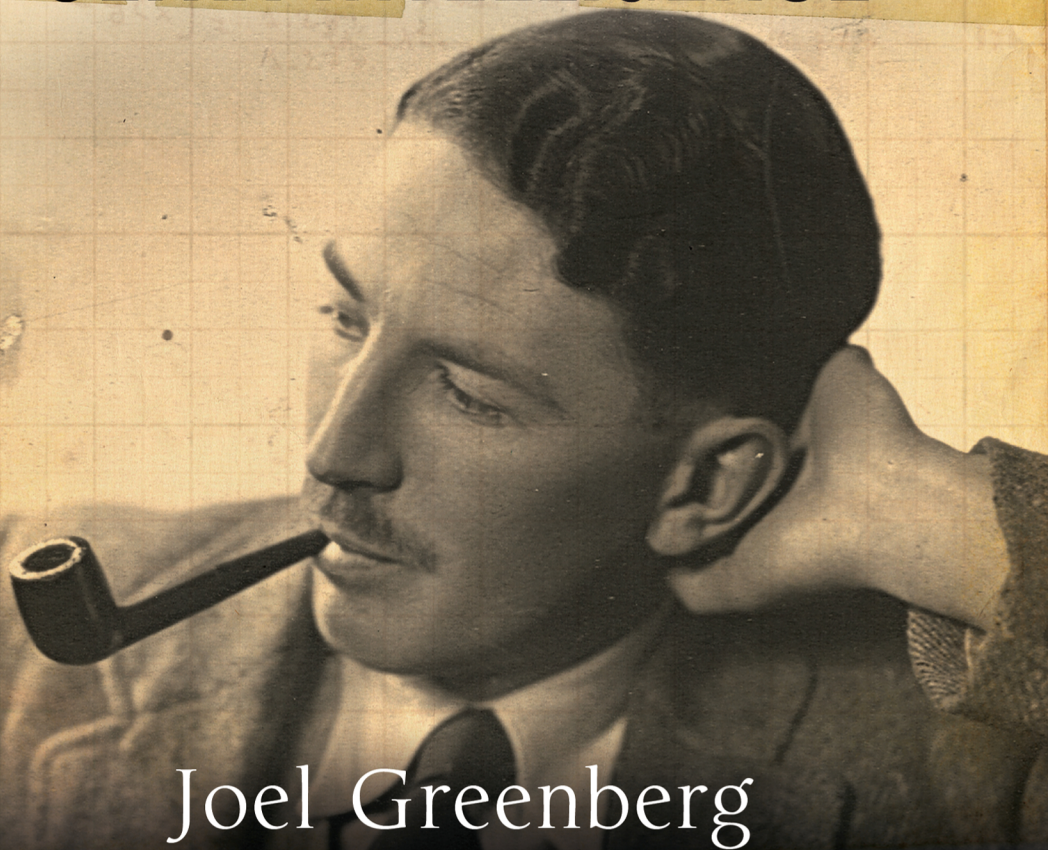


GORDON WELCHMAN

BLETCHLEY PARK'S
ARCHITECT OF
ULTRA INTELLIGENCE



Joel Greenberg

Foreword by Rosamond Welchman

Gordon Welchman

For Gordon Welchman and his family

Gordon Welchman

**Bletchley Park's Architect of
Ultra Intelligence**

Joel Greenberg

With a Foreword by
Rosamond Welchman



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*Gordon Welchman:
Bletchley Park's Architect of Ultra Intelligence*

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Foreword

Unlike my brother Nicholas Welchman, my sister Susanna Griffith and I were born too late to have any direct memory of my father's work at Bletchley Park. During my childhood Dad's war work was a mere rumour in our family – a hint that he had done something important during the war that we couldn't talk about. I was a sceptical child and did not totally believe this. When the secret was let out and Dad wrote his book, *The Hut Six Story*, it was a revelation to me, and something of a surprise. I was very fortunate to help Dad in his last year of life with his final paper on his codebreaking experience, which made those years more real to me. In 2001 I visited Bletchley Park – not nearly as developed then as it is now – with my son Daniel Tischler. We were lucky to hear John Herivel give a talk on the occasion of the opening of an exhibit about the 'Herivel Tip'. Both of us were surprised and delighted to find that the talk was largely about Dad's leadership role at Bletchley Park. It was the first time that I had heard in detail of Dad's work in words other than his own. I was also surprised to find myself and my son being identified as part of a sort of Bletchley Park 'family', a child and a grandchild. That must now be rather a large family!

Dad's war work and the secrecy about it for many years afterwards had a significant impact on our family life. I think it was difficult for Dad to settle down after the excitement and creativity of the war years, and we moved frequently, three times across the Atlantic. I never stayed in one school for more than two years, and often felt myself to be an outsider, too English in the United States, and too American in England. However, there are benefits to being an outsider, and I was very lucky to land up in some very interesting schools.

Dad was a charming person, quite the gentleman. His inclination was to enjoy life, and I remember him most with a twinkle in his eye and a subtle smile. I was occasionally startled, after he had met some slightly

disreputable friend of mine, to hear of his disapproval because in their presence he was so polite and accepting. The friend would have no clue of Dad's disapproval. However he was capable of changing his opinion later, and often did. He was always in control of himself, in my memory at least. If displeased, or perhaps a bit intoxicated, he would withdraw to his study to 'write a letter'. We always wondered if in fact all of that time was spent writing letters, but judging by the piles of letters that remain, a lot of it was!

Dad had several personal characteristics that I believe were related to his work during the war. When something interested him, he threw himself into it. He loved music, and amassed an enormous collection of records, all of which he seemed to know quite well, and played quite often. There was a time when he took up gardening, and performed Olympian feats in transforming an unpromising rocky slope into a lush and colourful garden. He claimed that his close reading of *Aku-Aku* (Thor Hyerdahl's book about the Easter Island statues) taught him how to move the ridiculously large stones. He was always curious and loved to read and learn about new ideas. When he was bed-ridden in his last months I remember him musing about a mobile of little sailing ships that floated about in the breeze above his bed, and wondering how one could tell just when they would all be in a straight line.

Dad had methodical habits. For example I remember that when leaving the house he had a system for counting off tasks that should be done on his fingers (turn out the lights, turn off the gas, lock the door, things like that). In his bachelor days after his first divorce he learned one recipe (a pot roast cooked in an electric frying pan) that I believe he served to me every time I visited during that period. It was always done in exactly the same way – quite delicious, by the way! He paid close attention to detail, for example recording even minuscule household expenses. He kept meticulous records of his tape recordings of music that he assembled into concerts he offered in a local nursing home. When calculating a tip in a restaurant, he insisted on doing long multiplication with paper and pencil, rather than estimating, which could be a bit embarrassing for his guests.

Dad's world shifted considerably during his lifetime. He took time to change in some respects but he certainly did change eventually both in attitudes and tastes. When his children were young Dad was sometimes distant as perhaps many English fathers of his generation were. He told me in the context of my own children that he didn't really know what to do with small children until he could read them a book. I remember being a little embarrassed by his attempts to produce appropriate Southern United

States accents when reading Uncle Remus folk stories aloud to us as children. However, I believe that at times he was able to do special things with each of us children as individuals, for example birding with my sister Susanna, and fishing with me. Hiking and camping were some of the best memories that I have of family activities. I inherited a collection of Dad's favourite photos, and several that clearly meant a lot to him were of my sister Susanna and me on a mountaintop in northern Vermont, where we used to go for summers.

I believe that Dad always considered himself to be English at heart. He applied for United States citizenship for reasons of security in his work, but he loved to return to visit his family and friends in England. It was sad that for so much of his life he did not get recognition for his work at Bletchley Park, but he told me that he felt his career had been interesting and rewarding regardless. My brother, my sister and I were enthusiastic when Joel Greenberg told us of his intention to write a book about our father. When Joel visited Nick and me in 2011 (sadly, less than a year before Nick's death) it gave us a wonderful opportunity to revisit old memories together. We found that we had a good collection of documents to offer Joel, and were pleased by his excitement about the boxes of Dad's papers that had been stashed in Nick's attic, forgotten. I also had a number of photos and items of memorabilia that I was given by Dad's third wife, Teeny. I am sure that Dad would have been very pleased to know of Joel's project and the considerable interest in his many achievements.

Rosamond Welchman

Preface

Along with the general public, I first became aware of the story of Bletchley Park (BP) and the codebreaking activities which took place there during the Second World War when Frederick Winterbotham published his book *The Ultra Secret* in November 1974. I had been awarded a PhD in Numerical Mathematics by the University of Manchester several months earlier and was aware of the contributions of both Max Newman and Alan Turing to the developments in computing which had taken place there in the 1950s. I of course knew nothing of their work at Bletchley Park and was keen to find out how it had influenced their post-war work in Manchester. Much to my disappointment, Winterbotham's book contained no technical detail. To get official approval for the book, he had restricted himself to describing how intelligence produced at BP was processed and distributed to Allied commanders in complete secrecy. In any event, he had neither access to official records nor direct knowledge of the actual techniques which produced it. British authorities continued to oppose the release of any information about the methods which were used to obtain the intelligence. Thus, subsequent books, such as Anthony Cave Brown's *Bodyguard of Lies* in 1975 and Ronald Lewin's *Ultra Goes to War* in 1978, also had little technical detail as those whom these authors interviewed were bound by the Official Secrets Act. R. V. Jones, who had become Assistant Director of Intelligence (Science) in the Air Ministry during the war, published his personal memoir, *Most Secret War* in 1978. His book told the story of the rise of scientific intelligence during the Second World War from his perspective. I eagerly purchased a copy but again was frustrated because, like Winterbotham, Jones was restricted both by what he could say about how intelligence was produced and by the fact that he was also not directly involved in the process. However, before the end of the decade, some details of the Enigma encryption machine and how it was broken were revealed in French and Polish publications.

In 1982, I came across a book published first in the United States and then in Britain, which provided a detailed description of how encrypted German communications sent over wireless networks had been intercepted by Britain's 'Y' Service and subsequently read by the codebreakers at BP. Here at last was a book that I and other mathematicians, technologists and historians could get our teeth into. Unfortunately, the British and American governments didn't feel the same way. The book, *The Hut Six Story*, caused quite a stir in both Britain's Government Communications Headquarters (GCHQ) and its American counterpart, the National Security Agency (NSA). It was written by an insider who had first-hand knowledge of how the Enigma machine operated and how messages encrypted by it had been read on an industrial scale. Its author was Gordon Welchman, the man who had produced the blueprint for the BP 'codebreaking factory' and who had personally led the attack against the German Air Force and Army's communications networks. With the publication of Winterbotham's book, Welchman had felt that he was at last released from his wartime pledge of secrecy. He had always been scrupulous in protecting the secret of his wartime activities and had avoided all conversation about the war itself, other than with those in the know. This was not a position that he felt comfortable with, as he revealed to the BBC in one of several interviews which were included in their *Secret War* series, broadcast in 1977:

One was terrified that somehow or other one would reveal a bit of information that one had learned from an Ultra decode rather than from a newspaper . . . I had really had enough of this awful responsibility by the end of the war when I was very glad to drop it, and after the war, for years and years, I didn't even read the histories of the war because I was afraid that somehow or other I might reveal something that I had learned from Ultra.

I was certainly puzzled by Welchman's book because earlier works had given little indication of how important his contribution had been. Yet reading *The Hut Six Story* and working through the technical detail provided, it seemed to me that he must have been a key figure at BP.

Welchman subsequently became an individual of some concern to both GCHQ and the NSA until his untimely death in 1985. He was interviewed several times by American Federal Agents following publication of his book and received aggressive communications from both GCHQ and NSA senior staff. Under threat of prosecution by the US Government, he was prevented from promoting his book.

He had been at BP throughout the war, arriving on 4 September 1939, the same day as the only BP veteran widely known to the general public, Alan Turing. His remarkable contribution to cryptography was achieved without any previous experience of it apart from a brief course that he attended in the spring of 1939 at the request of Alastair Denniston, the head of MI6's cryptography section, the Government Code and Cipher School (GC&CS). He was in fact a lecturer in algebraic geometry at Sidney Sussex College, Cambridge, and had been writing a book on the subject for five years. In the early years of the Second World War he was transformed into a key figure in the triumph of BP. Within two months of his arrival, he had independently reinvented a key part of the pre-war work of Polish cryptographers and laid the foundations for Sixta, a fusion of signals intelligence and cryptography. After a further month he had made three fundamental contributions to the ultimate success of BP: he was one of the first to recognize the need for a rapid expansion of BP's infrastructure for the decryption and analysis of intercepted Enigma traffic; he drew up an organizational plan which would enable BP to achieve such an expansion; he invented a device which would transform Turing's design for the bombe into a workable machine. Along with Alan Turing, he had in effect developed a radically new production-orientated approach to machine cryptanalysis. BP then turned to Welchman to put his plan in place and he took on the leadership of the group which would ultimately decrypt over one million German Air Force and Army signals. In 1943 he was given responsibility for all 'machine' developments at BP and while he was not directly involved in its creation, the world's first electronic computer, Colossus, was designed and built on his 'watch'. The role also included technical liaison with American cryptographic agencies.

In 1948 he decided to emigrate to the United States and initially played a key role in Project Whirlwind, an ambitious project at MIT which would, for the first time, apply computers to air traffic control and air security. Once again his insightful mind recognized the need for original work on the problems of computer applications. He also gave the first course of lectures on programming for a digital computer at MIT for the electrical engineering department. After working for several companies in the fledgling American computer industry, he joined the MITRE Corporation in 1962. MITRE had been tasked with the development and integration of digital computers to monitor US airspace, detect potential threats, and coordinate tactical responses. His work with MITRE led to numerous classified publications and several inventions which now lie at the heart of

American air defence systems. While his work at BP contributed to the birth of the digital age, his post-war career helped nurture it through its infancy.

After reading Welchman's book I became intrigued by BP and when I joined the Open University in 1977, I was delighted to discover that it was only a few miles away. I subsequently took every opportunity to snoop around the place, read books about it and take my children there when it opened to the public in the 1990s. After leaving the Open University in 2010, I joined BP as a volunteer supporter, historian, and later as a part-time member of the management team. I quickly realized that colleagues who had been researching BP for many years held Welchman in the highest esteem. Soon I started to think about writing his biography and, after getting the support of the Welchman family, I began researching this book.

Today, BP is a Museum and Heritage Site which receives thousands of visitors weekly from around the world. A number of the wartime huts and buildings remain, although many are in need of urgent repair. The story of GC&CS's wartime activities is told through guided tours, demonstrations of some of the technologies developed there, such as the bombses and Colossus and numerous displays. While visitors marvel at the achievements of those who worked there, most are hearing the names of the story's key players for the first time. Only two, Alan Turing and Dilly Knox, have inspired serious biographies. Yet they, along with Alastair Denniston, Edward Travis, John Tiltman, Bill Tutte, Tommy Flowers and Gordon Welchman, remain unknown to the general public. Each, in his own way, made BP's achievements possible but, like Turing's, Welchman's contribution is seen by many historians and former BP colleagues as being fundamental to its ultimate success.

As Welchman's BP colleague Sir Stuart Milner-Barry wrote in his obituary in 1985:

It was indeed a classic example of the hour producing the man. Without the fire in his belly, without the vision which again and again proved his intuition correct, and his capacity for inspiring others with his confidence, I do not believe that the task of converting the original break-through into an effective organization for the production of up-to-date intelligence could have been achieved.

Joel Greenberg

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When I first started to think about writing this book, I approached the Bletchley Park Trust to seek their support. I am grateful to Simon Greenish, the Trust's former CEO, for offering it unreservedly. Simon introduced me to Mark Baldwin, whom I would like to thank for putting me in touch with the Welchman family. Nick Welchman's loft held a treasure trove of his father's letters and documents, which he had faithfully kept safe since his father's death in 1985. Sadly, Nick passed away before this book was finished. Gordon's two daughters, Susanna and Rosamond, have also kindly shared memories of their father with me. The Welchman family has generously donated a considerable amount of material, including personal items and documents, to the Bletchley Park Trust. At the beginning of the project I sought the advice of my friend and colleague Frank Carter. I regard Frank as one of the world's foremost experts on the mathematics and technologies used at BP during the war. Frank's advice and knowledge has been invaluable to me and he has contributed technical material which can be found in Appendix 2. I am grateful to John Gallehawk who directed me to a number of relevant documents in the National Archives. I would also like to thank Michael Smith for his insightful views on a suitable structure for this book. Finally, I would like to thank my lovely daughters for their interest and encouragement.

Prologue

The weather was cool and dry with slightly above average sunshine in the British summer of 1974. It was also a turbulent political time on both sides of the Atlantic. The IRA had begun its bombing campaign on mainland Britain and had targeted the Tower of London, the Houses of Parliament, and pubs in Birmingham. In the United States, after the Watergate Scandal, Richard Nixon had become the first US president to be forced to resign. Gordon Welchman and his wife Teeny arrived in England in mid-July after visiting Teeny's relatives in Germany. Her mother was Welchman's second cousin, her father Bavarian and she had grown up in a mountain valley near the Austrian border.

The couple stayed with Teeny's godmother in England and, during the visit, her son-in-law happened to show Welchman an article in the 28 July issue of the *Sunday Telegraph*. The article was part two of a preview of a book by Frederick Winterbotham called *The Ultra Secret* due to be published on 2 October. The previous week's edition of the paper was still in the house and Welchman was able to read the entire article. After scrupulously avoiding all conversation about the Second World War and his part in it with anyone apart from one or two former wartime colleagues, for almost thirty years, one can only imagine his thoughts as he read about the revelations in Winterbotham's book. As he said in *The Hut Six Story*:

I felt that this turn of events released me from my wartime pledge of secrecy. I could at last talk to my friends, relatives, and colleagues about the activities of one of these two organizations, Hut 6, with which I was closely associated from the outset. I could even write my own account of what actually happened. I began to think of a book.

While on holiday in the UK in May 1972, he had met his old BP colleague Joe Hooper. Sir Leonard (Joe) Hooper had stayed on at GCHQ after the war and became its Director in January 1965, a post he held until

November 1973. Welchman had explained to Hooper why several aspects of his Hut 6 experience could be extremely valuable in the types of military research and development with which he had become involved. Hooper had assured him that within a few years he would be able to disclose all aspects of his experience, including the basic reasons for Hut 6's success and German failure in the field of Enigma security.

During his visit in 1974 Welchman wrote to George Goodall, a GCHQ official, to clarify GCHQ's position on the release of wartime documents and also to what extent he could use his knowledge of German battlefield communications in his consultancy work for the US Air Force. An old Hut 6 colleague, Harold Fletcher, who had remained on at GCHQ after the war until his retirement in December 1971, had put him in contact with Goodall. Welchman and Fletcher had remained friends after the war and the Welchmans visited the Fletchers in Cheltenham during their summer trip to England. Having become an American citizen in 1962, Welchman also asked Goodall if he was still eligible for a UK passport.

After returning to the US, he received a reply on 18 September. In his letter, Goodall said that there would be some relaxation on revealing the existence of material and its use but not on the means by which it was obtained. GCHQ was not concerned as long as Welchman restricted himself to the way in which German battlefield communications were organized, equipped and operated, but he should not discuss how they were exploited by the Allies. He suggested that Welchman wait to see what new policy emerged and said that he would keep him informed of developments, an undertaking he failed to honour. At least he was able to confirm that as Welchman had not renounced his UK citizenship, he was eligible to apply for a British passport at any time.

Welchman had also attached two papers he had written as part of his consultancy work for the MITRE Corporation in the USA that he thought GCHQ might be interested in: 'Selective Access to Tactical Information' (dated August 1970) and 'An Integrated Approach to the Defence of West Germany' (dated February 1974). Goodall said that they had aroused considerable interest and were still circulating in GCHQ.

Fletcher was also very interested in Welchman's current work. Like several others who had stayed on in GCHQ after the war, he had found himself in a difficult position. He could not deny to colleagues that he had been in the same organization during the war but the easiest way to avoid awkward questions about Hut 6, to friend and foe alike, was simply to say that he had been involved in other work at BP. This had become second

nature to him, so his initial reaction to Welchman's questions had been to say 'please leave me out'. However, Fletcher had decided that, as it had been ten years since he had ceased to operate at a high level and over three years since he had retired completely, the time for awkwardness or potential damage caused must surely be over. Fletcher and Welchman were also delighted to learn at that time that their old friend and BP colleague Stuart Milner-Barry had been knighted in the New Year Honours list

On returning to America, Welchman and his wife held a dinner party for some friends. One of those attending was Diana Lucy, who had actually introduced Welchman to his wife Teeny. In 1969 she had been working at the local hospital and had treated a couple, Elisabeth Wimer (known as Teeny by friends and family) and her then husband Bill, who had been in a car accident. The couple's car had been written off and they needed transport to the airport. Diana had given them the keys to her house which was not far away and told them that they could relax there. After work, her husband had driven the couple to the airport. Diana kept in touch with Elisabeth by letter and in late July 1971 she had a telephone call from her. Much to Diana's surprise, Teeny was in Newburyport, visiting a distant relative, and wondered whether Diana would like to come for tea. The distant relative was none other than Gordon Welchman and Diana and he subsequently became great friends.

At the party, the subject of Winterbotham's book came up and Welchman announced to the gathering that he could at last tell them what he had been doing during the Second World War. Diana's astonished reaction was matched by Welchman's when she revealed that she had been an intercept operator throughout the war. As Diana Stuart she had volunteered for the WAAF in August 1941 and undergone four months of training with the Post Office in Manchester and three months at a coastal RAF station. She had been sent to Chicksands Priory where she remained until 1945. After the war she had married an American, Frank Lucy, and settled in Newburyport in the spring of 1946. Later she would prove to be a valuable source of information to him about the inner workings of the intercept stations within the 'Y' Service.

In late 1981, just before his book was published, Welchman had become aware of the work of the Poles and in particular of Marian Rejewski, which had taken place years before GC&CS arrived at BP. His book, *The Hut Six Story* had been written with little knowledge of the immense contribution of the Poles and, as his book was about to go to press, he was only able to make minor corrections and include Rejewski in the dedication. Following

its publication, MITRE was forced to withdraw his security clearance, which in effect prevented him from continuing to work for them as a consultant. He decided to put the record straight in 1985 by publishing a paper in the first issue of a new academic journal, *Intelligence and National Security*, titled 'From Polish Bomba to British Bombe: The Birth of Ultra'. Scarred by his previous experience, he submitted his article to the Defence, Press and Broadcasting Committee (better known as the D-Notice Committee) which subsequently cleared the article in writing on 8 July 1985. About one week later, Welchman received a letter from the then Director of GCHQ, Sir Peter Marychurch. This was only the second official letter that Welchman had received from GCHQ since the war. It included the following extraordinary statement:

I ask you to consider not only the direct damage to security but also the knock-on effect of your actions; each time a person like yourself, of obviously deep knowledge and high repute, publishes inside information about the inner secrets of our work, there is more temptation and more excuse for others to follow suit.

The so-called inner secrets that Welchman had published were about technologies which had been obsolete in intelligence terms for many years. Despite an apparent vendetta against him by the intelligence services, Welchman, along with most of his former BP colleagues remained largely unknown to the general public. After his death his case was taken up by commentators on the intelligence services such as Nigel West and David Hooper .

As Sir Stuart Milner-Barry said in a letter to the *Guardian* after his death:

To talk of 'direct damage to security' in the context of Welchman's article in 'Intelligence and National Security' is surely absurd. The secrets of the Enigma and how it was broken are of fascinating interest historically, and it is a sad pity that the authorities still prevent the story being properly told. But to suppose that the battles which we had to wage before the birth of the first electronic computer (which must seem to present-day cryptanalysts rather like fighting with bows and arrows) could be relevant to security now is just not credible.¹

Chapter 1

Origins: From Algebraic Geometry to Cryptography

Fishponds, a suburb of Bristol known for its aeronautical industries in both world wars, was the birthplace of William Gordon Welchman on 15 June 1906. Gordon, as he became known, was the youngest of three children of William Welchman (1866–1954), a missionary who became a country parson and later Archdeacon of Bristol, and his wife, Elizabeth, daughter of the Reverend Edward Moule Griffith. Gordon's paternal grandfather George and great grandfather William were also clergymen.

When Welchman was about eighteen months old, his father became vicar of the medieval Temple Church in Bristol. The vicarage was in Berkeley Square, Clifton, which had a large central area of lawn, trees and flower beds on rising ground. The road outside the Welchman house fell gently to the left, and on the other side of the road was a stone ramp sloping up to railings that enclosed the lawn area. One day, Gordon was left in his pram outside the house but the brakes had not been properly adjusted. Before long the pram started to move down and across the road. When it reached the ramp on the other side, it turned over and threw him out. Miraculously, a pillow inside the pram also flew out and he landed on it unhurt. If his head had hit the pavement, one can only speculate on how history may have been changed.

Welchman was much younger than his brother and sister and felt out of place in his clerical home. While his sister Enid May pursued a career as a nurse, his brother Eric, thirteen years his senior, was one of the first officers to be killed at Mons in 1914 at the beginning of the First World War. Gordon overcame a childhood stammer through singing and this no doubt led to his lifelong passion for music and in particular, madrigals. He also decided to teach himself to dance and practised his steps with a broomstick, with which he became quite proficient. After completing his

early schooling, he was sent to Marlborough College, a public school in Wiltshire, which seemed to suit him very well. Founded in the 1840s, Marlborough was much younger than Harrow, Eton or Winchester. In the early twentieth century, many believed that institutional longevity was more important than academic strength, the latter being quite evident at Marlborough. Its Officer Training Corps offered marches, drills and lessons in map reading and target practice. In later life, Welchman shared with his son Nick,¹ who would also go to Marlborough, happy memories of elaborate wargames and manoeuvres. A career as an artillery officer might have beckoned but he had developed a close bond with a mathematics teacher called Alan Robson, an alumnus of Sidney Sussex College, Cambridge, which would set him on a different course.

While at Marlborough, Welchman would frequently cycle to a farm where his cousin Sara lived with her husband George Hussey and their two daughters, Myrtle and Gladys. Welchman became quite close to both girls and little did he know that Myrtle in due course would marry a Bavarian gentleman and have a daughter whose path he would cross many years later.

After attending Marlborough College from 1920 to 1925, he became a Mathematical Scholar at Trinity College, Cambridge, in 1925 and distinguished himself in the Tripos, gaining a first class in Part I in 1926 and was a 'wrangler' in Part II in 1928. 'Wrangler' was the quaint Cambridge word for a student who gained first-class honours in the third year. After teaching at Cheltenham Boys' School for one year, he returned to Cambridge in 1929 and was elected a fellow of Sidney Sussex College. The college needed another supervisor in mathematics and he was considered to be an admirable choice. Apart from having the highest professional qualifications, he also had considerable artistic and athletic interests that allowed him to find common ground with an unusually large number of undergraduates. His students remembered him as having a genial approachability and a capacity to understand and respond to their points of view. The College soon elected him to the office of Dean.² He was a musician and in great demand by the madrigal groups.³ Music would continue to be a prime leisure interest throughout his life.⁴ Unfortunately, a motorcycle accident would hamper his expertise as a budding trombonist.

Welchman was a university-standard hockey player and while at Sidney Sussex he would sometimes turn out for Cambridge University Wanderers. He was well known among Cambridge University's leading climbers and explorers and in 1932 led a University expedition to Spitzbergen, the largest

and only permanently populated island of the Svalbard archipelago. This was a much more daunting journey in 1932 than today and he wrote a long account of the expedition in the College's magazine, *The Pheon*. Years later he told friends that during the expedition he had gone to relieve himself and saw, much to his horror, that his urine was a bright red colour. He was in a state of panic until his colleagues reminded him that they had eaten beetroot for breakfast.⁵

Former students always seemed to remember two things about him; an impeccable dress sense and continual, unsuccessful efforts to light his pipe throughout lectures. He was in great demand at University dinners and parties because of his good looks and ability to talk on a range of subjects. One can well imagine him fitting in well at Cambridge in the 1920s and 1930s. Academically, he had specialized in the field of algebraic geometry and in 1934 had been commissioned by Cambridge University Press to write a book titled *Introduction to Algebraic Geometry*. The subject was notable for its conspicuous lack of practical application, being a branch of pure mathematics. Welchman was quite proud of the fact that he had painstakingly produced all of the diagrams that were to appear in the book.⁶

Apart from music and motorcycles, his other great interest as a young man was women. His dashing good looks no doubt were helpful in this regard but, as a gentleman, he never shared with friends or family the details of his youthful dalliances. He did, however, tell his son that he had once attached a sidecar to his motorcycle so that he could convey a young woman on a long journey. On arrival, he discovered that a missing bolt could have separated him from his *amour* at any stage en route.

Attitudes to women and motor transport at Cambridge between the wars were, to say the least, traditional. In the spring of 1919 there had been insistent calls for the reopening of the whole question of the position of women in the University. The *Cambridge Review* in June 1920 addressed the issue in an editorial as follows: 'so long as the sun and moon endureth, Cambridge should remain a society for men, and any sister institution should by its own arrangements produce a charter, and, as a separate institution, confer its own degrees'. It also went on to deplore the prevalence of young married fellows in Colleges and recommended a period of 'at least ten years' celibacy on election'. The problem for the anti-feminists was that the view of the country as a whole was against them and in 1918 the Representation of the People Act had been passed, enfranchising women over the age of thirty who met minimum property qualifications. Before the end of 1920 Oxford University had approved the

admission of women to full membership. By 1926, women had become eligible for teaching posts and just before the war Dorothy Garrod became the first woman professor in either Oxford or Cambridge. In 1928, women were granted equal voting rights to men in the UK.

Arcane attitudes were not just restricted to the role of women at Cambridge in the 1920s. In 1925, two Indian tennis stars, D. R. Rutman and S. M. Hadi, were turned down for the captaincy of the University team, even though on the basis of ability and seniority, the role should have gone to one of them. Yet, the prevailing view at the time supported an unwritten law that ‘gentlemen of colour’ should not be elected. Concerns were raised about the morality of young Cambridge men who were often noisy, obstreperous and ingenious. The arrival of the motor car created even more of a stir with the Senate being told in 1925 that ‘the motor habit, when it becomes an obsession, induces a state of mind out of harmony with the best traditions of Cambridge’. There was also a concern about undergraduate immorality being stimulated and facilitated by the use of the motor car after dark. The majority of these young men had been educated at public schools. Sidney Sussex was not a college overly concerned about its social image, yet in 1929, only 25 per cent of its freshmen were from state schools.⁷

In 1931, at the age of twenty-five, Welchman became friends with Betty Huntley-Wright, a beautiful young actress and vocalist.⁸ While family and friends believed that the relationship was purely platonic, Welchman may well have had other ideas as this poem written by him and sent to Betty suggests:

Dear Betty, I am greeting you
 The day that you are twenty.
 Of birthdays you have had a few
 And may you still have plenty.
 I wasn't there when you were 'naught'
 (Oh Betty, were you naughty?)
 But hope to drink your health in port
 The day that you are forty.
 When sixty years have rolled away
 I hope you'll still be merry,
 And on the happy natal day
 I'll drink your health in sherry.
 And if we both should be alive
 I hope we'll still be 'matey'

When I'll have got to eighty-five
And you'll have got to eighty.⁹

It was almost certainly music which brought Welchman together with his first wife, Katharine Hodgson, as they met at a summer music camp around 1936. Welchman was a member of the Cambridge University Madrigal Society and regularly performed with it. Katharine was a professional musician and came from a very strong military family. Her father, Francis Faith Hodgson, was a captain in the 84th Punjabis, Indian Army. Her mother's sister, Do, was married to Colonel Arthur Crookenden, a powerful figure in the family who went on to write a history of the Cheshire Regiment in the First World War. His three sons were also gallant soldiers who all ended the war with physical damage.

Gordon Welchman and Katharine Hodgson were married on 20 March 1937 at the parish church in the village of Pangbourne in Berkshire. They eventually settled in a house called Brandon Hill on the outskirts of Cambridge. Their first child, Jeremy Nicholas (Nick) was born on 11 January 1938 and family life was initially idyllic. Following the signing of the Munich agreement on 30 September 1938, the *Cambridge Review* was able to report that while a few meetings had been abandoned and a few lectures shortened, the course of University life seemed to be running as smoothly as ever.

Against this back-drop of life in 1930s Cambridge, in the latter part of 1938 Welchman received a letter which would change the course of his. Unknown to him, two former Cambridge dons, who had worked in the British Admiralty's cryptographic section, NID 25, (euphemistically known as Room 40 after the room that originally housed it in the Old Admiralty building) during the First World War, had been trawling through the staff and student lists at both Oxford and Cambridge. They were looking for men of 'the professor type' who were deemed suitable for secret work within the Foreign Office. In 1919, the remnants of NID 25 and the War Office's cryptographic branch, MI 1(b), had been amalgamated into a unified signals intelligence agency, the Government Code and Cipher School (GC&CS).¹⁰ When Rear Admiral Hugh Sinclair succeeded Sir Mansfield Cumming (the first 'C') as Chief of the Secret Intelligence Service (SIS) in late 1922 or early 1923, he was also made non-operational director of GC&CS. SIS was a section of the Foreign Office and referred to within government circles as both 'C's organization' and MI 1(c). Early in the Second World War, a new cover name, MI 6 was adopted. In January 1924,

Sinclair met with the operational head of GC&CS, Alastair Denniston, and informed him that his section's work would be integrated with that of SIS. GC&CS would be responsible for cryptography and SIS for the distribution of intelligence derived from this source. Furthermore, GC&CS would have full access to SIS records. In June, GC&CS was instructed to distribute decrypted material directly to its customer departments, with copies going to Sinclair. In the spring of 1926 SIS and GC&CS moved into combined headquarters in offices within Broadway Buildings opposite St James's Park Underground station.¹¹

The two dons were both from King's College. Frank Birch was a fellow during 1915–34 and a lecturer in history from 1915 until 1928. In the 1930s he had left Cambridge to work in the theatre. Frank Adcock had become a fellow in 1911 and held the chair of ancient history from 1925 until 1951. While the First World War cryptanalysts did not have much time for mathematicians, GC&CS was already putting one Cambridge mathematician through preliminary training in London and a second was recruited from Oxford in February 1939. Welchman had been noticed by one of Denniston's recruiters, hence the letter to him asking if, in the event of war, he would be prepared to defend King and Country by undertaking some secret government work. Welchman's answer was an emphatic yes and he duly attended preliminary indoctrination sessions on 20–23 and 27–30 March 1939 at the Broadway Buildings in London.¹² He had been recruited for the General Diplomatic Section and among his fellow trainees were the Cambridge mathematician who had been recruited the year before, Alan Turing, and two others who would become close working colleagues at BP, Dennis Babbage and John Jeffreys.

Following introductions by Denniston on the mornings of the 20th and 27th other instructors took over, two of whom would significantly influence Welchman and play a major role in the success of BP. Oliver Strachey¹³ followed Denniston on the afternoon of the 20th and 27th with sessions on 'Transposition'. He also did sessions on the morning of the 22nd and 29th on 'Substitution'.

As Welchman wrote about Strachey in *The Hut Six Story*:

I remember very little else about the preliminary indoctrination in London, except that I was very impressed by Oliver Strachey, a senior member of the GCCS staff, who during the coming war would head an organization known as Intelligence Services Oliver Strachey (ISOS). He seemed to be giving us an overview of the whole problem

of deriving intelligence from enemy communications, and this may well have been a strong guiding influence on my wartime work.

On the morning and afternoon of the 21st and 28th, the recruits were given an introduction to 'Book-Building' by John Tiltman.¹⁴ Tiltman would go on to be promoted to the rank of brigadier and head the Army Section at BP.

When he wrote *The Hut Six Story*, Welchman had no memory of meeting either Dilly Knox (who would be his first boss at BP) or Knox's assistant Peter Twinn during the course in London. Twinn had been the mathematician recruited from Oxford in February 1939 and he would remain in Knox's team in the period before the war and the move to BP. Following their indoctrination, the new recruits were placed on an emergency staff list and, in the event of war, they were told to report as soon as possible to Bletchley Park in Buckinghamshire. These men of the 'professor type' would be employed by the Foreign Office as temporary civil servants and paid the then handsome sum of £600 per year.

Back at Cambridge, the political temperature was rising. The balance of opinion seemed to favour the National Government until 1935 but by 1938, the national situation was confused and Cambridge Union debates degenerated into complete irrationality. Opinion could be swung to the right one day by fascists such as Oswald Mosley and to the left by pacifists such as Bertrand Russell. In November 1938 the Cambridge Union voted 233 to 107 that the defence of Britain was not safe in the hands of Mr Chamberlain. By the end of term, the post-Munich euphoria was wearing thin as more and more details emerged about the Nazi persecution of the Jews. Churchill addressed a meeting on 19 May 1939, specifically to counter the Union vote against conscription. The meeting was lively and at the end, the chairman declared that a show of hands indicated a 10 to 1 majority in favour of conscription.

The last word on the debate in Cambridge perhaps came from John Maynard Keynes. Writing from King's College on 14 October 1939 he said:

The intelligentsia of the Left were the loudest in demanding that the Nazi aggression should be resisted at all costs; when it comes to a showdown, scarce four weeks have passed before they remember that they are pacifists and write defeatist letters to your columns, leaving the defence of freedom to Colonel Blimp and the Old School Tie, for whom three cheers.¹⁵

On 1 September 1939 German forces invaded Poland and the next day, Britain and France issued an ultimatum demanding that Germany withdraw from Poland within twelve hours. On 3 September Britain and France declared war on Germany and in Cambridge, as he listened to the news as it came over the wireless, Welchman began packing his essential belongs. The next day, after saying goodbye to Katharine and Nick, he climbed into his open-topped Morgan three-wheeler and began the forty-seven-mile journey to Bletchley Park. He would be followed there in the months and years to come by a formidable team of Cambridge intellectuals recruited by Adcock and Birch such as F. L. Lucas, D. W. Lucas, L. P. Wilkinson, J. Saltmarsh, G. C. Morris, A. J. H. Knight, G. Barraclough, Max Newman, F. H. Hinsley, J. H. Plumb, H. O. Evennett, T. D. Jones, R. J. Getty, D. R. Taunt, L. W. Forster, D. W. Babbage, R. F. Bennett, E. R. P. Vincent, D. Parmée and F. J. Norton. Welchman would personally go on to recruit, among others: C. H. O'D. Alexander, P. S. Milner-Barry, J. W. J. Herivel and D. Rees.

Chapter 2

Bletchley Park: The First Four Months

On 3 September 1939, the operational head of GC&CS, Alastair Denniston, informed T. J. Wilson of the Foreign Office that they had been obliged to recruit men from the emergency list at a rate of pay agreed by the Treasury. Welchman's name was on that list¹ as one of the men of 'the professor type' and he duly reported for duty on 4 September. He was greeted by Denniston in his office on the ground floor of the mansion at BP which had been the morning room of BP's pre-war owners, the Leon family.

BP had been bought by Sir Herbert Leon, a wealthy London stockbroker and his second wife Fanny around 1882 along with 581 acres of land. They had added servants' and domestic quarters and further extensions. The mansion, which one former GC&CS employee described as 'ghastly' and another as 'indescribably ugly', had a number of different architectural styles integrated into its façade. Apparently, the Leons travelled abroad extensively, would see some architectural feature which they liked and would return home with a sketch of it for their builders to implement. Sir Herbert died in 1926 and his wife carried on running the estate until her death in January 1937. Sir Herbert's heir, his son George, duly sold off the bulk of the estate at auction by splitting it into lots. Lot 1, which initially didn't sell and consisted of 55 acres including the mansion, stable yard and lake, was bought by a consortium of local builders and developers headed by Captain Herbert Faulkner, a keen horseman whom Welchman would later remember riding around BP in his hunting attire. Faulkner was planning to divide the land into smaller parcels for residential development and knock down the mansion and most of the other buildings on the site. He also planned to keep the lake, which stood to the south of the mansion, and build himself a house on the Leons' croquet lawn alongside it. He had

already taken down some stables and removed some of the wood panelling in the mansion when he was approached by agents representing a branch of the Foreign Office, GC&CS.

The Chief of SIS and non-operational director of GC&CS, Hugh Sinclair, had become concerned that most of the British intelligence services were based in the middle of London and he had started looking for a site outside the capital to serve as a war station for intelligence activities. Bletchley Park was an ideal location as it was close to Bletchley station which was on the main north–south West Coast rail line, and near the A5, a major arterial route along which ran trunk telephone cabling connecting the north and south of the country. There were also direct rail links from Bletchley station to both Oxford and Cambridge which would prove useful as many of the people on the emergency staff list of the ‘professor type’ would come from the universities there. A deal was struck for the site to be leased for a period of three months and it was subsequently purchased by Sinclair on 9 June 1938 for £6,000.² Faulkner didn’t get his house by the lake but he subsequently got the contract to build the wartime huts and brick buildings at BP, many of which still stand today.

During the Munich crisis, partly as a precautionary measure and partly as a mobilization exercise, Sinclair sent GC&CS and other Foreign Office staff to BP. Telecommunications engineers had already been working on the site since its purchase. At the end of September 1938 the Munich agreement was signed and most of the GC&CS staff returned to London. The following year it was clear that war was imminent and, around 15 August 1939, GC&CS returned to BP along with other intelligence units to begin their wartime activities.

Denniston sent Welchman to join the team led by a veteran First World War cryptanalyst, Dilly Knox. They were based in the end cottage of three within the BP stable yard which became known as ‘The Cottage’. The team already included the brilliant mathematician Alan Turing from King’s College, Cambridge, which was also Knox’s *alma mater*. Turing had also arrived on 4 September but had been working part-time for GC&CS before it moved to BP. Other notable people working in The Cottage were John Jeffreys from Downing College, Cambridge, whom Welchman knew well, Peter Twinn, the Oxford mathematician who had been recruited earlier in the year, and Tony Kendrick, who had been Knox’s only assistant in 1938. When he arrived, the team were already hard at work at unravelling the mysteries of an encryption machine with the brand name Enigma. They had begun this work well before they arrived at BP. Welchman was