, and physics.

There was no doubt as to what he would have liked to do over the next few years: his aim was to study for a degree in physics at the local university, Queen's University Belfast. However, there were two problems.

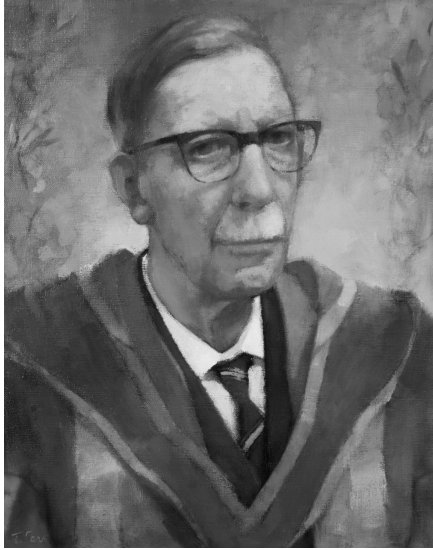


Figure 1.16 Portrait of Karl George Emelús, painted by Tom Carr in 1965; collection of Queen's University Belfast. Courtesy Queen's University Belfast.

The first one was merely a matter of timing. He was only 16 and the minimum age for entering Queen's was 17. The second was more significant—the question of whether he should be getting a permanent job and, if he did get to Queen's, how he might support himself and avoid putting an unfair financial burden on his parents. Of course, his father being on military service may, from this point of view, have been a blessing.

On the actual facts of the next few months, there is no uncertainty. He applied for various jobs in the city—office boy in a small factory, a junior job at the BBC—but he did not get appointed to any of them. At one interview, he was told he was overqualified; at others his body language may have given the message that he did not really want the job.

Then, presumably coming up to the beginning of the university term in September, he was taken on as a laboratory assistant in the very place where he wanted to study the following year—the physics department at Queen's. Annie went with him to the university and met Professor Emelús, the Head of Department (Figure 1.16), and saw where he would be working. Then, in the *subsequent* summer, he did indeed register to start his studies.

However, there are different stories about how all this was arranged and how the financial problems were solved. At Queen's itself, there is a long-standing belief, or perhaps myth, that his position as a laboratory assistant was